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Ocean Wind 1 Offshore Wind Farm Final Environmental Impact Statement

May 2023

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Office of Renewable Energy Programs

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ENVIRONMENTAL IMPACT STATEMENT FOR THE OCEAN WIND 1 OFFSHORE WIND FARM

DRAFT ( ) FINAL (X)

Lead Agency:	U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs
Cooperating Federal Agencies:	National Oceanic and Atmospheric Administration, National Marine Fisheries Service U.S. Department of Defense U.S. Department of Defense, U.S. Army Corps of Engineers U.S. Department of Homeland Security, U.S. Coast Guard U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement U.S. Environmental Protection Agency U.S. Department of the Interior, National Park Service U.S. Department of the Interior, U.S. Fish and Wildlife Service
Cooperating State Agencies:	New Jersey Department of Environmental Protection New York State Department of State New Jersey Board of Public Utilities
Contact Person:	Lisa Landers National Environmental Policy Act Coordinator Office of Renewable Energy Programs, Environment Branch for Renewable Energy Bureau of Ocean Energy Management Office (703) 787-1520 lisa.landers@boem.gov
Area:	Area of Renewable Energy Lease Number OCS-A 0498

Abstract:

This Final Environmental Impact Statement (EIS) assesses the reasonably foreseeable impacts on physical, biological, socioeconomic, and cultural resources that could result from the construction and installation, operations and maintenance, and conceptual decommissioning of the Ocean Wind 1 Offshore Wind Farm (Project) proposed by Ocean Wind LLC (Ocean Wind), in its Construction and Operations Plan (COP). The proposed Project described in the COP and this Final EIS would be approximately 1,100 megawatts in scale and sited 15 miles (13 nautical miles) southeast of Atlantic City, New Jersey, within the area of Renewable Energy Lease Number OCS-A 0498 (Lease Area). The Project would serve demand for renewable energy in New Jersey. This Final EIS was prepared in accordance with the requirements of the National Environmental Policy Act (42 United States Code 4321–4370f) and implementing regulations of the Council on Environmental Quality and the Department of the Interior. This Final EIS will inform the Bureau of Ocean Energy Management's decision on whether to approve, approve with modifications, or disapprove the Project's COP.

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S. Executive Summary

S.1. Introduction

This Final Environmental Impact Statement (EIS) assesses the reasonably foreseeable impacts on physical, biological, socioeconomic, and cultural resources that could result from the construction and installation, operations and maintenance (O&M), and conceptual decommissioning of a commercial-scale offshore wind energy facility and transmission cable to shore known as the Ocean Wind 1 Offshore Wind Farm (Project). The Bureau of Ocean Energy Management (BOEM) has prepared the Final EIS under the National Environmental Policy Act (NEPA) (42 U.S. Code [USC] 4321–4370f). This Final EIS will inform BOEM's decision on whether to approve, approve with modifications, or disapprove the Project's Construction and Operations Plan (COP).

Cooperating agencies may rely on this EIS to support their decision-making. In conjunction with submitting its COP, Ocean Wind LLC (Ocean Wind, the Applicant) applied to the National Marine Fisheries Service (NMFS) for an incidental take authorization under the Marine Mammal Protection Act (MMPA) of 1972, as amended (16 USC 1361 et seq.), for incidental take of marine mammals during Project construction. NMFS needs to render a decision regarding the request for authorization due to NMFS' responsibilities under the MMPA (16 USC 1371 (a)(5)(A) and its implementing regulations. NMFS intends to adopt the Final EIS if, after independent review and analysis, NMFS determines the Final EIS to be sufficient to support its separate proposed action and decision to issue the authorization, if appropriate. The U.S. Army Corps of Engineers (USACE) similarly intends to adopt the EIS to meet its responsibilities under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act of 1899 (RHA).

S.2. Purpose and Need for the Proposed Action

In Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, issued January 27, 2021, President Biden stated that it is the policy of the United States "to organize and deploy the full capacity of its agencies to combat the climate crisis to implement a Government-wide approach that reduces climate pollution in every sector of the economy; increases resilience to the impacts of climate change; protects public health; conserves our lands, waters, and biodiversity; delivers environmental justice; and spurs well-paying union jobs and economic growth, especially through innovation, commercialization, and deployment of clean energy technologies and infrastructure."

Through a competitive leasing process under 30 Code of Federal Regulations (CFR) 585.211, Ocean Wind was awarded commercial Renewable Energy Lease OCS-A 0498 covering an area offshore New Jersey (Lease Area). Under the terms of the lease, Ocean Wind has the exclusive right to submit a COP for activities within the Lease Area, and it has submitted a COP to BOEM proposing the construction and installation, O&M, and conceptual decommissioning of an approximately 1,100-megawatt (MW) offshore wind energy facility in the Lease Area in accordance with BOEM's COP regulations under 30 CFR 585.626, et seq. (Figure S-1).

Based on BOEM's authority under the Outer Continental Shelf Lands Act (OCSLA) to authorize renewable energy activities on the Outer Continental Shelf (OCS), and Executive Order 14008; the shared goals of the federal agencies to deploy 30 GW of offshore wind energy capacity in the United States by

2030, while protecting biodiversity and promoting ocean co-use[1]; and in consideration of the goals of the Applicant, the purpose of BOEM's action is to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP. BOEM will make this determination after weighing the factors in Subsection 8(p)(4) of the OCSLA that are applicable to plan decisions and in consideration of the above goals. BOEM's action is needed to fulfill its duties under the lease, which require BOEM to make a decision on the lessee's plans to construct and operate a commercial-scale offshore wind energy facility within the Lease Area (the Proposed Action).

In addition, the National Oceanic and Atmospheric Administration's (NOAA) NMFS received a request for authorization to take marine mammals incidental to construction activities related to the Project, which NMFS may authorize under the MMPA. NMFS's issuance of an MMPA incidental take authorization is a major federal action and, in relation to BOEM's action, is considered a connected action (40 CFR 1501.9(e)(1)). The purpose of the NMFS action—which is a direct outcome of Ocean Wind's request for authorization to take marine mammals incidental to specified activities associated with the Project (e.g., pile driving)—is to evaluate Ocean Wind's request under requirements of the MMPA (16 USC 1371(a)(5)(A)) and its implementing regulations administered by NMFS and to decide whether to issue the authorization. NMFS needs to render a decision regarding the request for authorization due to NMFS' responsibilities under the MMPA (16 USC 1371(a)(5)(A)) and its implementing regulations. NMFS intends to adopt the Final EIS if, after independent review and analysis, NMFS determines the Final EIS to be sufficient to support its separate proposed action and decision to issue the authorization, if appropriate.

The USACE Philadelphia District anticipates requests for authorization of a permit action to be undertaken through authority delegated to the District Engineer by 33 CFR 325.8, pursuant to Section 10 of the RHA (33 USC 403) and Section 404 of the CWA (33 USC 1344). In addition, USACE anticipates that a "Section 408 permission" will be required pursuant to Section 14 of the RHA (33 USC 408) for any proposed alterations that have the potential to alter, occupy, or use any federally authorized civil works projects. USACE considers issuance of permits under these three delegated authorities a major federal action connected to BOEM's action (40 CFR 1501.9(e)(1)). The need for the Project as provided by the Applicant in Ocean Wind's COP and reviewed by USACE for NEPA purposes is to provide a commercially viable offshore wind energy project within the Lease Area to meet New Jersey's need for clean energy. The basic Project purpose, as determined by USACE for Section 404(b)(1) guidelines evaluation, is offshore wind energy generation. The overall Project purpose for Section 404(b)(1) guidelines evaluation, as determined by USACE, is the construction and operation of a commercial-scale offshore wind energy project for renewable energy generation and distribution to the New Jersey energy grids.

The purpose of USACE Section 408 action as determined by Engineer Circular 1165-2-220 is to evaluate the Applicant's request and determine whether the proposed alterations are injurious to the public interest or impair the usefulness of the USACE project. The USACE Section 408 permission is needed to ensure that congressionally authorized projects continue to provide their intended benefits to the public. USACE intends to adopt BOEM's EIS to support its decision on any permits and permissions requested under Section 10 of the RHA, Section 404 of the CWA, and Section 14 of the RHA. USACE would adopt the EIS under 40 CFR 1506.3 if, after its independent review of the document, it concludes that the EIS satisfies USACE's comments and recommendations. Based on its participation as a cooperating agency and its consideration of the final EIS, USACE would issue a Record of Decision (ROD) to formally document its decision on the Proposed Action.

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[1] Biden Administration Jumpstarts Offshore Wind Energy Projects to Create Jobs | The White House: https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/29/fact-sheet-biden-administration-jumpstarts-offshore-wind-energy-projects-to-create-jobs/.

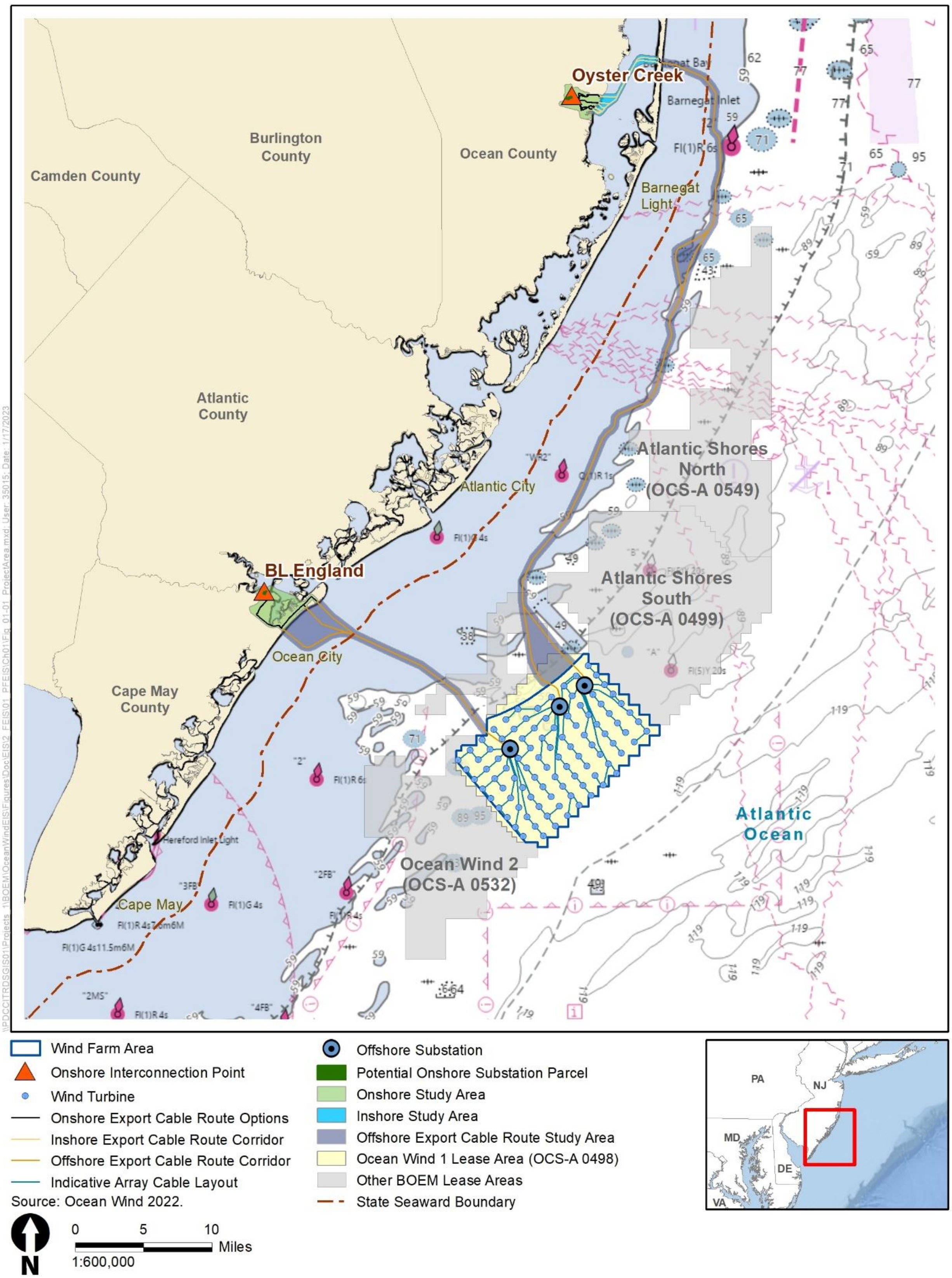

Figure S-1 Ocean Wind 1 Project

S.3. Public Involvement

On March 30, 2021, BOEM issued a Notice of Intent (NOI) to prepare an EIS, initiating a 30-day public scoping period from March 30 to April 29, 2021 (86 *Federal Register* 16630). The NOI solicited public input on the significant resources and issues, impact-producing factors, reasonable alternatives, and potential mitigation measures to analyze in the EIS. BOEM also used the NEPA scoping process to initiate the Section 106 consultation process under the National Historic Preservation Act (54 USC 300101 et seq.), as permitted by 36 CFR 800.2(d)(3), and sought public comment and input through the NOI regarding the identification of historic properties or potential effects on historic properties from activities associated with approval of the Ocean Wind 1 COP. BOEM held three virtual public scoping meetings on April 13, April 15, and April 20, 2021, to present information on the Project and NEPA process, answer questions from meeting attendees, and to solicit public comments. Scoping comments were received through Regulations.gov on docket number BOEM-2021-0024, via email to a BOEM representative, and through oral testimony at each of the three public scoping meetings. BOEM received total of 381 comment submissions from federal and state agencies, local governments, non-governmental organizations, and the general public during the scoping period. The topics most referenced in the scoping comments included commercial fisheries and for-hire recreational fishing; finfish, invertebrates, and essential fish habitat; marine mammals; birds; air quality and climate change; recreation and tourism; employment and job creation; scenic and visual resources; purpose and need; alternatives; cumulative impacts; and mitigation and monitoring. BOEM considered all scoping comments while preparing this Final EIS.

On June 24, 2022, BOEM issued a Notice of Availability of the Draft EIS, initiating a 45-day public comment period from June 24 to August 8, 2022 (87 *Federal Register* 37883). BOEM held three virtual public hearings on July 14, July 20, and July 26, 2022. On August 5, 2022, the comment period was extended by 15 days to conclude on August 23, 2022 (87 *Federal Register* 48038). Public comments were received through Regulations.gov on docket number BOEM-2022-0021, via email and mail to a BOEM representative, and through oral testimony at each of the three public hearings. BOEM received a total of 1,389 comment submissions from federal and state agencies, local governments, non-governmental organizations, and the general public during the comment period. BOEM assessed and considered all the comments received in preparation of the Final EIS. See Appendix A for additional information on public involvement.

S.4. Alternatives

BOEM considered a reasonable range of alternatives during the EIS development process that emerged from scoping, interagency coordination, and internal BOEM deliberations. The Final EIS evaluates the No Action Alternative and five action alternatives (two of which have sub-alternatives). The action alternatives are not mutually exclusive; BOEM may select a combination of alternatives that meet the purpose and need of the proposed Project. The alternatives are as follows:

- No Action Alternative
- Alternative A—Proposed Action
- Alternative B—No Surface Occupancy at Select Locations to Reduce Visual Impacts
    - Alternative B-1—No Surface Occupancy at Select Locations to Reduce Visual Impacts (Smaller Turbine Model)
    - Alternative B-2—No Surface Occupancy at Select Locations to Reduce Visual Impacts (Larger Turbine Model)
- Alternative C—Wind Turbine Layout Modification to Establish a Buffer Between Ocean Wind 1 and Atlantic Shores South

 - Alternative C-1—No Surface Occupancy to Establish a Buffer with Turbine Relocation
 - Alternative C-2—No Surface Occupancy to Establish a Buffer with Turbine Layout Compression
- Alternative D—Sand Ridge and Trough Avoidance
- Alternative E—Submerged Aquatic Vegetation Avoidance

Alternatives considered but dismissed from detailed analysis and the rationale for their dismissal are described in Section 2.1.7 and Appendix C.

S.4.1 No Action Alternative

Under the No Action Alternative, BOEM would not approve the COP; Project construction and installation, O&M, and conceptual decommissioning would not occur; and no additional permits or authorizations for the Project would be required. Any potential environmental and socioeconomic impacts, including benefits, associated with the Project as described under the Proposed Action would not occur. The current resource condition, trends, and impacts from ongoing activities under the No Action Alternative serves as the existing baseline against which the direct and indirect impacts of all action alternatives are evaluated.

Over the life of the proposed Project, other reasonably foreseeable future potentially impact-producing offshore wind and non-offshore wind activities would likely be implemented, which would cause changes to the existing baseline conditions even in the absence of the Proposed Action. The continuation of all other existing and reasonably foreseeable future activities described in Appendix F (*Planned Activities Scenario*) without the Proposed Action serves as the baseline for the evaluation of cumulative impacts of all alternatives.

S.4.2 Alternative A—Proposed Action

The Proposed Action would construct, operate, maintain, and decommission an approximately 1,100-MW wind energy facility on the OCS offshore New Jersey, approximately 15 miles southeast of Atlantic City, within the range of design parameters described in Volume I of the Ocean Wind 1 COP (Ocean Wind 2023) and summarized in Table S-1 and Appendix E, *Project Design Envelope and Maximum-Case Scenario*, subject to applicable mitigation measures. Refer to Volume I of the Ocean Wind 1 COP (Ocean Wind 2023) for additional details on Project design.

Table S-1. Summary of Project Design Envelope Parameters

Project Parameter Details
General (Layout and Project Size)
• Up to 98 WTGs • Project anticipated to be in service in late 2024 or early 2025
Foundations
• Monopile foundations with transition piece, or one-piece monopile/transition piece, where the transition piece is incorporated into the monopile • Foundation piles would be installed using a pile-driving hammer • Scour protection around all foundations

Project Parameter Details
Wind Turbine Generators
• Rotor diameter up to 788 feet (240 meters) • Hub height up to 512 feet (156 meters) above MLLW • Upper blade tip height up to 906 feet (276 meters) above MLLW • Lowest blade tip height 70.8 feet (22 meters) above MLLW
Inter-Array Cables
• Target burial depth of 4 to 6 feet (1.2 to 1.8 meters) depending on site conditions, navigation risk, and third-party requirement (final burial depth dependent on Cable Burial Risk Assessment and coordination with agencies) • Cables could be up to 170 kV (alternating current) • Preliminary layout available; however, final layout pending • Maximum total cable length is 190 miles (approximately 300 kilometers) • Cable lay, installation, and burial: Activities may involve use of a jetting tool (jet ROV or jet sled), vertical injection, leveling, mechanical cutting, plowing (with or without jet-assistance), pre-trenching, controlled-flow excavation
Offshore Export Cables
• Up to three maximum 275 kV alternating current export cables • Target burial depth of 4 to 6 feet (1.2 to 1.8 meters) depending on site conditions, navigation risk, and third-party requirements (final burial depth dependent on burial risk assessment and coordination with agencies) • Two export cable route corridors, Oyster Creek and BL England • Maximum total cable length is 143 miles (230 kilometers) for Oyster Creek and 32 miles (51 kilometers) for BL England • Cable lay, installation, and burial: Activities may involve use of a jetting tool (jet ROV or jet sled), vertical injection, leveling, mechanical cutting, plowing (with or without jet-assistance), pre-trenching, backhoe dredger, controlled-flow excavation
Offshore Substations
• Up to three OSS • Total structure height up to 296 feet (90 meters) above MLLW • Maximum length and width of topside structure 295 feet (90 meters; with ancillary facilities) • OSS installed atop a modular support frame and monopile substructure or atop a piled jacket foundation substructure • Foundation piles to be installed using a pile-driving hammer • Scour protection installed at foundation locations where required
Landfall for the Offshore Export Cable
• Open cut or trenchless (e.g., HDD, direct pipe, or auger bore) installation at landfall • Up to six cable ducts for landfall, if installed by trenchless technology • A reception pit (may be subsea pit, not yet finalized) would be required to be constructed at the exit end of the bore • Construction reception pit: excavator barge, land excavator mounted to a barge, sheet piling from barge used for intertidal cofferdams, swamp excavators

Project Parameter Details
Offshore Substations Interconnector Cable
• Maximum 275 kV alternating current cables • Target burial depth of 4 to 6 feet (1.2 to 1.8 meters) depending on conditions (final burial depth dependent on burial risk assessment and coordination with agencies) • Potential layout available; however, final layout pending • Maximum total cable length is 19 miles (approximately 30 kilometers) • Cable lay, installation, and burial: Activities may involve use of a jetting tool, vertical injection, pre-trenching, scar plow, trenching (including leveling, mechanical cutting), plowing, controlled-flow excavation
Onshore Export Cable
• Connect with offshore cables at TJB and carry electricity to the onshore substation • Would be buried at a target burial depth of 4 feet (1.2 meters) (this represents a target burial depth rather than a minimum or maximum) • Could require up to a 50-foot (15-meter) wide construction corridor and up to a 30-foot (9-meter) wide permanent easement for Oyster Creek and BL England cable corridors excluding landfall locations and cable splice locations to accommodate space for splice vaults, joint bays, and HDD • Permanent easements are expected to be larger at splice vaults and transition joint bay locations • Up to eight export cables circuits would be required, with each cable circuit comprising up to three single cables. The cables would consist of copper or aluminum conductors wrapped with materials for insulation protection and sealing. • TJBs, splice vaults/grounding link boxes, and fiber optic system, including manholes
Onshore Substations and Interconnector Cable
• Two onshore substations in proximity to existing substations with associated infrastructure • Each onshore substation would require a permanent site (for Oyster Creek interconnection point up to 31.5 acres and for BL England up to 13 acres), including area for the substation equipment and buildings, energy storage, and stormwater management and landscaping • During construction, up to an additional 3 acres would be required for temporary workspace • The main buildings within the substations would be up to 1,017 feet long, 492 feet wide, and 82 feet tall (310 meters long, 150 meters wide, and 25 meters tall) • Secondary buildings may be used to house reactive compensation, transformers, filters, a control room, and a site office. The external electrical equipment may include switchgear, busbars, transformers, high-voltage reactors, SVC/static synchronous compensator, synchronous condensers, harmonic filters, and other auxiliary equipment. Lightning protection would include up to 35 lightning masts at Oyster Creek and up to 25 masts at BL England for a total height up to 98 feet (30 meters). • Maximum height of overhead lines would be 115 feet (35 meters) • Interconnector cable to existing substation

HDD = horizontal directional drilling; kV = kilovolt; MLLW = mean lower low water; OSS = Offshore Substation; ROV = remotely operated vehicle; SVC = static VAR compensator; TJB = Transition Joint Bay; WTG = wind turbine generator

S.4.3 Alternative B—No Surface Occupancy at Select Locations to Reduce Visual Impacts

Under Alternative B, the construction, O&M, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, no surface occupancy would occur at select wind turbine generator (WTG) positions to reduce the visual impacts of the proposed Project. Each of the sub-alternatives below may be individually selected or combined with any or all other alternatives or sub-alternatives, subject to the combination meeting the purpose and need.

- **Alternative B-1:** No Surface Occupancy at Select Locations to Reduce Visual Impacts (Smaller Turbine Model): This alternative would exclude placement of WTGs at up to nine WTG positions that are nearest to coastal communities (positions F01 to K01 and B02 to D02).
- **Alternative B-2:** No Surface Occupancy at Select Locations to Reduce Visual Impacts (Larger Turbine Model): This alternative would exclude placement of WTGs at up to 19 WTG positions that are nearest to coastal communities (positions F01 to K01, A02 to K02, A03, and C03). Selection of this alternative would be contingent on the larger turbine with a 240-meter rotor diameter being commercially available when BOEM issues its ROD as well as its technical and economic feasibility, and consistency with the purpose and need.

S.4.4 Alternative C—Wind Turbine Layout Modification to Establish a Buffer Between Ocean Wind 1 and Atlantic Shores South

Under Alternative C, the construction, O&M, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the Ocean Wind 1 COP, subject to applicable mitigation measures. However, modifications would be made to the wind turbine array layout to create a 0.81-nautical-mile (nm) to 1.08-nm buffer between WTGs in the lease area of OCS-A 0498 (Ocean Wind 1 Lease Area) and WTGs in the lease area of OCS-A 0499 (Atlantic Shores South Lease Area) to reduce impacts on existing ocean uses, such as commercial and recreational fishing and marine (surface and aerial) navigation. Each of the sub-alternatives below may be individually selected or combined with any or all other alternatives or sub-alternatives, subject to the combination meeting the purpose and need.

- **Alternative C-1:** No Surface Occupancy to Establish a Buffer with Turbine Relocation: No surface occupancy along the northeastern boundary of the Ocean Wind 1 Lease Area (A02 to A09) through the exclusion of eight WTG positions, relocation of up to eight WTG positions to the northern portion of the Ocean Wind 1 Lease Area, or some combination of exclusion and relocation of WTG positions, to allow for a 0.81-nm to 1.08-nm buffer between WTGs in the Ocean Wind 1 Lease Area and WTGs in the Atlantic Shores South Lease Area.
- **Alternative C-2:** No Surface Occupancy to Establish a Buffer with Turbine Layout Compression: No surface occupancy along the northeastern boundary of the Ocean Wind 1 Lease Area to allow for an 0.81-nm to 1.08-nm buffer between WTGs in the Ocean Wind 1 Lease Area and WTGs in the Atlantic Shores South Lease Area. However, under Alternative C-2, the wind turbine array layout would be compressed to allow for a full build of up to 98 WTGs. Ocean Wind 1's turbine array row spacing would be reduced from 1 nm between rows to no less than 0.92 nm between rows.

S.4.5 Alternative D—Sand Ridge and Trough Avoidance

Under Alternative D, the construction, O&M, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the Ocean Wind 1 COP, subject to applicable mitigation measures. However, modifications would be made to the wind turbine array layout to minimize impacts on sand ridge and trough features in the northeastern corner of the Lease Area. This alternative would result in the exclusion of up to 15 WTG positions in the sand ridge and trough area that include A07 to E07, A08 to E08, and A09 to E09. Selection of this alternative with the exclusion of more than nine WTGs would be contingent on the larger turbine with a 240-meter rotor diameter being commercially available when BOEM issues its ROD as well as its technical and economic feasibility, and consistency with the purpose and need.

S.4.6 Alternative E—Submerged Aquatic Vegetation Avoidance

Under Alternative E, the construction, operation, maintenance, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the Ocean Wind 1 COP, subject to applicable mitigation measures. However, the Oyster Creek export cable route traversing Island Beach State Park would be limited to the export cable route option developed to minimize impacts on submerged aquatic vegetation in Barnegat Bay. The alternative may be combined with any or all other alternatives or sub-alternatives, subject to the combination meeting the purpose and need. The submerged aquatic vegetation avoidance export cable route option would make landfall within an auxiliary parking lot of Swimming Area 2 in Island Beach State Park, continue north within parking lots, then northwest under Shore Road before entering Barnegat Bay. Upon entering Barnegat Bay, the export cable route would continue within a previously dredged channel and then reconnect to the Oyster Creek export cable route in Barnegat Bay.

S.5. Environmental Impacts

This Final EIS uses a four-level classification scheme to characterize the potential beneficial impacts and adverse impacts of alternatives as either **negligible**, **minor**, **moderate**, or **major**. Resource-specific adverse and beneficial impact level definitions are presented in each Chapter 3 resource section.

BOEM analyzes the impacts of past and ongoing activities in the absence of the Project as the No Action Alternative. The No Action Alternative serves as the existing baseline against which all action alternatives are evaluated. BOEM also separately analyzes cumulative impacts of the No Action Alternative, which considers all other ongoing and reasonably foreseeable future activities described in Appendix F, *Planned Activities Scenario*. In this analysis, the cumulative impacts of the No Action Alternative serve as the baseline against which the cumulative impacts of all action alternatives are evaluated. Table S-2 summarizes the impacts of each alternative and the cumulative impacts of each alternative; refer to the Chapter 3 resource sections for additional analysis supporting these impact determinations. Under the No Action Alternative, the environmental and socioeconomic impacts and benefits of the action alternatives would not occur.

NEPA implementing regulations (40 CFR 1502.16) require that an EIS evaluate the potential unavoidable adverse impacts associated with a proposed action. Adverse impacts that can be reduced by mitigation measures but not eliminated are considered unavoidable. The same regulations also require that an EIS review the potential impacts of irreversible or irretrievable commitments of resources resulting from implementation of a proposed action. Irreversible commitments occur when the primary or secondary impacts from the use of a resource either destroy the resource or preclude it from other uses. Irretrievable commitments occur when a resource is consumed to the extent that it cannot recover or be replaced.

Appendix L, *Other Impacts*, describes potential unavoidable adverse impacts. Most potential unavoidable adverse impacts associated with the Proposed Action would occur during the construction phase, and would be temporary. Appendix L also describes irreversible and irretrievable commitment of resources by resource area. The most notable such commitments could include effects on habitat or individual members of protected species, as well as potential loss of use of commercial fishing areas.

Table S-2 Summary and Comparison of Impacts Among Alternatives with No Mitigation Measures

Resource	No Action Alternative	Alternative A Proposed Action	Alternative B (B-1/B-2)[1] Reduce Visual Impacts	Alternative C (C-1/C-2)[1] Buffer Between Lease Areas	Alternative D Sand Ridge and Trough Avoidance	Alternative E Submerged Aquatic Vegetation Avoidance
3.4 Air Quality						
Alternative Impacts	Moderate	Minor to moderate; minor beneficial	Minor to moderate; minor beneficial	Minor to moderate; minor beneficial	Minor to moderate; minor beneficial	Minor to moderate; minor beneficial
Cumulative Impacts	Moderate; minor to moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial
3.5 Bats						
Alternative Impacts	Negligible to minor	Negligible to minor	Negligible to minor	Negligible to minor	Negligible to minor	Negligible to minor
Cumulative Impacts	Negligible to minor	Negligible to minor	Negligible to minor	Negligible to minor	Negligible to minor	Negligible to minor
3.6 Benthic Resources						
Alternative Impacts	Negligible to moderate	Negligible to moderate; moderate beneficial	Negligible to minor; moderate beneficial	Negligible to minor; moderate beneficial	Negligible to minor; moderate beneficial	Negligible to minor; moderate beneficial
Cumulative Impacts	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial
3.7 Birds						
Alternative Impacts	Minor	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial
Cumulative Impacts	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial	Moderate; moderate beneficial

Resource	No Action Alternative	Alternative A Proposed Action	Alternative B (B-1/B-2)[1] Reduce Visual Impacts	Alternative C (C-1/C-2)[1] Buffer Between Lease Areas	Alternative D Sand Ridge and Trough Avoidance	Alternative E Submerged Aquatic Vegetation Avoidance
3.8 Coastal Habitats						
Alternative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3.9 Commercial Fisheries and For-Hire Recreational Fishing						
Alternative Impacts	Minor to major on commercial fisheries and minor to moderate on for-hire recreational fishing depending on the fishery or fishing operation; minor to moderate beneficial	Minor to major on commercial fisheries and minor to moderate on for-hire recreational fishing depending on the fishery or fishing operation; minor to moderate beneficial	Minor to major on commercial fisheries and minor to moderate on for-hire recreational fishing depending on the fishery or fishing operation; minor to moderate beneficial	Minor to major on commercial fisheries and minor to moderate on for-hire recreational fishing depending on the fishery or fishing operation; minor to moderate beneficial	Minor to major on commercial fisheries and minor to moderate on for-hire recreational fishing depending on the fishery or fishing operation; minor to moderate beneficial	Minor to major on commercial fisheries and minor to moderate on for-hire recreational fishing depending on the fishery or fishing operation; minor to moderate beneficial
Cumulative Impacts	Minor to major on commercial fisheries and minor to moderate on for-hire recreational fishing depending on the fishery or fishing operation; minor to moderate beneficial	Minor to major on commercial fisheries and minor to moderate on for-hire recreational fishing depending on the fishery or fishing operation; minor to moderate beneficial	Minor to major on commercial fisheries and minor to moderate on for-hire recreational fishing depending on the fishery or fishing operation; minor to moderate beneficial	Minor to major on commercial fisheries and minor to moderate on for-hire recreational fishing depending on the fishery or fishing operation; minor to moderate beneficial	Minor to major on commercial fisheries and minor to moderate on for-hire recreational fishing depending on the fishery or fishing operation; minor to moderate beneficial	Minor to major on commercial fisheries and minor to moderate on for-hire recreational fishing depending on the fishery or fishing operation; minor to moderate beneficial
3.10 Cultural Resources						
Alternative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

Resource	No Action Alternative	Alternative A Proposed Action	Alternative B (B-1/B-2)[1] Reduce Visual Impacts	Alternative C (C-1/C-2)[1] Buffer Between Lease Areas	Alternative D Sand Ridge and Trough Avoidance	Alternative E Submerged Aquatic Vegetation Avoidance
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3.11 Demographics, Employment, and Economics						
Alternative Impacts	Minor; minor beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial
Cumulative Impacts	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial	Minor; moderate beneficial
3.12 Environmental Justice						
Alternative Impacts	Minor to moderate; minor beneficial	Moderate	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3.13 Finfish, Invertebrates, and Essential Fish Habitat						
Alternative Impacts	Moderate	Negligible to moderate	Negligible to moderate	Negligible to moderate	Negligible to moderate	Negligible to moderate
Cumulative Impacts	Moderate	Negligible to moderate	Negligible to moderate	Negligible to moderate	Negligible to moderate	Negligible to moderate
3.14 Land Use and Coastal Infrastructure						
Alternative Impacts	Negligible; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial
Cumulative Impacts	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial	Minor; minor beneficial
3.15 Marine Mammals						
Alternative Impacts	Odontocetes and pinnipeds: minor to moderate	Odontocetes and pinnipeds: minor; minor beneficial	Odontocetes and pinnipeds: minor; minor beneficial	Odontocetes and pinnipeds: minor; minor beneficial	Odontocetes and pinnipeds: minor; minor beneficial	Odontocetes and pinnipeds: minor; minor beneficial
	Other Mysticetes: minor to moderate	Other Mysticetes: moderate	Other Mysticetes: moderate	Other Mysticetes: moderate	Other Mysticetes: moderate	Other Mysticetes: moderate

Resource	No Action Alternative	Alternative A Proposed Action	Alternative B (B-1/B-2)[1] Reduce Visual Impacts	Alternative C (C-1/C-2)[1] Buffer Between Lease Areas	Alternative D Sand Ridge and Trough Avoidance	Alternative E Submerged Aquatic Vegetation Avoidance
	NARW: moderate to major[2]	NARW: moderate to major[2]	NARW: moderate to major[2]	NARW: moderate to major[2]	NARW: moderate to major[2]	NARW: moderate to major[2]
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
	NARW: moderate to major[2]	NARW: moderate to major[2]	NARW: moderate to major[2]	NARW: moderate to major[2]	NARW: moderate to major[2]	NARW: moderate to major[2]
3.16 Navigation and Vessel Traffic						
Alternative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3.17 Other Uses						
Alternative Impacts	Marine Mineral Extraction: negligible	Marine Mineral Extraction: negligible	Marine Mineral Extraction: negligible	Marine Mineral Extraction: negligible	Marine Mineral Extraction: negligible	Marine Mineral Extraction: negligible
	Military and National Security Uses: negligible	Military and National Security: minor for most but moderate for search and rescue activities	Military and National Security: minor for most but moderate for search and rescue activities	Military and National Security: minor for most but moderate for search and rescue activities	Military and National Security: minor for most but moderate for search and rescue activities	Military and National Security Uses: minor, but moderate for search and rescue activities
	Aviation and Air Traffic: negligible	Aviation and Air Traffic: minor	Aviation and Air Traffic: minor	Aviation and Air Traffic: minor	Aviation and Air Traffic: minor	Aviation and Air Traffic: minor
	Cables and Pipelines: negligible	Cables and Pipelines: negligible	Cables and Pipelines: negligible	Cables and Pipelines: negligible	Cables and Pipelines: negligible	Cables and Pipelines: negligible
	Radar Systems: negligible	Radar: minor	Radar: minor	Radar: minor	Radar: minor	Radar: minor
	Scientific Research and Surveys: moderate	Scientific Research and Surveys: major	Scientific Research and Surveys: major	Scientific Research and Surveys: major	Scientific Research and Surveys: major	Scientific Research and Surveys: major

Resource	No Action Alternative	Alternative A Proposed Action	Alternative B (B-1/B-2)[1] Reduce Visual Impacts	Alternative C (C-1/C-2)[1] Buffer Between Lease Areas	Alternative D Sand Ridge and Trough Avoidance	Alternative E Submerged Aquatic Vegetation Avoidance
Cumulative Impacts	Marine Mineral Extraction: negligible to minor	Marine Mineral Extraction: negligible to minor	Marine Mineral Extraction: negligible to minor	Marine Mineral Extraction: negligible to minor	Marine Mineral Extraction: negligible to minor	Marine Mineral Extraction: negligible to minor
	Military and National Security: minor for most but moderate for search and rescue activities	Military and National Security Uses: negligible to minor for most but moderate for search and rescue activities	Military and National Security Uses: negligible to minor for most but moderate for search and rescue activities	Military and National Security Uses: minor for most but moderate for search and rescue activities	Military and National Security Uses: negligible to minor for most but moderate for search and rescue activities	Military and National Security Uses: negligible to minor for most but moderate for search and rescue activities
	Aviation and Air Traffic: negligible to minor	Aviation and Air Traffic: negligible to minor	Aviation and Air Traffic: negligible to minor	Aviation and Air Traffic: negligible to minor	Aviation and Air Traffic: negligible to minor	Aviation and Air Traffic: negligible to minor
	Cables and Pipelines: negligible to minor	Cables and Pipelines: negligible to minor	Cables and Pipelines: negligible to minor	Cables and Pipelines: negligible to minor	Cables and Pipelines: negligible to minor	Cables and Pipelines: negligible to minor
	Radar Systems: moderate	Radar Systems: moderate	Radar Systems: moderate	Radar Systems: moderate	Radar Systems: moderate	Radar Systems: moderate
	Scientific Research and Surveys: major	Scientific Research and Surveys: major	Scientific Research and Surveys: major	Scientific Research and Surveys: major	Scientific Research and Surveys: major	Scientific Research and Surveys: major
3.18 Recreation and Tourism						
Alternative Impacts	Negligible	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial
Cumulative Impacts	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial	Moderate; minor beneficial

Resource	No Action Alternative	Alternative A Proposed Action	Alternative B (B-1/B-2)[1] Reduce Visual Impacts	Alternative C (C-1/C-2)[1] Buffer Between Lease Areas	Alternative D Sand Ridge and Trough Avoidance	Alternative E Submerged Aquatic Vegetation Avoidance
3.19 Sea Turtles						
Alternative Impacts	Minor	Negligible to minor; minor beneficial	Negligible to minor; minor beneficial	Negligible to minor; minor beneficial	Negligible to minor; minor beneficial	Negligible to minor; minor beneficial
Cumulative Impacts	Minor	Minor	Minor	Minor	Minor	Minor
3.20 Scenic and Visual Resources						
Alternative Impacts	Minor to moderate	Negligible to major	Negligible to major	Negligible to major	Negligible to major	Negligible to major
Cumulative Impacts	Major	Major	Major	Major	Major	Major
3.21 Water Quality						
Alternative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3.22 Wetlands						
Alternative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Cumulative Impacts	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate

Impact rating colors are as follows: orange = major; yellow = moderate; green = minor; light green = negligible. All impact levels are assumed to be adverse unless otherwise specified as beneficial. Where impacts are presented as multiple levels, the color representing the most adverse level of impact has been applied.

[1] Impacts are the same under Alternatives B-1 and B-2 and Alternatives C-1 and C-2 unless otherwise noted in the table.

[2] Impacts were assessed as moderate to major for the No Action Alternative and action alternatives for North Atlantic right whale (NARW) because impacts on individual NARWs could have severe population-level effects and compromise the viability of the species due to their low population numbers and continued state of decline.

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ABBREVIATIONS AND ACRONYMS

Abbreviation	Definition
°C	degrees Celsius
°F	degrees Fahrenheit
µg/L	microgram per liter
µPa	micropascal
µPa-m	micropascal meter
μPa^2	micropascal squared
$\mu Pa^2 s$	micropascal squared second
AAQS	ambient air quality standards
ACHP	Advisory Council on Historic Preservation
ADLS	Aircraft Detection Lighting System
AFB	Air Force Base
AIS	Automatic Identification System
AMAPPS	Atlantic Marine Assessment Program for Protected Species
AMSL	above mean sea level
APE	area of potential effects
APM	Applicant-proposed measure
ARSR-4	Air Route Surveillance Radar-4
ASMFC	Atlantic States Marine Fisheries Commission
ASR-9	Airport Surveillance Radar-9
AWEA	American Wind Energy Association
BA	Biological Assessment
BIA	biologically important area
BMP	best management practice
BOEM	Bureau of Ocean Energy Management
BPU	Board of Public Utilities
BSEE	Bureau of Safety and Environmental Enforcement
CAA	Clean Air Act
CBRA	Cable Burial Risk Assessment
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
COBRA	CO-Benefits Risk Assessment
COP	Construction and Operations Plan
CWA	Clean Water Act
DASR	Digital Airport Surveillance Radar
dB	decibel
dBA	A-weighted decibel
dB_{RMS}	root-mean-square decibels
dB re 1 µPa	decibel relative to 1 micropascal

Abbreviation	Definition
DNA	deoxyribonucleic acid
DO	dissolved oxygen
DOD	Department of Defense
DPS	distinct population segment
EBS	Ecological Baseline Studies
EC	Earth curvature
EFH	essential fish habitat
EIS	Environmental Impact Statement
EMF	electromagnetic field
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
FMP	Fishery Management Plan
FOV	field of view
FTE	full-time equivalent
FWRAM	Full Waveform Range-dependent Acoustic Model
G&G	geophysical and geotechnical
GDP	gross domestic product
GHG	greenhouse gas
GW	gigawatt
HABS	Historic American Buildings Survey
HAP	hazardous air pollutant
HAPC	habitat area of particular concern
HDD	horizontal directional drilling
HFC	high-frequency cetaceans
HRG	high-resolution geophysical
HUC	hydrologic unit code
HVAC	high-voltage alternating current
HVDC	high-voltage direct current
Hz	Hertz
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IPF	impact-producing factor
IWG	Interagency Working Group
kJ	kilojoule
km^2	square kilometer
KOP	Key Observation Point
kV	kilovolt
Lease Area	area of Renewable Energy Lease Number OCS-A 0498
LFC	low-frequency cetaceans
LME	Large Marine Ecosystem
m/s	meter per second

Abbreviation	Definition
m^2	square meter
MAFMC	Mid-Atlantic Fishery Management Council
MEC	munitions and explosives of concern
MFC	mid-frequency cetaceans
mg/L	milligram per liter
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
MONM	Marine Operation Noise Model
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NABCI	North American Bird Conservation Initiative
NARW	North Atlantic right whale
NEAMAP	Northeast Area Monitoring and Assessment Program
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NJDEP	New Jersey Department of Environmental Protection
nm	nautical mile
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_X	nitrogen oxides
NRHP	National Register of Historic Places
NSRA	Navigation Safety Risk Assessment
NWI	National Wetlands Inventory
NYSDOS	New York State Department of State
O&M	operations and maintenance
Ocean Wind	Ocean Wind LLC
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OPAREA	operating area
OREC	Offshore Wind Renewable Energy Certificate
Ørsted	Ørsted Wind Power North America, LLC
OSS	Offshore Substation(s)
PATON	private aid to navigation
PCB	polychlorinated biphenyls
PDE	Project Design Envelope
PM_{10}	particulate matter smaller than 10 microns in diameter

Abbreviation	Definition
$PM_{2.5}$	particulate matter smaller than 2.5 microns in diameter
Project	Ocean Wind 1 Offshore Wind Farm
PTS	permanent threshold shift
Q	quarter
RAL	radar-activated light
RHA	Rivers and Harbors Act of 1899
RMS	root mean square
ROD	Record of Decision
RODA	Responsible Offshore Development Alliance
RSZ	rotor-swept zone
SAP	Site Assessment Plan
SAR	search and rescue
SAV	submerged aquatic vegetation
SC-GHG	social cost of greenhouse gases
screening criteria	Bureau of Ocean Energy Management's screening criteria
SEL	sound exposure level
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Officer
SLIA	seascape, open ocean, and landscape impact assessment
SLVIA	seascape, landscape, and visual impact assessment
SO_2	sulfur dioxide
SPL	sound pressure level
SPL_{peak}	peak sound pressure level
SPL_{RMS}	root-mean-square sound pressure level
STSSN	Sea Turtle Stranding and Salvage Network
SWPPP	stormwater pollution prevention plan
TCP	traditional cultural property
TJB	Transition Joint Bay
TSS	Traffic Separation Scheme
TTS	temporary threshold shift
UME	Unusual Mortality Event
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
VIA	visual impact assessment
VMS	Vessel Monitoring System
VOC	volatile organic compound
WEA	Wind Energy Area
WNS	white-nose syndrome

Abbreviation	Definition
WSR-88D	Weather Surveillance Radar-1988 Doppler
WTG	wind turbine generator

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1. Introduction

This Final Environmental Impact Statement (EIS) assesses the potential biological, socioeconomic, physical, and cultural impacts that could result from the construction, operations and maintenance (O&M), and conceptual decommissioning of the Ocean Wind 1 Offshore Wind Farm (Project) proposed by Ocean Wind LLC (Ocean Wind),[1] in its Construction and Operations Plan (COP).[2] The proposed Project described in the COP and this Final EIS would be approximately 1,100 megawatts (MW) in scale and sited 15 miles (13 nautical miles [nm]) southeast of Atlantic City, New Jersey, within the area of Renewable Energy Lease Number OCS-A 0498 (Lease Area). The Project is designed to serve demand for renewable energy in New Jersey. This Final EIS will inform the Bureau of Ocean Energy Management (BOEM) in deciding whether to approve, approve with modifications, or disapprove the COP (30 Code of Federal Regulations [CFR] 585.628).

This Final EIS was prepared following the requirements of the National Environmental Policy Act (NEPA) (42 United States Code [USC] 4321 et seq.) and implementing regulations (40 CFR 1500–1508). The Council on Environmental Quality's (CEQ) current regulations contain a presumptive time limit of 2 years for completing EISs, and a presumptive page limit of 150 pages or fewer or 300 pages for proposals of unusual scope or complexity. BOEM has followed those limits in preparing this EIS in accordance with the new regulations. Additionally, this Final EIS was prepared consistent with the U.S. Department of the Interior's NEPA regulations (43 CFR 46), longstanding federal judicial and regulatory interpretations, and Administration priorities and policies including Secretary's Order No. 3399 requiring bureaus and offices to not apply any of the provisions of the 2020 changes to CEQ regulations (85 *Federal Register* 43304–43376) "in a manner that would change the application or level of NEPA that would have been applied to a proposed action before the 2020 Rule went into effect." The Ocean Wind 1 COP and all of the volumes and appendices supporting the COP are incorporated into the EIS by reference and are available at: https://www.boem.gov/ocean-wind-1-construction-and-operations-plan.

1.1. Background

In 2009, the U.S. Department of the Interior announced final regulations for the Outer Continental Shelf (OCS) Renewable Energy Program, which was authorized by the Energy Policy Act of 2005. The Energy Policy Act provisions implemented by BOEM provide a framework for issuing renewable energy leases, easements, and rights-of-way for OCS activities (see Section 1.3). BOEM's renewable energy program occurs in four distinct phases: (1) regional planning and analysis, (2) lease issuance, (3) site assessment, and (4) construction and operations. The history of BOEM's planning and leasing activities offshore New Jersey is summarized in Table 1-1.

[1] Ocean Wind LLC was previously owned by Ørsted Wind Power North America, LLC (75 percent ownership) in partnership with Public Service Enterprise Group (25 percent ownership). On January 18, 2023, Ørsted announced that it will acquire Public Service Enterprise Group's 25-percent equity stake, taking full ownership of Ocean Wind 1.

[2] The Ocean Wind 1 COP and appendices are available on BOEM's website: https://www.boem.gov/ocean-wind-1-construction-and-operations-plan.

Table 1-1 History of BOEM Planning and Leasing Offshore New Jersey

Year	Milestone
2011	On April 20, 2011, BOEM published a Call for Information and Nominations for Commercial Leasing for Wind Power on the OCS Offshore New Jersey in the *Federal Register*. The public comment period for the Call closed on June 6, 2011. In response, BOEM received 11 commercial indications of interest. After analyzing AIS data and holding discussions with stakeholders, BOEM removed OCS Blocks Wilmington NJ18– 02 Block 6740 and Block 6790 (A, B, C, D, E, F, G, H, I, J, K, M, N) and Block 6840 (A) to alleviate navigational safety concerns resulting from vessel transits out of the New York Harbor.
2012	On February 3, 2012, BOEM published in the *Federal Register* a Notice of Availability of a final EA and FONSI for commercial wind lease issuance and site assessment activities on the Atlantic OCS offshore New Jersey, Delaware, Maryland, and Virginia.
2014	On July 21, 2014, BOEM published a Proposed Sale Notice requesting public comments on the proposal to auction two leases offshore New Jersey for commercial wind energy development.
2015	On September 23, 2015, BOEM announced that it published a Final Sale Notice, which stated a commercial lease sale would be held November 9, 2015, for the WEA offshore New Jersey. The New Jersey WEA was auctioned as two leases. RES America Developments, Inc. was the winner of Lease Area OCS-A 0498 and US Wind, Inc. was the winner of lease OCS-A 0499.
2016	On April 14, 2016, BOEM received an application to assign 100 percent of the commercial lease OCS-A 0498 to Ocean Wind. BOEM approved the assignment on May 10, 2016.
2017	On February 14, 2017, BOEM received a request to extend the preliminary term[3] for commercial lease OCS-A 0498 from March 1, 2017, to March 1, 2018. BOEM approved the request on March 1, 2017.
2018	On September 15, 2017, Ocean Wind submitted a Site Assessment Plan for commercial wind lease OCS-A 0498, which was subsequently revised on November 10, 2017, January 25, 2018, and February 23, 2018. BOEM approved the Site Assessment Plan on May 17, 2018.
2019	On August 15, 2019, Ocean Wind submitted its COP for the construction, operations, and conceptual decommissioning of the Project within a portion of the Lease Area. Updated versions of the COP were submitted on March 13, 2020, September 24, 2020, March 24, 2021, December 10, 2021, May 27, 2022, October 14, 2022, and April 24, 2023.
2020	On December 8, 2020, Ocean Wind submitted an application to BOEM to assign the portion of lease OCS-A 0498 that is not covered by the COP to Ørsted North America, Inc. BOEM approved the assignment on March 26, 2021. The lease area assigned to Ørsted North America, Inc. now carries the new lease number OCS-A 0532.
2021	On March 30, 2021, BOEM published a Notice of Intent to Prepare an EIS for Ocean Wind's Proposed Wind Energy Facility Offshore New Jersey (86 *Federal Register* 16630).
2022	On June 24, 2022, BOEM published a Notice of Availability of a Draft EIS initiating a 45-day public comment period for the Draft EIS (87 *Federal Register* 37883). On August 3, 2022, BOEM announced a 15-day extension of the public review and comment period and published a notice of the extension on August 5, 2022 (87 *Federal Register* 48038).
2023	On May 26, 2023, BOEM published a Notice of Availability of a Final EIS initiating a minimum 30-day mandatory waiting period, during which BOEM is required to pause before issuing a ROD.

Source: BOEM 2021a, 2021b

[3] Per 30 CFR 585.235(a)(1), each commercial lease will have a preliminary term of 12 months, within which the lessee must submit a Site Assessment Plan or a combined Site Assessment Plan and COP. The preliminary term begins on the effective date of the lease.

AIS = Automatic Identification System; EA = Environmental Assessment; FONSI = Finding of No Significant Impact; ROD = Record of Decision; WEA = Wind Energy Area

1.2. Purpose and Need for the Proposed Action

In Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, issued January 27, 2021, President Joseph R. Biden stated that it is the policy of the United States "to organize and deploy the full capacity of its agencies to combat the climate crisis to implement a Government-wide approach that reduces climate pollution in every sector of the economy; increases resilience to the impacts of climate change; protects public health; conserves our lands, waters, and biodiversity; delivers environmental justice; and spurs well-paying union jobs and economic growth, especially through innovation, commercialization, and deployment of clean energy technologies and infrastructure."

Through a competitive leasing process under 30 CFR 585.211, RES America Developments, Inc. was awarded commercial Renewable Energy Lease OCS-A 0498 covering an area offshore New Jersey (the Lease Area). BOEM subsequently approved 100-percent assignment of the lease to Ocean Wind. Under the terms of the lease, Ocean Wind has the exclusive right to submit a COP for activities within the Lease Area, and it has submitted a COP to BOEM proposing the construction and installation, O&M, and conceptual decommissioning of an offshore wind energy facility in the Lease Area (the Ocean Wind 1 Offshore Wind Farm or the Project) in accordance with BOEM's COP regulations under 30 CFR 585.626, et seq. Ocean Wind's goal is to develop a commercial-scale offshore wind energy facility in the Lease Area with up to 98 wind turbine generators (WTG), inter-array cables, up to three Offshore Substations (OSS), two onshore substations, and two transmission cable routes making landfall in Ocean County, New Jersey and Cape May County, New Jersey (Figure 1-1).

The Project would contribute to New Jersey's goal of 11 gigawatts (GW) of offshore wind energy generation by 2040 as outlined in New Jersey Governor's Executive Order No. 307, issued on September 22, 2022. Furthermore, Ocean Wind's stated goal is to construct and operate a commercial-scale offshore wind energy facility in the Lease Area intended to fulfill the New Jersey Board of Public Utilities' (BPU) September 20, 2018, solicitation for 1,100 MW of offshore wind capacity. The 1,100-MW solicitation and a corresponding Offshore Wind Renewable Energy Certificate (OREC) allowance of 4,851,489 MW-hours per year were awarded to Ocean Wind via BPU on June 21, 2019 (BPU Docket No. QO18121289, In the Matter of the Board of Public Utilities Offshore Wind Solicitation for 1,100 MW – Evaluation of the Offshore Wind Applications[4]).

The BPU Order identifies 1,100 MW of offshore wind as the required capacity of the Project and requires as a Term and Condition of the award that the Project be funded through OREC as defined by the New Jersey Offshore Wind Economic Development Act of 2010. For each MW-hour delivered to the transmission grid, the Project will be credited and subsequently compensated for one OREC. Ocean Wind's annual OREC allowance is 4,851,489 MW-hours per year per the 2019 award by BPU. According to the BPU Order, any unmet OREC allowances in a given year may be carried forward to the next year and the total allowance cannot be reduced or increased without mutual consent by BPU and Ocean Wind. Ocean Wind's stated goal is to routinely meet the OREC allowance in order to obtain the maximum possible annual payment from BPU for the Project's operations.

Based on BOEM's authority under the Outer Continental Shelf Lands Act (OCSLA) to authorize renewable energy activities on the OCS, and Executive Order 14008; the shared goals of the federal agencies to deploy 30 GW of offshore wind energy capacity in the United States by 2030, while

[4] BPU's June 21, 2019, Order, Docket No. QO18121289, is available at: https://www.njcleanenergy.com/files/file/6-21-19-8D.PDF.

protecting biodiversity and promoting ocean co-use[5]; and in consideration of Ocean Wind's goals, the purpose of BOEM's action is to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP. BOEM will make this determination after weighing the factors in subsection 8(p)(4) of the OCSLA that are applicable to plan decisions and in consideration of the above goals. BOEM's action is needed to fulfill its duties under the lease, which require BOEM to make a decision on the lessee's plans to construct and operate a commercial-scale offshore wind energy facility within the Lease Area (the Proposed Action).

[5] Fact Sheet: Biden Administration Jumpstarts Offshore Wind Energy Projects to Create Jobs | The White House: https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/29/fact-sheet-biden-administration-jumpstarts-offshore-wind-energy-projects-to-create-jobs/.

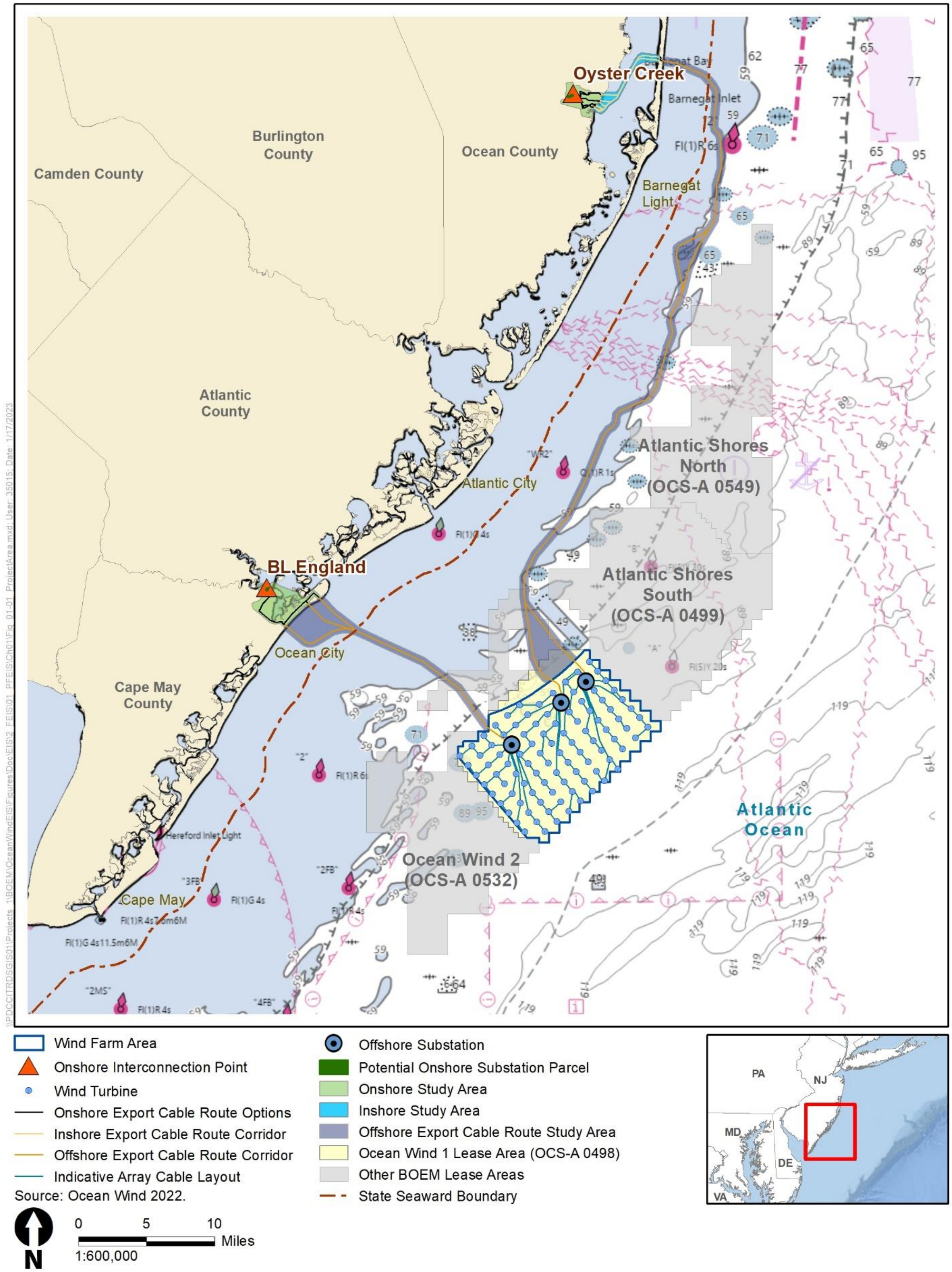


Figure 1-1 Ocean Wind 1 Project Area

In addition, the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) received a request for authorization to take marine mammals incidental to construction activities related to the Project, which NMFS may authorize under the Marine Mammal Protection Act (MMPA). NMFS' issuance of an MMPA incidental take authorization is a major federal action and, in relation to BOEM's action, is considered a connected action (40 CFR 1501.9(e)(1)). The purpose of the NMFS action—which is a direct outcome of Ocean Wind's request for authorization to take marine mammals incidental to specified activities associated with the Project (e.g., pile driving)—is to evaluate Ocean Wind's request under requirements of the MMPA (16 USC 1371(a)(5)(A)) and its implementing regulations administered by NMFS and to decide whether to issue the authorization. NMFS needs to render a decision regarding the request for authorization due to NMFS' responsibilities under the MMPA (16 USC 1371(a)(5)(A)) and its implementing regulations. NMFS intends to adopt the Final EIS if, after independent review and analysis, NMFS determines the Final EIS to be sufficient to support its separate proposed action and decision to issue the authorization, if appropriate.

The U.S. Army Corps of Engineers (USACE) Philadelphia District anticipates requests for authorization of a permit action to be undertaken through authority delegated to the District Engineer by 33 CFR 325.8, pursuant to Section 10 of the Rivers and Harbors Act of 1899 (RHA) (33 USC 403) and Section 404 of the Clean Water Act (CWA) (33 USC 1344). In addition, USACE anticipates that a "Section 408 permission" will be required pursuant to Section 14 of the RHA (33 USC 408) for any proposed alterations that have the potential to alter, occupy, or use any federally authorized civil works projects. USACE considers issuance of permits under these three delegated authorities a major federal action connected to BOEM's action (40 CFR 1501.9(e)(1)). The need for the Project as provided by the Applicant in Ocean Wind's COP and reviewed by USACE for NEPA purposes is to provide a commercially viable offshore wind energy project within the Lease Area to meet New Jersey's need for clean energy. The basic Project purpose, as determined by USACE for Section 404(b)(1) guidelines evaluation, is offshore wind energy generation. The overall Project purpose for Section 404(b)(1) guidelines evaluation, as determined by USACE, is the construction and operation of a commercial-scale offshore wind energy project for renewable energy generation and distribution to the New Jersey energy grids.

The purpose of USACE Section 408 action as determined by Engineer Circular 1165-2-220 is to evaluate the Applicant's request and determine whether the proposed alterations are injurious to the public interest or impair the usefulness of the USACE project. The USACE Section 408 permission is needed to ensure that congressionally authorized projects continue to provide their intended benefits to the public. USACE intends to adopt BOEM's EIS to support its decision on any permits and permissions requested under Section 10 of the RHA, Section 404 of the CWA, and Section 14 of the RHA. USACE would adopt the EIS under 40 CFR 1506.3 if, after its independent review of the document, it concludes that the EIS satisfies USACE's comments and recommendations. Based on its participation as a cooperating agency and its consideration of the final EIS, USACE would issue a Record of Decision (ROD) to formally document its decision on the Proposed Action.

1.3. Regulatory Overview

The Energy Policy Act of 2005, Public Law 109-58, amended the OCSLA (43 USC 1331 et seq.)[6] by adding a new subsection 8(p) that authorizes the Secretary of the Interior to issue leases, easements, and rights-of-way in the OCS for activities that "produce or support production, transportation, or transmission of energy from sources other than oil and gas," which include wind energy projects.

[6] Public Law No. 109-58, § 119 Stat. 594 (2005)

The Secretary of the Interior delegated this authority to the former Minerals Management Service, and later to BOEM. Final regulations implementing the authority for renewable energy leasing under the OCSLA (30 CFR 585) were promulgated on April 22, 2009.[7] These regulations prescribe BOEM's responsibility for determining whether to approve, approve with modifications, or disapprove Ocean Wind's COP (30 CFR 585.628).

Subsection 8(p)(4) of the OCSLA states: "[t]he Secretary shall ensure that any activity under [subsection 8(p)] is carried out in a manner that provides for –

(A) safety;
(B) protection of the environment;
(C) prevention of waste;
(D) conservation of the natural resources of the outer Continental Shelf;
(E) coordination with relevant Federal agencies;
(F) protection of national security interests of the United States;
(G) protection of correlative rights in the outer Continental Shelf;
(H) a fair return to the United States for any lease, easement, or right-of-way under this subsection;
(I) prevention of interference with reasonable uses (as determined by the Secretary) of the exclusive economic zone, the high seas, and the territorial seas;
(J) consideration of—
  (i) the location of, and any schedule relating to, a lease, easement, or right-of-way for an area of the outer Continental Shelf; and
  (ii) any other use of the sea or seabed, including use for a fishery, a sealane, a potential site of a deepwater port, or navigation;
(K) public notice and comment on any proposal submitted for a lease, easement, or right of-way under this subsection; and
(L) oversight, inspection, research, monitoring, and enforcement relating to a lease, easement, or right-of-way under this subsection."

As stated in M-Opinion 37067, ". . . subsection 8(p)(4) of OCSLA imposes a general duty on the Secretary to act in a manner providing for the subsection's enumerated goals. The subsection does not require the Secretary to ensure that the goals are achieved to a particular degree, and she retains wide discretion to determine the appropriate balance between two or more goals that conflict or are otherwise in tension."[8]

Section 2 of commercial Renewable Energy Lease OCS-A 0498 provides the lessee with an exclusive right to submit a COP to BOEM for approval. Section 3 provides that BOEM will decide whether to approve a COP in accordance with applicable regulations in 30 CFR 585, noting that BOEM retains the right to disapprove a COP based on its determination that the proposed activities would have unacceptable environmental consequences, would conflict with one or more of the requirements set forth in 43 USC 1337(p)(4), or for other reasons provided by BOEM under 30 CFR 585.613(e)(2) or 585.628(f). Section 3 of the lease also provides that BOEM reserves the right to approve a COP with modifications, as well as the right to authorize other uses within the leased area that will not unreasonably interfere with activities described in Addendum A, Description of Leased Area and Lease Activities.

BOEM's evaluation and decision on the COP are also governed by other applicable federal statutes and implementing regulations such as NEPA and the Endangered Species Act (ESA) (16 USC 1531–1544). The analyses in this Final EIS will inform BOEM's decision under 30 CFR 585.628 for the COP that was

[7] Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 74 *Federal Register* 19638–19871 (April 29, 2009)
[8] M-Opinion 37067 at page 5, http://doi.gov/sites/doi.gov/files/m-37067.pdf.

initially submitted in August 2019 and later updated with new information on March 13, 2020, September 24, 2020, March 24, 2021, December 10, 2021, May 27, 2022, and October 14, 2022. BOEM is required to coordinate with federal agencies and state and local governments and ensure that renewable energy development occurs in a safe and environmentally responsible manner. In addition, BOEM's authority to approve activities under the OCSLA only extends to approval of activities on the OCS. Appendix A outlines the federal, state, regional, and local permits and authorizations that are required for the Project and the status of each permit and authorization. Appendix A also provides a description of BOEM's consultation efforts during development of the Final EIS.

1.4. Relevant Existing NEPA and Consulting Documents

The following documents were utilized to inform the preparation of this Final EIS and are incorporated in their entirety by reference.

- *Final Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, OCS EIS/EA MMS 2007-046* (MMS 2007)—This Programmatic EIS was developed by the Minerals Management Service to support establishment of a program that provides for efficient and orderly development of alternative energy projects on the federal OCS, as well as the alternate use of offshore facilities for other energy- and marine-related activities. The four alternatives considered in the Final Programmatic EIS are: (1) the proposed action (i.e., the establishment of the Alternative Energy and Alternate Use Program on the OCS through rulemaking); (2) a case-by-case alternative (i.e., the Minerals Management Service would consider individual project proposals for alternative energy or alternate use on a case-by-case basis but would not issue formal regulations); (3) a no action alternative (i.e., the Minerals Management Service would not approve leases, easements, or rights-of-way for any alternative energy facility on the federal OCS or alternate use of existing offshore facilities); and (4) a preferred alternative (i.e., a combination of the proposed action and the case-by-case alternative). The document examined the potential environmental consequences of each of these alternatives and was used to establish initial measures to mitigate environmental consequences.
- *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia Final Environmental Assessment,* OCS EIS/EA BOEM 2012-003 (BOEM 2012)—BOEM prepared this Environmental Assessment to consider the environmental impacts of issuing renewable energy leases and authorizing site characterization activities needed to develop specific project proposals on those leases in identified Wind Energy Areas (WEA) on the OCS offshore New Jersey, Delaware, Maryland, and Virginia. BOEM used this Environmental Assessment to inform decisions to issue leases in the refined WEAs and to subsequently approve Site Assessment Plans (SAP) on those leases.
- *Ocean Wind 1 Offshore Wind Farm Biological Assessment for the United States Fish and Wildlife Service* (BOEM 2022a)—BOEM prepared this document pursuant to Section 7 of the ESA to evaluate potential effects of the Proposed Action on ESA-listed species under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS).
- *Ocean Wind 1 Offshore Wind Farm Biological Assessment for National Marine Fisheries Service* (BOEM 2022b)—BOEM prepared this document pursuant to Section 7 of the ESA to evaluate potential effects of the Proposed Action on ESA-listed species under the jurisdiction of NMFS.
- *Ocean Wind 1 Offshore Wind Farm Essential Fish Habitat Assessment for National Marine Fisheries Service* (BOEM 2022c)—BOEM prepared this document pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) to evaluate the potential effects of the Proposed Action on essential fish habitat (EFH) and EFH species under the jurisdiction of NMFS.

- *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement* (BOEM 2021c)—BOEM prepared this document for the Vineyard Wind Offshore Wind Energy Project COP submitted by Vineyard Wind LLC. The Final EIS analyzes the potential environmental impacts of the COP (the proposed action) and alternatives to the proposed action.
- *South Fork Wind Farm and South Fork Export Cable Project Final Environmental Impact Statement* (BOEM 2021d)—BOEM prepared this document for the COP submitted by South Fork Wind, LLC. The Final EIS analyzes the potential environmental impacts of the COP (the proposed action) and alternatives to the proposed action.

Additional environmental studies conducted to support planning for offshore wind energy development are available on BOEM's website: https://www.boem.gov/renewable-energy-research-completed-studies.

1.5. Methodology for Assessing the Project Design Envelope

Ocean Wind proposes using a Project Design Envelope (PDE) concept. This concept allows Ocean Wind to define and bracket proposed Project characteristics for environmental review and permitting while maintaining a reasonable degree of flexibility for selection and purchase of Project components such as WTGs, foundations, submarine cables, and OSS.

This Final EIS assesses the impacts of the PDE that is described in the Ocean Wind COP and presented in Appendix E by using the "maximum-case scenario" process. The maximum-case scenario is composed of each design parameter or combination of parameters that would result in the greatest impact for each physical, biological, and socioeconomic resource. This Final EIS evaluates potential impacts of the Proposed Action and each action alternative using the maximum-case scenario to assess the design parameters or combination of parameters for each environmental resource.[9] This Final EIS considers the interrelationship between aspects of the PDE rather than simply viewing each design parameter independently. Certain resources may have multiple maximum-case scenarios, and the most impactful design parameters may not be the same for all resources. Appendix E explains the PDE approach in more detail and presents a detailed table outlining the design parameters with the highest potential for impacts by resource area. Through consultation with its own engineers and outside industry experts, BOEM verified that the maximum-case scenario analyzed in the Final EIS could reasonably occur.

1.6. Methodology for Assessing Impacts

This Final EIS also assesses past, present (ongoing), and reasonably foreseeable future (planned) actions that could occur during the life of the Project. Ongoing and planned actions occurring within the geographic analysis areas include (1) other offshore wind energy development activities; (2) undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); (3) tidal energy projects; (4) marine minerals use and ocean-dredged material disposal; (5) military use; (6) marine transportation (commercial, recreational, and research-related); (7) fisheries use, management, and monitoring surveys; (8) global climate change; (9) oil and gas activities; and (10) onshore development activities. Appendix F (*Planned Activities Scenario*) describes the actions that BOEM has identified as potentially contributing to the existing baseline, and the actions potentially contributing to cumulative impacts when combined with impacts from the alternatives over the specified spatial and temporal scales. The geographic analysis area was determined for each resource analyzed in this Final EIS. A description of how the spatial boundaries were determined and a corresponding figure are provided at the beginning of each resource section in Chapter 3.

[9] BOEM's draft guidance on the use of design envelopes in a COP is available at: https://www.boem.gov/sites/default/files/renewable-energy-program/Draft-Design-Envelope-Guidance.pdf.

1.6.1 Past and Ongoing Activities and Trends (Existing Baseline)

Each resource-specific environmental consequences section in Chapter 3 of this Final EIS includes a description of the baseline conditions of the affected environment. The existing baseline considers past and present activities in the geographic analysis area, including those related to offshore wind projects with an approved COP (e.g., Vineyard Wind 1 and South Fork) and approved past and ongoing site assessment surveys, as well as other non-wind activities (e.g., Navy military training, existing vessel traffic, climate change). The existing condition of resources as influenced by past and ongoing activities and trends represents the existing baseline condition for impact analysis. Other factors currently affecting the resource, including climate change, are also acknowledged for that resource and are included in the impact-level conclusion.

1.6.2 Planned Activities

It is reasonable to predict that future activities may occur over time and that, cumulatively, those activities would affect the existing baseline conditions discussed in Section 1.6.1. Cumulative impacts are analyzed and concluded separately in each resource-specific environmental consequences section in Chapter 3 of this Final EIS. The existing baseline condition as influenced by future planned activities evaluated in Appendix F (*Planned Activities Scenario*) and the Proposed Action represent the sum of the cumulative impacts expected if the Project is approved. The impacts of future planned offshore wind projects are predicted using information from and assumptions based on COPs submitted to BOEM that are currently undergoing independent review.

2. Alternatives

This chapter (1) describes the alternatives carried forward for detailed analysis in this Final EIS, including the Proposed Action, No Action, and other action alternatives; (2) describes the non-routine activities and low-probability events that could occur during construction, O&M, and decommissioning of the proposed Project; and (3) presents a summary and comparison of impacts among alternatives and resource affected.

Identification of Preferred Alternative: The CEQ NEPA regulations require the identification of a preferred alternative in the Final EIS. BOEM has identified Alternative A in combination with Alternative E as the Preferred Alternative. Alternative E narrows the export cable route options in the PDE and cannot be implemented independently. The Preferred Alternative is depicted on Figure 2-2, Figure 2-3, Figure 2-6, and Figure 2-12. The Preferred Alternative is identified to let the public know which alternative BOEM, as the lead agency, is leaning toward before an alternative is selected for action when a ROD is issued. No final agency action is being taken by the identification of the Preferred Alternative and BOEM is not obligated to select the Preferred Alternative.

2.1. Alternatives Analyzed in Detail

BOEM considered a reasonable range of alternatives during the EIS development process that emerged from scoping, interagency coordination, and internal BOEM deliberations. Alternatives were reviewed using BOEM's screening criteria ("screening criteria"), presented in Appendix C, *Additional Analysis for Alternatives Dismissed*. Alternatives that met the screening criteria (i.e., were found to be infeasible or did not meet the purpose and need) were dismissed from detailed analysis in this Final EIS. Alternatives considered but dismissed from detailed analysis and the rationale for their dismissal are described in Section 2.1.7 and Appendix C. The alternatives carried forward for detailed analysis in this Final EIS are summarized in Table 2-1 below and described in detail in Sections 2.1.1 through 2.1.6. The alternatives listed in Table 2-1 are not mutually exclusive. BOEM may "mix and match" multiple listed Final EIS alternatives to result in a preferred alternative that will be identified in the Final EIS provided that (1) the design parameters are compatible; and (2) the preferred alternative still meets the purpose and need.

Although BOEM's authority under the OCSLA only extends to the activities on the OCS, alternatives related to addressing nearshore and onshore elements as well as offshore elements of the Proposed Action are analyzed in the EIS. BOEM's regulations (30 CFR 585.620) require that the COP describes all planned facilities that the lessee would construct and use for the Project, including onshore and support facilities and all anticipated Project easements. As a result, those federal, state, and local agencies with jurisdiction over nearshore and onshore impacts are able to adopt, at their discretion, those portions of BOEM's EIS that support their own permitting decisions.

NMFS and USACE are serving as cooperating agencies. NMFS intends to adopt the Final EIS if, after independent review and analysis, NMFS determines the Final EIS to be sufficient to support its separate proposed action and decision to issue the authorization, if appropriate. USACE similarly intends to adopt the EIS if it is determined to be sufficient after independent review to meet its responsibilities under Section 404 of the CWA and Section 10 of the RHA. Under the Proposed Action and other action alternatives, NMFS' action alternative is to issue the requested Letter of Authorization to the Applicant to authorize incidental take for the activities specified in its application and that are being analyzed by BOEM in the reasonable range of alternatives described here. USACE is required to analyze alternatives to the proposed Project that are reasonable and practicable pursuant to NEPA and the CWA 404(b)(1) Guidelines. The range of alternatives analyzed in the Final EIS, including cable route options within the

PDE and alternatives considered but dismissed, represents a reasonable range of alternatives for this analysis.

BOEM decided to use the NEPA substitution process for National Historic Preservation Act (NHPA) Section 106 purposes, pursuant to 36 CFR 800.8(c), during its review of the Project. Section 106 of the NHPA regulations, "Protection of Historic Properties" (36 CFR 800), provides for use of the NEPA substitution process to fulfill a federal agency's NHPA Section 106 review obligations in lieu of the procedures set forth in 36 CFR 800.3 through 800.6. Draft avoidance, minimization, and mitigation measures to resolve adverse effects on historic properties are presented in Appendix H, *Mitigation and Monitoring*. Ongoing consultation with consulting parties and government-to-government consultation with tribal nations may result in additional measures or changes to these measures.

Table 2-1 Alternatives Considered for Analysis

Alternative	Description
No Action Alternative	Under the No Action Alternative, BOEM would not approve the COP; the Project construction and installation, O&M, and conceptual decommissioning would not occur; and no additional permits or authorizations for the Project would be required.[1] Any potential environmental and socioeconomic impacts, including benefits, associated with the Project as described under the Proposed Action would not occur. The current resource condition, trends, and effects from ongoing activities under the No Action Alternative serve as the baseline against which all action alternatives are evaluated. Over the life of the proposed Project, other reasonably foreseeable future impact-producing offshore wind and non-offshore wind activities are expected to occur, which would cause changes to the existing baseline conditions even in the absence of the Proposed Action. The continuation of all other existing and reasonably foreseeable future activities described in Appendix F (*Planned Activities Scenario*) without the Proposed Action serves as the baseline for the evaluation of cumulative impacts.
Alternative A: Proposed Action (Preferred Alternative)	Under Alternative A, the construction, O&M, and conceptual decommissioning of an 1,100-MW wind energy facility consisting of up to 98 WTGs, up to three alternating-current OSS, inter-array cables linking the individual WTGs to the OSS, and substation interconnector cables linking the substations to each other would be developed in the Lease Area, approximately 13 nm southeast of Atlantic City, New Jersey. Up to three offshore export cables (installed within two export cable route corridors) that connect to onshore export cable systems and two onshore substations with connections to the existing electrical grid in New Jersey at BL England and Oyster Creek would also be developed. The BL England export cable route corridor would landfall in Ocean City, New Jersey, and the Oyster Creek export cable route corridor would landfall in Lacey Township, New Jersey. Development of the wind energy facility would occur within the range of design parameters outlined in the COP (Ocean Wind 2023), subject to applicable mitigation measures.
Alternative B: No Surface Occupancy at Select Locations to Reduce Visual Impacts	Under Alternative B, the construction, O&M, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the COP, subject to applicable mitigation measures. However, no surface occupancy would occur at select WTG positions to reduce the visual impacts of the proposed Project. Each of the sub-alternatives below may be individually selected or combined with any or all other alternatives or sub-alternatives, subject to the combination meeting the purpose and need.

[1] Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization under the MMPA to the Applicant.

Alternative	Description
	• **Alternative B-1:** No Surface Occupancy at Select Locations to Reduce Visual Impacts (Smaller Turbine Model): This alternative would exclude placement of WTGs at up to nine[2] WTG positions that are nearest to coastal communities (positions F01 to K01 and B02 to D02). The final number of WTG positions excluded in the Final EIS may be fewer than nine to ensure consistency with an 1,100-MW nameplate capacity and annual OREC allowance to fulfill Ocean Wind's contractual obligations with BPU. • **Alternative B-2:** No Surface Occupancy at Select Locations to Reduce Visual Impacts (Larger Turbine Model): This alternative would exclude placement of WTGs at up to 19 WTG positions that are nearest to coastal communities (positions F01 to K01, A02 to K02, A03, and C03). Selection of this alternative would be contingent on the larger turbine with a 240-meter rotor diameter being commercially available when BOEM issues its ROD as well as technical and economic feasibility and consistency with the purpose and need. The final number of WTG positions excluded in the Final EIS may be fewer than 19 to ensure consistency with an 1,100-MW nameplate capacity and annual OREC allowance to fulfill Ocean Wind's contractual obligations with BPU.

[2] The PDE parameters for WTGs outlined in the COP include a rotor diameter up to 240 meters. Current and near-term commercially available WTGs likely used for this Project range from a 12.4-MW WTG (smaller turbine model) to a 14.7-MW WTG (larger turbine model). Calculations using these turbine nameplate capacities and the Project nameplate capacity (1,100 MW) were used to develop alternatives (i.e., 1,100 MW divided by 12.4 MW equals 89 WTGs; therefore, a maximum of nine WTGs could be removed). The calculated WTG number represents the maximum number prior to applying a capacity factor. Capacity factor is the average power output divided by the maximum power capability for a given time period. Capacity factor plays a role in estimating the expected annual energy production, and for the Project would most likely vary between 45 percent and 63 percent. Ocean Wind has selected the GE Haliade-X 12-MW WTG; however, the environmental review analyzes the PDE as it is presented in the COP.

Alternative	Description
Alternative C: Wind Turbine Layout Modification to Establish a Buffer Between Ocean Wind 1 and Atlantic Shores South	Under Alternative C, the construction, O&M, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the Ocean Wind 1 COP, subject to applicable mitigation measures. However, modifications would be made to the wind turbine array layout to create a 0.81-nm to 1.08-nm buffer[3] between WTGs in the lease area of OCS-A 0498 (Ocean Wind 1 Lease Area) and WTGs in the lease area of OCS-A 0499 (Atlantic Shores South Lease Area) to reduce impacts on existing ocean uses, such as commercial and recreational fishing and marine (surface and aerial) navigation. Each of the sub-alternatives below may be individually selected or combined with any or all other alternatives or sub-alternatives, subject to the combination meeting the purpose and need. • **Alternative C-1:** No Surface Occupancy to Establish a Buffer with Turbine Relocation: No surface occupancy along the northeastern boundary of the Ocean Wind 1 Lease Area (A02 to A09) through the exclusion of eight WTG positions, relocation of up to eight WTG positions to the northern portion of the Ocean Wind 1 Lease Area, or some combination of exclusion and relocation of WTG positions, to allow for a 0.81-nm to 1.08-nm buffer between WTGs in the Ocean Wind 1 Lease Area and WTGs in the Atlantic Shores South Lease Area. • **Alternative C-2:** No Surface Occupancy to Establish a Buffer with Turbine Layout Compression: No surface occupancy along the northeastern boundary of the Ocean Wind 1 Lease Area to allow for a 0.81-nm to 1.088-nm buffer between WTGs in the Ocean Wind 1 Lease Area and WTGs in the Atlantic Shores South Lease Area. However, under Alternative C-2, the wind turbine array layout would be compressed to allow for a full build of up to 98 WTGs. Ocean Wind 1's turbine array row spacing would be reduced from 1 nm between rows to no less than 0.99 nm between rows.
Alternative D: Sand Ridge and Trough Avoidance	Under Alternative D, the construction, O&M, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the Ocean Wind 1 COP, subject to applicable mitigation measures. However, modifications would be made to the wind turbine array layout to minimize impacts on sand ridge and trough features in the northeastern corner of the Lease Area. This alternative would result in the exclusion of up to 15 WTG positions in the sand ridge and trough area that include A07 to E07, A08 to E08, and A09 to E09. The identification of individual WTGs for exclusion, should the number excluded be fewer than 15, would be coordinated with NMFS. Selection of this alternative with the exclusion of more than nine WTGs would be contingent on the larger turbine with a 240-meter rotor diameter being commercially available when BOEM issues its ROD as well as its technical and economic feasibility, and consistency with the purpose and need. The final number of WTG positions considered for exclusion in the Final EIS may be reduced to fewer than nine to fifteen to ensure consistency with an-1,100 MW nameplate capacity and annual OREC allowance to fulfill Ocean Wind's contractual obligations with BPU.

[3] Buffer distance would range between 0.81 nm and 1.08 nm; however, distance between individual WTGs may be greater than 1.08 nm.

Alternative	Description
Alternative E: Submerged Aquatic Vegetation Avoidance (Preferred Alternative)	Under Alternative E, the construction, operation, maintenance, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the Ocean Wind 1 COP, subject to applicable mitigation measures. However, the Oyster Creek export cable route traversing Island Beach State Park would be limited to the option developed to minimize impacts on submerged aquatic vegetation in Barnegat Bay. The submerged aquatic vegetation avoidance export cable route option would make landfall within an auxiliary parking lot of Swimming Area 2 in Island Beach State Park, continue north within parking lots, then northwest under Shore Road before entering Barnegat Bay. Upon entering Barnegat Bay, the export cable route would continue within a previously dredged channel and then reconnect to the Oyster Creek export cable route in Barnegat Bay. This alternative would narrow the design envelope so that the Applicant could only select the northernmost export cable route; the northernmost export cable route would not function independently but is intended to be combined with another alternative or sub-alternative, subject to the combination meeting the purpose and need.

2.1.1 No Action Alternative

Under the No Action Alternative, BOEM would not approve the COP. Project construction and installation, O&M, and decommissioning would not occur, and no additional permits or authorizations for the Project would be required.[4] Any potential environmental and socioeconomic impacts, including benefits, associated with the Project as described under the Proposed Action would not occur. The current resource condition and effects from ongoing activities under the No Action Alternative serve as the existing baseline against which all direct and indirect impacts from alternatives are evaluated.

Over the life of the proposed Project, other reasonably foreseeable future potentially impact-producing offshore wind and non-offshore wind activities would likely be implemented, which would cause changes to the existing baseline conditions even in the absence of the Proposed Action. The continuation of all other existing and reasonably foreseeable future activities described in Appendix F (*Planned Activities Scenario*) without the Proposed Action serves as the future baseline for the evaluation of cumulative impacts.

2.1.2 Alternative A—Proposed Action (Preferred Alternative)

The Proposed Action is to construct, operate, maintain, and decommission an approximately 1,100-MW wind energy facility consisting of up to 98 WTGs, up to three OSS, inter-array cables linking the individual WTGs to the OSS, and substation interconnector cables linking the substations to each other in the Lease Area, approximately 13 nm southeast of Atlantic City, New Jersey (Figure 1-1). Up to three offshore export cables (installed within two export cable route corridors) that connect to onshore export cable systems and two onshore substations with connections to the existing electrical grid in New Jersey at BL England and Oyster Creek would also be developed. The BL England export cable route corridor would landfall in Ocean City, New Jersey, and the Oyster Creek export cable route corridor would landfall in Lacey Township, New Jersey. Development of the wind energy facility would occur within the range of design parameters described in Volume I of the Ocean Wind 1 COP (Ocean Wind 2023) and summarized in Appendix E, *Project Design Envelope and Maximum-Case Scenario*. The expected annual energy production of the Proposed Action is 4,851,489 MW-hours per year or 100 percent of Ocean

[4] Under the No Action Alternative, impacts on marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization under the MMPA to the Applicant.

Wind's annual OREC allowance per the 2019 award by BPU. A description of construction and installation, O&M, and decommissioning activities to be undertaken for the Proposed Action is included in Sections 2.1.2.1 through 2.1.2.4 below. Refer to Volume I of the Ocean Wind 1 COP (Ocean Wind 2023) for additional details on Project design.

2.1.2.1. Committed Mitigation and Monitoring

Ocean Wind has committed to measures as part of its Project to avoid or minimize impacts on physical, biological, socioeconomic, and cultural resources (summarized in COP Volume II, Table 1.1-2; Ocean Wind 2023). These measures are described in Appendix H, *Mitigation and Monitoring*, and are incorporated as part of the Proposed Action. Consultations under Section 7 of the ESA and the MSA as well as the submission for and issuance of other necessary permits and authorizations under applicable statutes, including the MMPA and Coastal Zone Management Act, may result in additional measures or changes to these measures.

As part of the Proposed Action, Ocean Wind has committed to conducting several pre-, during, and post-construction monitoring surveys. Ocean Wind is voluntarily conducting pre-construction surveys under existing permits. A list of these surveys is provided below along with the Project phase during which the monitoring would occur. A description of the survey activities is provided in the respective resource sections in Chapter 3.

Table 2-2 Monitoring Surveys

Monitoring Survey	Project Phase	Chapter 3 Resource Section
Fisheries Monitoring Plan	Pre-construction, Construction, and Operation	Commercial Fisheries and For-Hire Recreational Fishing
Benthic Monitoring Plan	Pre-construction, Construction, and Operation	Benthic Resources
Protected Species Mitigation and Monitoring Plan: Marine Mammals, Sea Turtles, and ESA-listed Fish	Pre-construction, Construction, and Operation	Finfish, Invertebrates, and EFH; Marine Mammals; Sea Turtles
Avian and Bat Post-Construction Monitoring Framework	Operation	Bats; Birds
Submerged Aquatic Vegetation Monitoring Plan	Pre-construction, Construction, and Operation	Benthic Resources

2.1.2.2. Construction and Installation

The Proposed Action would include the construction and installation of both onshore and offshore facilities. Construction and installation would begin in 2023 and be completed in 2025. Ocean Wind anticipates initiating land-based construction before beginning the offshore components. An indicative Project schedule is included in COP Volume I, Chapter 4, Figure 4.5-1 (Ocean Wind 2023) and summarized below. Timeframes are identified by the 3-month quarter (Q) of that respective year.

Onshore Export Cables and Onshore Substations	Q3 of 2023 to Q1 of 2025
Landfall Cable Installation	Q4 of 2023 to Q4 of 2024
Offshore Export Cable Installation	Q2 of 2024 to Q1 of 2025
Offshore Foundations (WTG and OSS)	Q2 of 2024 to Q4 of 2024

Inter-array Cable Installation	Q3 of 2024 to Q2 of 2025
WTG and OSS Installation and Commissioning	Q3 of 2024 to Q4 of 2025

2.1.2.2.1 Site Preparation Activities

Site preparation activities are necessary during construction. Site preparation includes activities such as high-resolution geophysical (HRG) surveys, geotechnical surveys, and unexploded ordnance (UXO)/munitions and explosives of concern (MEC) risk mitigation. HRG surveys are anticipated to support the construction of WTG and OSS foundations and installation of export, inter-array, and OSS interconnector cables.

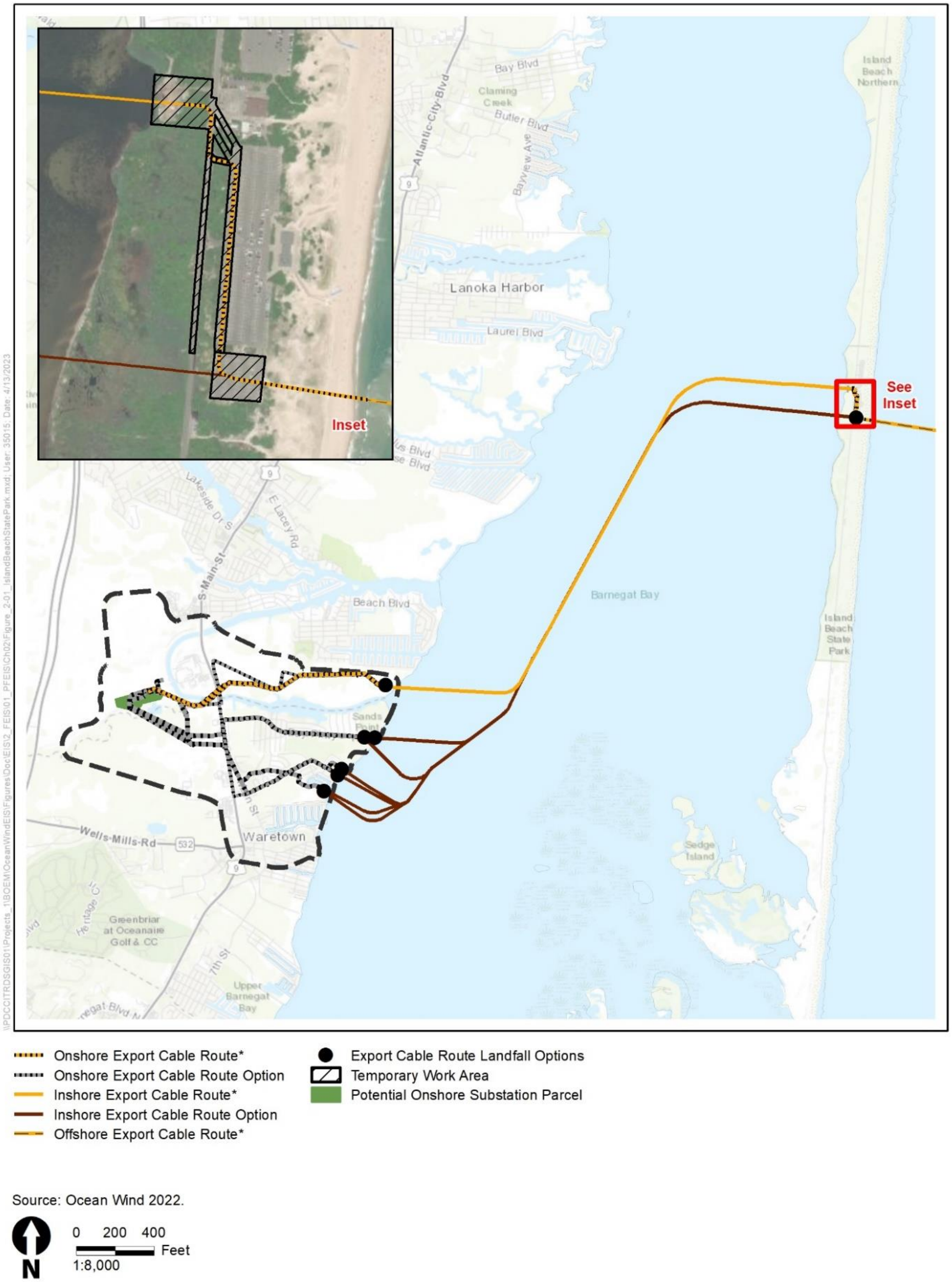
HRG surveys would occur as part of site preparation activities before and during construction and would also occur intermittently after construction. Surveys would include equipment operating at less than 180 kilohertz and consist of multibeam depth sounding, seafloor imaging, and shallow- and medium-penetration sub-bottom profiling within the Project area. Potential equipment used during HRG surveys would be side-scan sonar, multibeam echosounders, magnetometers and gradiometers, parametric sub-bottom profilers, compressed high-intensity radiated pulses sub-bottom profilers, boomers, or sparkers. Although survey plans would not be completed until construction contracting commences, Ocean Wind assumes that HRG surveys would be conducted 24 hours a day with an assumed average daily distance of 43.5 miles (70 kilometers). A maximum of three vessels would work concurrently within a 24-hour period with an assumed transit speed of 4 knots (2.1 meters per second [m/s]). Throughout the 5-year period for which MMPA Incidental Take Authorization regulations would be promulgated, the HRG surveys would be a total of 624 days.

Avoidance is the preferred approach to UXO/MEC mitigation; however, for instances where avoidance is not possible, confirmed UXO/MEC may be removed through in-situ disposal or physical relocation. In-situ disposal of UXO/MEC would be done with low-order (deflagration) or high-order (detonation) methods or by cutting the UXO/MEC to extract the explosive components. Although the exact number and type of UXO in the Project area are not yet know, it is currently assumed that up to 10 UXOs may need to be detonated in place. If necessary, these detonations would occur on up to 10 different days (i.e., one detonation would occur per day) (Ocean Wind 2023).

2.1.2.2.2 Onshore Activities and Facilities

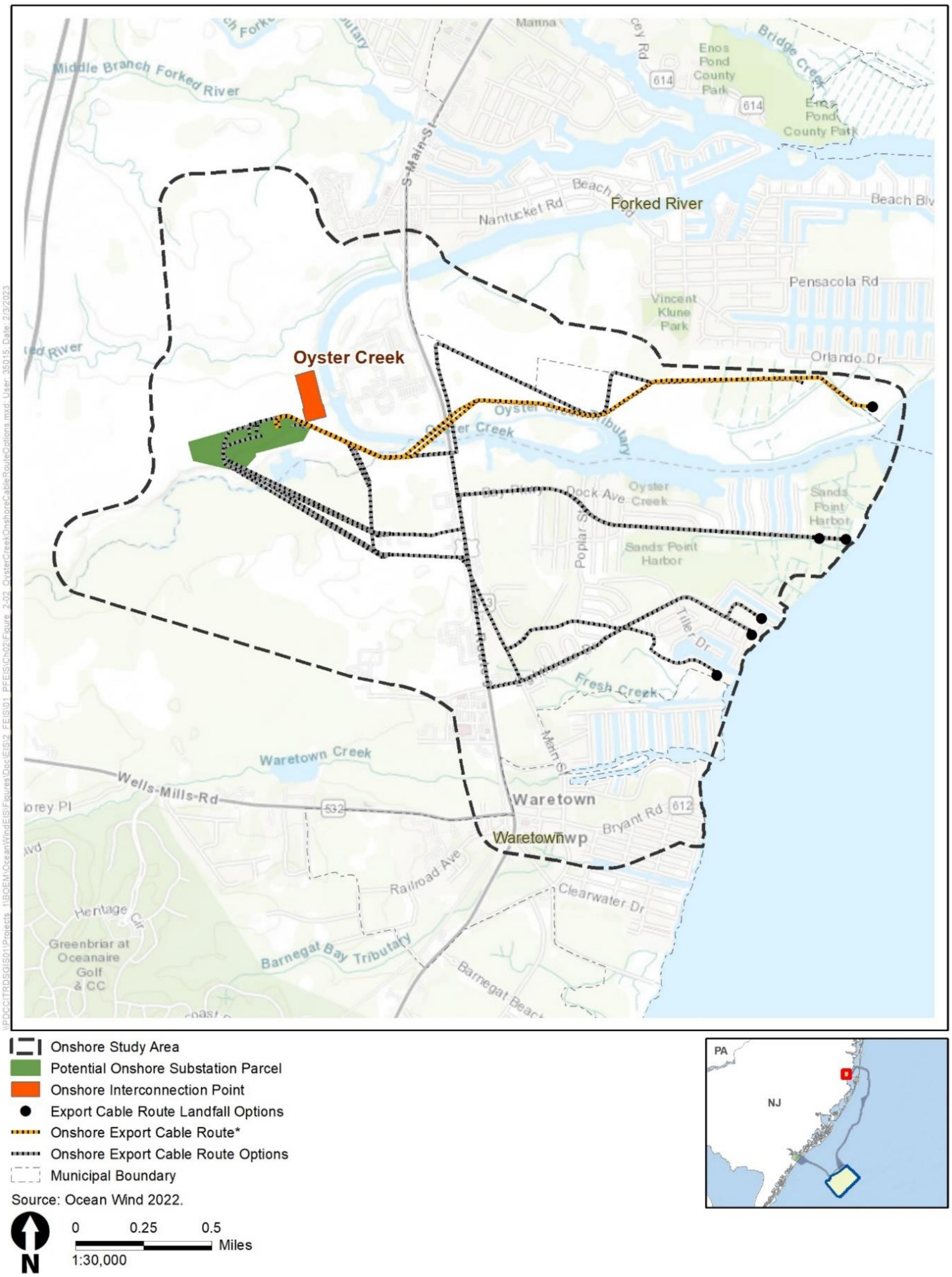
Proposed onshore Project elements include the landfall site, the Transition Joint Bay (TJB) that connects the offshore export cable to the onshore export cable, the onshore export cable route(s) to the onshore substation, and the connection from the onshore substation to the existing grid (these elements collectively compose the Onshore Project area). Appendix E, *Project Design Envelope and Maximum-Case Scenario*, describes the PDE for onshore activities and facilities and COP Volume I provides additional details on construction and installation methods (Ocean Wind 2023). These onshore elements of the Proposed Action are included in BOEM's analysis in the EIS to support the analysis of a complete Project; however, BOEM's authority under the OCSLA only extends to the activities on the OCS.

The proposed Project includes two interconnection points with the PJM electric transmission system: Oyster Creek and BL England. To reach the onshore substation at Oyster Creek, the offshore export cables would first cross Island Beach State Park using one of two routes as shown on Figure 2-1 before making landfall and following the onshore cable route as shown on Figure 2-2. To reach the onshore substation at BL England, the offshore export cables would make landfall at the designated locations in Ocean City and follow the onshore cable routes as shown on Figure 2-3. Critical structures and equipment at onshore substations would be elevated to 3 feet above the current 100-year base flood elevation, consistent with Federal Emergency Management Agency design recommendations, to account for tidal surge and sea level rise as a result of climate change. The PDE also includes additional landfall and onshore export cable route options to reach the onshore substation at Oyster Creek and additional landfall and onshore export cable route options to reach the onshore substation at BL England to allow for route refinement and optimization. The PDE includes all proposed onshore options, which will be analyzed collectively as part of the Proposed Action in the Final EIS. Ocean Wind has identified its preferred onshore routes on Figure 2-1 and Figure 2-2 for Oyster Creek and Figure 2-3 for BL England, but it may elect to obtain permits for and construct any of the depicted onshore routes. The transition of the export cables from offshore to onshore would occur at a TJB onshore and be accomplished by using open cut (i.e., trenching) or trenchless methods (bore or horizontal directional drilling [HDD]). The TJBs would be buried below grade and accessible via a manhole cover. The TJBs would be protected from erosion caused by storm events through stabilization of the area using imported fill topped with concrete mattresses.



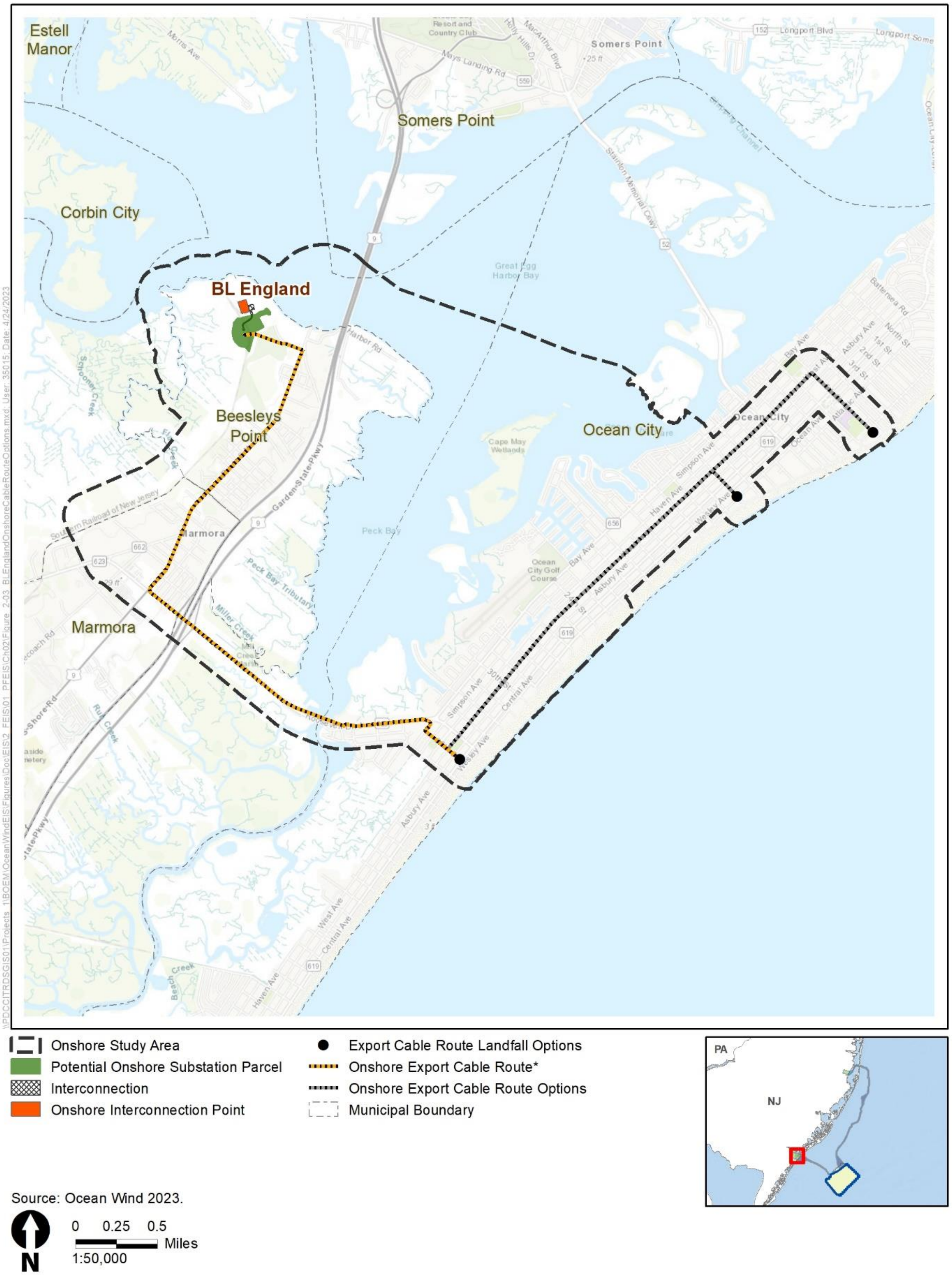
* Asterisks within the figure legend identify the cable routes for which Ocean Wind has submitted permit applications.

Figure 2-1 Oyster Creek Export Cable Route Options at Island Beach State Park



* Asterisks within the figure legend identify the cable routes for which Ocean Wind has submitted permit applications.

Figure 2-2 Onshore Cable Route Options to Oyster Creek Substation (Preferred Alternative)



* Asterisks within the figure legend identify the cable routes for which Ocean Wind has submitted permit applications.

Figure 2-3 Onshore Cable Route Options to BL England Substation (Preferred Alternative)

Onshore export cables would be buried and housed within a single duct bank buried along the onshore export cable route. The planned duct bank would be encased in concrete with a target burial depth of 4 feet. The duct bank would include six conduits for the power cables, two conduits for fiber optic communications cables, and two conduits for ground continuity conductors. Installation of onshore export cable would require up to a 50-foot (15-meter) wide construction corridor and up to a 30-foot (9-meter) wide permanent easement for the Oyster Creek and BL England cable corridors excluding landfall locations and cable splice locations. Permanent easements are expected to be larger at splice vaults and TJB locations. The Oyster Creek onshore cable route options that cross Route 9 and Oyster Creek would be installed using trenchless technology.

The proposed onshore export cable routes would terminate at the Oyster Creek and BL England substation sites. The proposed Oyster Creek substation is sited on the former Oyster Creek nuclear plant in Lacey Township, which was retired and is in the decommissioning phase. It would occupy up to 31.5 acres (127,476 square meters [m^2]). The proposed BL England substation is sited on the site of a former coal, oil, and diesel plant in Upper Township that was retired in phases between 2014 and 2019. It would occupy up to 13 acres (52,609 m^2). For both proposed substations, either an overhead connection or an underground transmission line with an overhead tie-line may be used from the onshore substation to an interconnection point at an existing nearby facility.

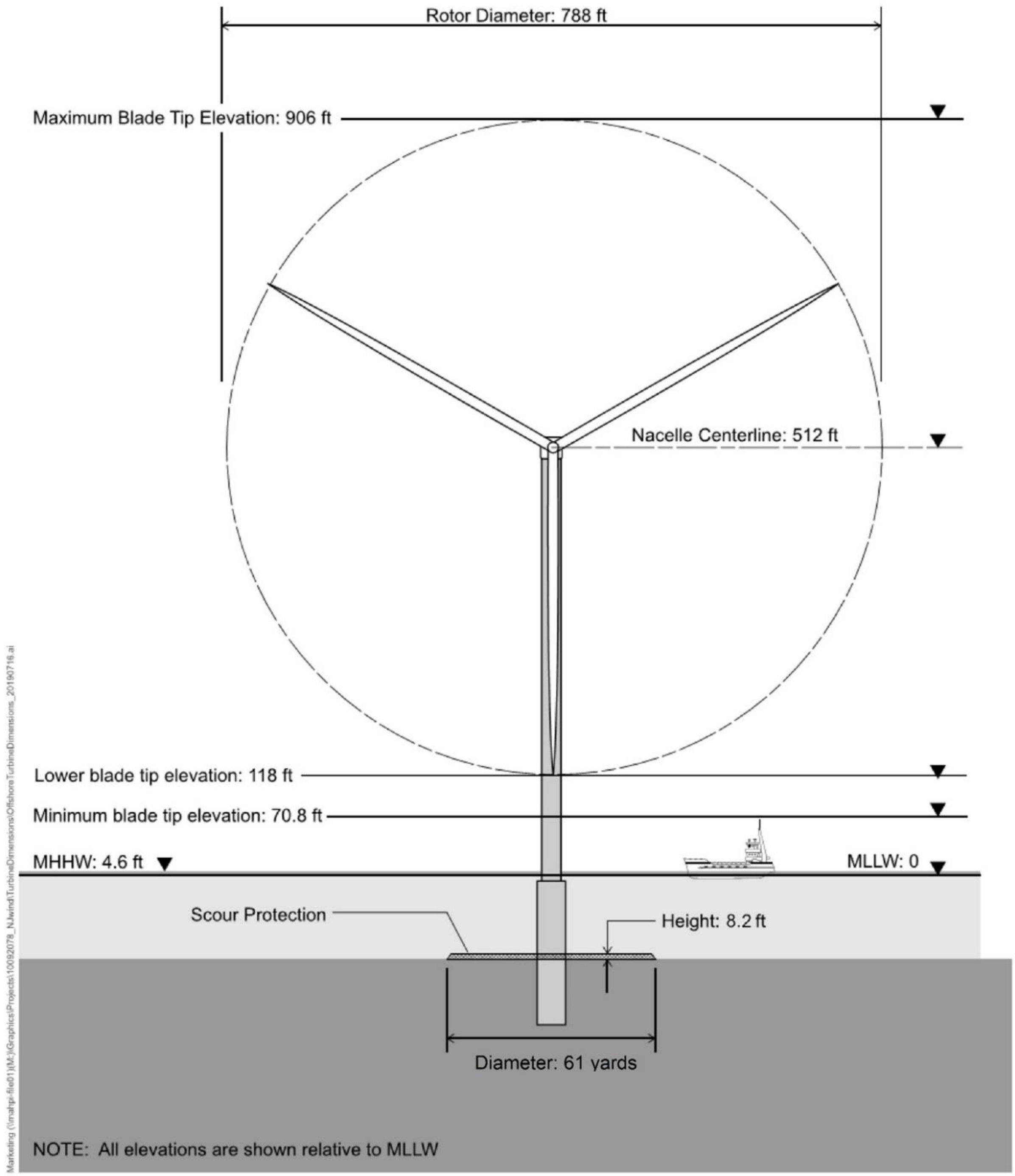
2.1.2.2.3 Offshore and Nearshore Activities and Facilities

Proposed offshore Project components include WTGs and their foundations, OSS and their foundations, scour protection for foundations, inter-array and substation interconnection cables, and offshore export cables (these elements collectively compose the Offshore Project area). Infrastructure and equipment for environmental monitoring, asset monitoring, and communication systems are also proposed. The proposed offshore Project elements are on the OCS as defined in the OCSLA, with the exception that a portion of the export cables would be within state waters (Figure 1-1). Appendix E, *Project Design Envelope and Maximum-Case Scenario*, describes the PDE for offshore activities and facilities and COP Volume I provides additional details on construction and installation methods (Ocean Wind 2023).

Ocean Wind proposes the installation of up to 98 WTGs extending up to 906 feet (276 meters) above mean lower low water (MLLW) with a spacing of 1 nm by 0.8 nm between WTGs in a southeast-northwest orientation within the 68,450-acre (277-square-kilometer [km^2]) Wind Farm Area.[5] Refer to Figure 2-4 for a schematic drawing of the maximum WTG design parameters. Ocean Wind would mount the WTGs on monopile foundations (Figure 2-5). A monopile foundation typically consists of a single steel tubular section, consisting of sections of rolled steel plate welded together. A transition piece is fitted over the monopile and secured via bolts or grout. OSS would be placed on either monopile or piled jacket foundations. Piled jacket foundations are formed of a steel lattice construction, composed of tubular steel members and welded joints, and secured to the seabed by hollow steel pin piles attached to each of the jacket feet. Renderings of the WTGs and indicative figures of the OSS monopile and piled jacket foundations are included in COP Volume I, Section 6.1.1 (Ocean Wind 2023). The WTG foundations would have a maximum seabed penetration of 164 feet (50 meters). Where required, scour protection would be placed around foundations to stabilize the seabed near the foundations as well as the foundations themselves. The scour protection would be a maximum of 8.2 feet (2.5 meters) in height,

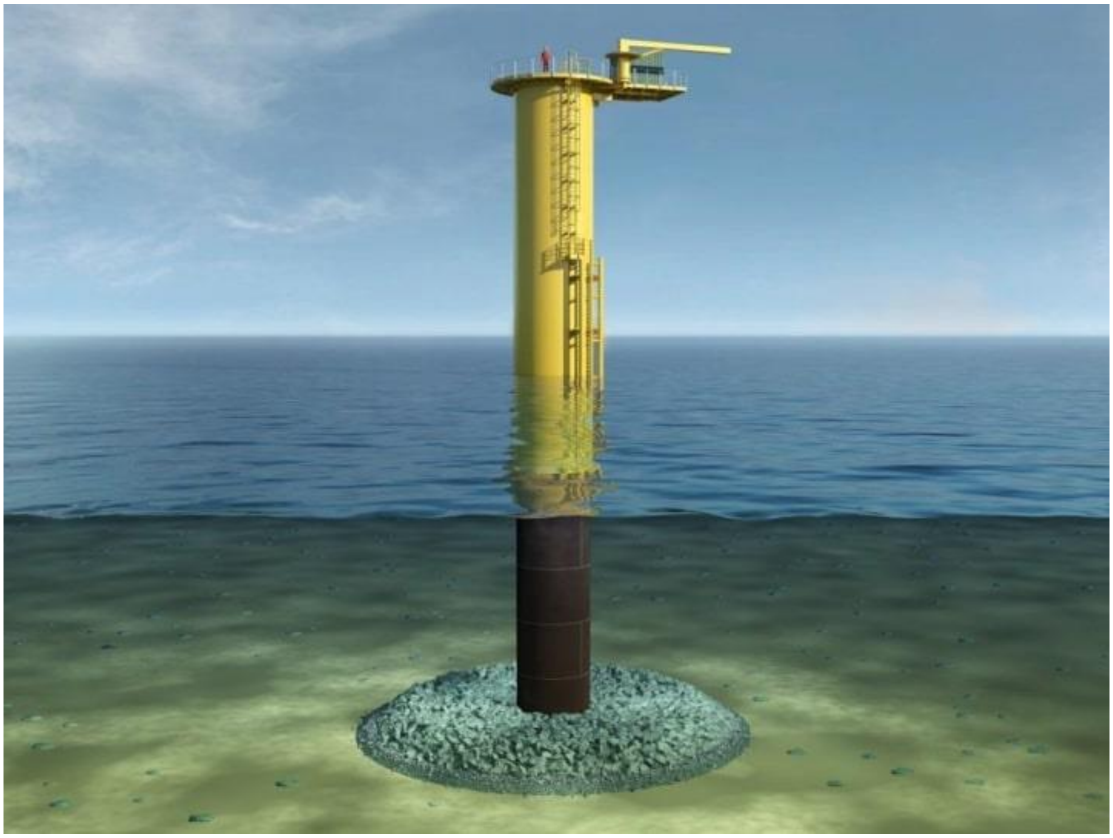
[5] Subsequent to publication of the Draft EIS, Ocean Wind submitted an updated COP incorporating an array layout compression scenario analyzed under Alternative C-2, Wind Turbine Layout Modification to Establish a Buffer Between Ocean Wind 1 and Atlantic Shores South. This array layout compression scenario, depicted on Figure 2-6 of the Draft EIS, modifies the WTG array layout by compressing the WTG array layout to create a 0.81-nm buffer. Ocean Wind 1 and Atlantic Shores South, in coordination with the U.S. Coast Guard, developed this mutually agreeable scenario, which was documented in a joint letter signed by Ocean Wind and Atlantic Shores Offshore Wind on July 21, 2022.

would extend away from the foundation as far as 73 feet (22.3 meters). Each WTG would contain approximately 1,585 gallons (6,000 liters) of transformer oil and 146 gallons (553 liters) of general oil (for hydraulics and gearboxes). Use of other chemicals would include diesel fuel, coolants/refrigerants, grease, paints, and sulfur hexafluoride. COP Volume I, Section 8.1 provides additional details related to proposed chemicals and their anticipated volumes (Ocean Wind 2023).



Source: Ocean Wind 2023.
MHHW = mean higher high water; MLLW = mean lower low water

Figure 2-4 Wind Turbine Schematic (Maximum Design Parameter)



Source: Ocean Wind 2023.

Figure 2-5 Monopile Foundation Type

Ocean Wind proposes to install foundations and WTGs using up to two jack-up vessels, as well as necessary support vessels and barges as listed in COP Volume I, Table 6.1.2-1 (Ocean Wind 2023). After the seabed has been prepared for foundations, Ocean Wind would begin pile driving until the target embedment depth is met. Installation of monopile and piled jacket foundations are similar, although piled jacket foundations would require more seabed preparation for each of the jacket feet.

Ocean Wind proposes to construct up to three OSS to collect the electricity generated by the offshore turbines. OSS help stabilize and maximize the voltage of power generated offshore, reduce potential electrical losses, and transmit energy to shore. OSS are generally installed in two phases: first the foundation substructure would be installed in a similar method to that described above, then the topside structure would be installed on the foundation structure. More information on installation can be found in COP Volume I, Section 6.1.2 (Ocean Wind 2023). Each substation is expected to require two primary vessels, which may include jack-up vessels, jack-up barges, sheerleg barges, or Heavy-Lift Vessels, as well as necessary support vessels and barges as listed in COP Volume I, Table 6.1.2-2 (Ocean Wind 2023). OSS would consist of a topside structure with one or more decks on either a monopile or piled jacket foundation. Inter-array cables would transfer electrical energy generated by the WTGs to the OSS. OSS would include step-up transformers and other electrical equipment needed to connect the 66-kilovolt (kV) inter-array cables to the 275-kV or 220-kV offshore export cables. Substations would be connected to one another via substation interconnector cables. Up to two interconnector cables with a maximum voltage of 275 kV would be buried beneath the seabed.

The WTGs and OSS would be lit and marked in accordance with Federal Aviation Administration (FAA) and United States Coast Guard (USCG) lighting standards and consistent with BOEM best practices. Ocean Wind proposes to implement an Aircraft Detection Lighting System (ADLS) to automatically activate lights when aircraft approach. Ocean Wind would paint WTGs no lighter than radar-activated light (RAL) 9010 Pure White and no darker than RAL 7035 Light Grey. Additionally, the lower sections of each structure would be marked with high-visibility yellow paint from the water line to an approximate height of at least 50 feet (15 meters), consistent with International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) guidance.

Ocean Wind proposes several cable installation methods for the inter-array and substation interconnector cables. Site preparation activities for cable laying would include boulder and sand wave clearance and pre-lay grapnel runs. A combination of displacement plow, subsea grab, or back hoe dredger may be used to clear boulders. For dense boulder fields, a displacement plow would most likely be used. A displacement plow is a Y-shaped tool composed of a boulder board attached to a plow. The plow is pulled along the seabed and scrapes the seabed surface, pushing boulders out of the cable corridor. The plow is lightly ballasted to clear the corridor of boulders but not create a deep depression in the seabed. A displacement plow cannot be used in areas where slopes are steep. Multiple passes may be required dependent on the burial tool selected and seabed conditions. Where there are steep slopes, large obstructions occur, or boulder density is low, a subsea grab may be used. In shallower waters, a backhoe dredger may be used. Following boulder clearance, a series of grapnels would be towed along the final cable route to locate and clear remaining obstructions, such as abandoned cables, fishing gear, and marine debris, prior to cable installation (i.e., a pre-lay grapnel run). A pre-lay grapnel run would be undertaken usually no more than 2 weeks before installation of the cable along a particular route length.

Sand waves (i.e., mobile sediment features on the seabed that resemble sand dunes) may be cleared prior to cable installation. Cables must be buried at a depth beneath the level where natural sand wave movement would not uncover them. Also, the natural slope of the sand waves can pose a hazard for installation tools that require a relatively level surface to operate effectively. Sand wave clearance may be needed where cable exposure is predicted over the lifetime of the Project due to seabed mobility or where slopes are greater than approximately 10 degrees (17.6 percent). Sand wave clearance would be accomplished using traditional dredging methods (e.g., trailing suction hopper dredging), controlled-flow excavation, or a sand wave removal plow to side cast material. Multiple passes may be required. Where there is a time gap between sand wave clearing and installation, the area may start to infill and pre-sweeping may be required to remove partial infill prior to cable installation.

Inter-array and substation interconnection cables would be laid and buried up to 2 weeks post-lay using a jetting tool if seabed conditions allow. Alternatively, the inter-array cables may be installed by using a tool towed behind the installation vessel to simultaneously open the seabed and lay the cable, or by laying the cable and following with a tool to embed the cable. Possible installation methods for these options include jetting, vertical injection, control flow excavation, trenching, and plowing. The inter-array and substation interconnector cables have a target burial depth of 4 to 6 feet (1.2 to 1.8 meters) below the stable seabed.

Two offshore export cable route corridors are proposed by Ocean Wind in the COP: Oyster Creek and BL England (Ocean Wind 2023). Up to two offshore export cables would be buried under the seabed within the Oyster Creek export cable route corridor to make landfall and deliver electrical power to the Oyster Creek substation. The offshore export cable route corridor to Oyster Creek would begin within the Wind Farm Area and proceed northwest to the Atlantic Ocean side of Island Beach State Park. At Island Beach State Park, Ocean Wind proposes two options. In the first option, the cable route would directly cross the barrier island using an HDD installation to cross the Swimming Area 2 Beach. HDD entry pits would be in an auxiliary parking lot of Swimming Area 2. The inshore export cable route corridor to Oyster Creek would exit the bay side of the Island Beach State Park and cross Barnegat Bay southwest to make landfall near Oyster Creek in either Lacey or Ocean Township. In the second option, the route would diverge and continue north within parking lots, then northwest under Shore Road before entering Barnegat Bay. Upon entering Barnegat Bay, the export cable route would continue within a previously dredged channel and then reconnect to the Oyster Creek export cable route in Barnegat Bay. Offshore export cables would be installed up to the TJB using open cut (i.e., trenching) or trenchless methods (i.e., bore or HDD). The final method would be based on an assessment of topography, bathymetry, accessibility, tidal conditions, geotechnical situation, environmental constraints, and other parameters. Sheet piling would be temporarily installed to support open cut trenches and as intertidal cofferdams for HDD exit pits. Open cut installation entails excavation of a trench using a land-based or barge-mounted excavator, positioning and securing the cable, burial and backfill to restore pre-existing contours, and revegetation. HDD installation involves excavation of an exit pit, drilling and pumping drilling fluid to create a bore and then pulling conduit into the bore. The export cable is then pulled through the installed conduit. The installation process is supported by a marine work platform and support vessels. The landfall at Island Beach State Park would cross Swimming Beach 2. HDD is the preferred option at this location to achieve burial depths of 30 feet or more. The landfall for BL England would cross Ocean City beaches that are included in the USACE beach nourishment program. Based on USACE guidance, the cable must be buried at depths not attainable by open cut or trenching (30 feet or more) and therefore HDD is the preferred option (Ocean Wind 2023). One offshore export cable would be buried under the seabed within the BL England export cable route corridor to make landfall and deliver electrical power to the BL England substation. The BL England offshore export cable route corridor would begin within the Wind Farm Area and proceed west to make landfall in Ocean City, New Jersey. Each offshore export cable would consist of three-core 275-kV alternating current cables.

Dredging may be required in shallow areas in Barnegat Bay to facilitate vessel access for export cable installation west of Island Beach State Park and near the landfall at Lacey or Ocean Township. Ocean Wind also proposes to dredge Barnegat Inlet and the Oyster Creek Channel within the authorized width and depth, if necessary to allow for safe and reliable passage of construction vessels into Barnegat Bay. Barnegat Inlet and the Oyster Creek Channel in Barnegat Bay are part of the Barnegat Inlet Federal Navigation Project, operated and maintained by USACE. Maintenance dredging of Barnet Inlet and the Oyster Creek Channel were previously analyzed by USACE in the *Final Environmental Assessment, National Regional Sediment Management (RSM) Program, WRDA 2016 Section 1122 Beneficial Use Pilot Project: Barnegat Inlet, Ocean County, New Jersey* (USACE 2020a) and the *Final Environmental Assessment, National Regional Sediment Management (RSM) Program, WRDA 2016 Section 1122 Beneficial Use Pilot Project: Oyster Creek Channel, Barnegat Inlet Federal Navigation Project, Ocean County, New Jersey* (USACE 2020b). Ocean Wind has coordinated with USACE Philadelphia District regarding current channel conditions and planned maintenance dredging, as USACE maintains the authorized depths within Barnegat Inlet and the Oyster Creek Channel through regular maintenance dredging. Dredging of approximately 18,000 cubic yards within an 3.7-acrea area would be conducted using a hydraulic cutterhead or closed-clamshell dredging and dredged material would be transferred to an upland disposal facility via a pipeline system, barge, or scow and disposed of in accordance with U.S. Environmental Protection Agency (USEPA) Guidelines, USACE Guidelines, New Jersey Administrative Code 7:7 Appendix G for the Management and Regulation of Dredging Activities and Dredged Material in New Jersey’s Tidal Waters, and applicable State Surface Water Quality Standards at New Jersey Administrative Code 7:9B and permit conditions.

Offshore export cables would be installed similarly to the inter-array cables. The installation vessel would transit to and take position at the landfall location and the cable end would be pulled into the preinstalled duct ending in the TJB. The installation vessel would transit the route toward the OSS, installing the cable by simultaneous lay and burial (plow/jetting/cutting) or surface lay and burial by a cable burial vessel (jetting/cutting/control flow excavation). The export cables have a target burial depth of 4 to 6 feet (1.2 to 1.8 meters) below the stable seabed.

Target burial depth is determined based on an assessment of seabed conditions, seabed mobility, and the risk of interaction with external hazards such as fishing gear and vessel anchors, while also considering other factors such as installation beneath maintained navigational channels and decreased thermal conductivity with increased cable burial depth. A Cable Burial Risk Assessment (CBRA) would be developed prior to construction and coordination with agencies would also inform final target burial depth. In the event that cables cannot achieve proper burial depths or where the proposed cables would cross existing infrastructure, Ocean Wind proposes the following protection methods: (1) rock placement, (2) concrete mattress placement, (3) frond mattress placement, (4) rock bags, or (4) seabed spacers. When the cable has been installed, post cable-lay surveys and depth-of-burial surveys would be conducted to determine if the cable has reached the desired depth. The remedial protection measures described above may be required in places where the target burial depth cannot be met. Ten percent of the inter-array, substation interconnector, and export cables would likely require protection.

The construction and installation phase of the proposed Project would make use of both construction and support vessels to complete tasks in the Wind Farm Area. Construction vessels would travel between the Wind Farm Area and the following ports that are expected to be used during construction: Atlantic City, New Jersey as a construction management base; Paulsboro, New Jersey or from Europe directly for foundation fabrication and load out; Norfolk, Virginia or Hope Creek, New Jersey for WTG pre-assembly and load out; and Port Elizabeth, New Jersey or Charleston, South Carolina, or directly from Europe for cable staging. During installation of inter-array and substation interconnection cables, Ocean Wind anticipates a maximum of 20 vessels operating during a typical workday in the Wind Farm Area. For offshore export cable installation, Ocean Wind anticipates a maximum of 26 vessels operating during a typical workday.

Ocean Wind proposes to deploy up to two wave buoys in the Wind Farm Area, up to six floating or bottom-mounted Acoustic Doppler Current Profilers in seabed frames along the export cable routes, and up to one wave buoy or bottom-mounted Acoustic Doppler Current Profilers may be deployed in Barnegat Bay to conduct meteorological and metocean evaluations during construction activities. Meteorological data to be collected and analyzed, including wind speed and direction, wave heights, and current speed and direction, would provide real-time data for vessels operating offshore. After construction, one wave buoy within 500 meters of a WTG would stay in place up to 5 years to support asset management, structural monitoring, and marine transfer operations.

2.1.2.3. Operations and Maintenance

The proposed Project is anticipated to have an operating period of 35 years.[6] Ocean Wind would use an onshore O&M facility in Atlantic City, New Jersey sited at the location of a retired marine terminal. Ørsted Wind Power North America, LLC (Ørsted) plans to rehabilitate this former marina facility near Absecon Inlet to create a port facility off the mid-Atlantic coast that can service potential wind turbine farms. The O&M facility would include offices, control rooms, warehouses, and workshop space. Approximately 500 feet (152 meters) of dockside harbor facilities and associated parking facilities would be added. The City of Atlantic City intends to secure authorization for marina upgrades, namely dredging in the marina and at Absecon Inlet, for the benefit of multiple marina users. Ørsted's rehabilitation of the former marina facility (including office and warehouse construction) and the City of Atlantic City's

[6] For analysis purposes, BOEM assumes in this Final EIS that the proposed Project would have an operating period of 35 years. Ocean Wind's lease with BOEM (Lease OCS-A 0498) has an operations term of 25 years that commences on the date of COP approval. (See https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NJ/NJ-SIGNED-LEASE-OCS-A-0498.pdf; see also 30 CFR 585.235(a)(3).) Ocean Wind would need to request and be granted an extension of its operations term from BOEM under the regulations at 30 CFR 585.425 et seq. in order to operate the proposed Project for 35 years. While Ocean Wind has not made such a request, this EIS uses the longer period in order to avoid possibly underestimating any potential effect.

marina upgrades are being separately reviewed and authorized by USACE (USACE Public Notices NAP-2021-00187-39 and NAP-2021-00573-95, respectively) and state and local agencies. The improvements are not dependent on the Proposed Action being analyzed in this EIS.

The proposed Project would include a comprehensive maintenance program, including preventive maintenance based on statutory requirements, original equipment manufacturers' guidelines, and industry best practices. Ocean Wind would inspect WTGs, OSS, foundations, offshore export cables, inter-array cables, onshore export cables, and other parts of the proposed Project using methods appropriate for the location and element.

2.1.2.3.1 Onshore Activities and Facilities

The onshore substations, onshore export cables, and grid connections would include inspections, preventative maintenance, and, as needed, corrective maintenance. Inspections of these facilities would occur as often as weekly. Routine preventive maintenance would occur annually for main servicing, but individual aspects may occur each quarter. Maintenance programs would conform to the equipment manufacturers' warranty requirements.

2.1.2.3.2 Offshore Activities and Facilities

Ocean Wind would conduct inspections of foundations, bathymetry, scour (and associated scour protection, if deployed), and cable burial. Multi-beam echosounder surveys would be conducted during years 1, 4, and 5 post-commissioning, after which an optimal survey frequency would be determined based on initial findings. Sonar, remotely operated vehicles, drones, and divers may be required. Routine maintenance is expected for WTGs, foundations, and OSS. Ocean Wind would conduct annual maintenance of WTGs, including safety surveys, blade maintenance, and painting as needed. OSS would be routinely maintained for preventative maintenance up to 12 times per year. A cable maintenance and monitoring plan would be developed and implemented. Although the offshore export cables, inter-array cables, and OSS interconnector cables typically have no maintenance requirements unless a failure occurs, cable failures may result from anchors and fishing gear. During these low-probability events, cables would be located, unburied, and lifted above sea level for repair or replacement aboard the cable-handling vessel. Upon completion of the repair, the cable would be lowered onto the seabed, assessed to determine its proximity to the original location, and reburied using a jetting tool. Spare parts for key Project components may be housed at the O&M facility so Ocean Wind could initiate repairs expeditiously. Portions of the cables are anticipated to become exposed due to natural sediment transport processes and would require scour protection replenishment or reburial. Ocean Wind would conduct multi-beam echosounder bathymetry survey along the cable routes immediately following installation and at 1 year, 2 to 3 years, and 5 to 8 years post-commissioning, after which survey frequency would depend on prior survey findings. Additional surveys may be conducted after major storm events as otherwise needed (Ocean Wind 2023).

Ocean Wind would need to use vessels, remote sensing equipment, and vehicles during O&M activities described above. The Project would use a variety of vessels to support O&M including crew transfer vessels, service operation vessels, jack-up vessels, and supply vessels. In a year, the Proposed Action would generate a maximum of 908 crew vessel trips, 102 jack-up vessel trips, and 104 supply vessel trips; and a maximum of 2,278 crew transfer vessel trips, or service operations vessel trips (COP Volume I, Section 6.1.3.5, Table 6.1.2-11; Ocean Wind 2023).

2.1.2.4. Decommissioning

Under 30 CFR 585 and commercial Renewable Energy Lease OCS-A 0498, Ocean Wind would be required to remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the seafloor of all obstructions created by the proposed Project. All facilities would need to be removed 15 feet (4.6 meters) below the mudline (30 CFR 285.910(a)). Absent permission from BOEM, Ocean Wind would have to achieve complete decommissioning within 2 years of termination of the lease and either reuse, recycle, or responsibly dispose of all materials removed. Ocean Wind has submitted a conceptual decommissioning plan as part of the COP, and the final decommissioning application would outline Ocean Wind's process for managing waste and recycling proposed Project components (Volume I, Section 6.3; Ocean Wind 2023). Although the proposed Project is anticipated to have an operational life of 35 years, it is possible that some installations and components may remain fit for continued service after this time. Ocean Wind would have to apply for and be granted an extension if it wanted to operate the proposed Project for more than the 25-year operations term stated in its lease.

BOEM would require Ocean Wind to submit a decommissioning application upon the earliest of the following dates: 2 years before the expiration of the lease, 90 days after completion of the commercial activities on the commercial lease, or 90 days after cancellation, relinquishment, or other termination of the lease (see 30 CFR 285.905). Upon completion of the technical and environmental reviews, BOEM may approve, approve with conditions, or disapprove the lessee's decommissioning application. This process would include an opportunity for public comment and consultation with municipal, state, and federal management agencies. Ocean Wind would need to obtain separate and subsequent approval from BOEM to retire in place any portion of the proposed Project. Approval of such activities would require compliance under NEPA and other federal statutes and implementing regulations.

If the COP is approved or approved with modifications, Ocean Wind would have to submit a bond (or another form of financial assurance) that would be held by the U.S. government to cover the cost of decommissioning the entire facility in the event that Ocean Wind would not be able to decommission the facility.

2.1.2.4.1 Onshore Activities and Facilities

At the time of decommissioning, some components of the onshore electrical infrastructure may still have substantial life expectancies. Depending on the needs at the time, the onshore cables installed overhead may either be used for other projects or removed. There are no proposed plans to disrupt streets or onshore public utility rights-of-way by excavating or deconstructing buried onshore facilities and components.

2.1.2.4.2 Offshore Activities and Facilities

For both WTGs and OSS, decommissioning would be a "reverse installation" process, with turbine components or the OSS topside structure removed prior to foundation removal. Ocean Wind would remove monopile foundations by cutting below the seabed level in accordance with standard practices and seabed conditions at the time of demolition. Ocean Wind proposes to leave scour protection placed around the base of the monopile, if used, in place. This request would be made to BOEM through 30 CFR 585.434(a). However, the Bureau of Safety and Environmental Enforcement (BSEE) would most likely require that the scour protection be removed in accordance with 30 CFR 285.902(a). Offshore cables would either be left in place or removed, or a combination of both, depending on regulatory requirements at the time of decommissioning. It is anticipated that the inter-array cables would be removed using controlled-flow excavation or a grapnel to lift the cables from the seabed.

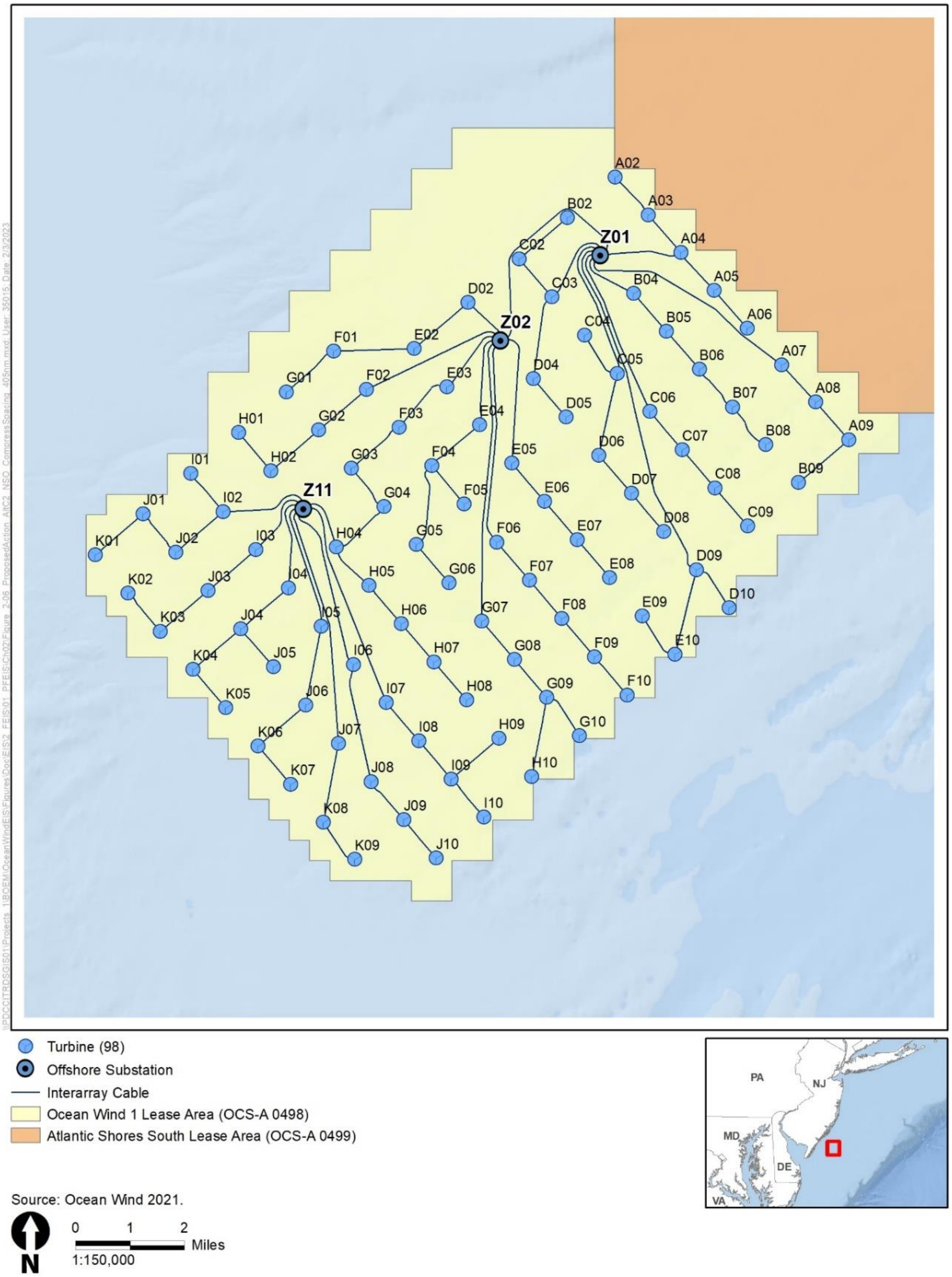


Figure 2-6 Proposed Action[7] (Preferred Alternative)

[7] Ocean Wind's October 2022 COP updated the proposed array layout to a scenario analyzed under Alternative C-2 in the Draft EIS: No Surface Occupancy to Establish a Buffer with Turbine Layout Compression (Compression Layout for 0.81-nm Buffer).

2.1.3 Alternative B—No Surface Occupancy at Select Locations to Reduce Visual Impacts

Alternative B was developed through the scoping process for the Draft EIS in response to public comments concerning the visual impacts of the Project. Under Alternative B, no surface occupancy would occur at select WTG positions to reduce the visual impacts of the proposed Project. The range of design parameters for Project components and activities to be undertaken for construction and installation, O&M, and conceptual decommissioning would be the same as described for the Proposed Action. Alternative B includes two sub-alternatives to account for two different turbine sizes and power-generating capabilities. Each of the below sub-alternatives may be individually selected or combined with any or all other alternatives or sub-alternatives, subject to the combination meeting the purpose and need.

- **Alternative B-1:** No Surface Occupancy at Select Locations to Reduce Visual Impacts (Smaller Turbine Model) (Figure 2-7). This alternative would exclude placement of WTGs at up to nine WTG positions that are nearest to coastal communities (positions F01 to K01 and B02 to D02).
- **Alternative B-2:** No Surface Occupancy at Select Locations to Reduce Visual Impacts (Larger Turbine Model) (Figure 2-8). This alternative would exclude placement of WTGs at up to 19 WTG positions that are nearest to coastal communities (positions F01 to K01, A02 to K02, A03, and C03). Selection of this alternative would be contingent on the larger turbine with a 240-meter rotor diameter being commercially available when BOEM issues its ROD as well as its technical and economic feasibility, and consistency with the purpose and need.

Exclusion of WTG positions would result in reduced expected annual energy production. For example, removal of the maximum number (nine) of WTGs under Alternative B-1 could result in a 14-percent reduction in expected annual energy production as measured in MW-hours per year in comparison to the Proposed Action. Removing fewer than nine WTGs would decrease the reduction in expected annual energy production; however, there would be a corresponding decrease in the ability for Alternative B-1 to reduce the visual impacts of the Project. Any changes to the stated MW-hour allowance in the June 2019 Order would require the consent of both BPU and Ocean Wind. Alternatives B-1 and B-2 would require redesign of the inter-array cables and may require additional site investigation. Collecting and processing the additional survey data could lead to a Project delay of up to 2 years.

2.1.4 Alternative C—Wind Turbine Layout Modification to Establish a Buffer Between Ocean Wind 1 and Atlantic Shores South

During the scoping process for the Draft EIS public comments from USCG, the Responsible Offshore Development Alliance (RODA), and commercial fishermen identified concerns with the different layouts between the Ocean Wind 1 and Atlantic Shores South projects and proximity of the two projects in the adjacent lease areas. BOEM developed Alternative C in coordination with USCG to address the concerns raised during the scoping process. Under Alternative C, modifications would be made to the wind turbine array layout to create a 0.81-nm to 1.08-nm buffer between WTGs in OCS-A 0498 (Ocean Wind 1 Lease Area) and WTGs in OCS-A 0499 (Atlantic Shores South Lease Area). Atlantic Shores South would also need to modify its wind turbine layout in order to create a total buffer distance of between 0.8 nm and 1.1 nm; however, this Final EIS only analyzes the portion of the buffer within the Ocean Wind 1 Lease Area. A buffer would provide a clear visual distinction between the separate projects and provide for sufficient maneuvering space for both surface and aerial (helicopter) navigation. Each of the below sub-alternatives may be individually selected or combined with any or all other alternatives or sub-alternatives, subject to the combination meeting the purpose and need. The range of design parameters for Project components and activities to be undertaken for construction and installation, O&M, and conceptual decommissioning would be the same as described for the Proposed Action.

- **Alternative C-1:** No Surface Occupancy to Establish a Buffer with Turbine Relocation (Figure 2-9). This alternative would result in no surface occupancy along the northeastern boundary of the Ocean Wind 1 Lease Area through the exclusion of eight WTG positions (A02 to A09), relocation of up to eight WTG positions to the northern portion of the Ocean Wind 1 Lease Area, or some combination of exclusion and relocation of WTG positions, to allow for a 0.81-nm to 1.08-nm buffer between WTGs in the Ocean Wind 1 Lease Area and WTGs in the Atlantic Shores South Lease Area.
- **Alternative C-2:** No Surface Occupancy to Establish a Buffer with Turbine Layout Compression (Figure 2-10). This alternative would result in no surface occupancy along the northeastern boundary of the Ocean Wind 1 Lease Area to allow for an 0.81-nm to 1.08-nm buffer (Figure 2-10[8]) between the WTGs in the Ocean Wind 1 Lease Area and the WTGs in the Atlantic Shores South Lease Area. However, under Alternative C-2, the wind turbine array layout would be compressed to allow for a full build of up to 98 WTGs. Ocean Wind 1's turbine array row spacing would be reduced from 1 nm between rows to no less than 0.99 nm between rows.

Exclusion of WTG positions would lead to a reduced expected annual energy production. For example, removal of the eight 12-MW WTGs under Alternative C-1 could result in a 12.5-percent reduction in expected annual energy production as measured in MW-hours per year in comparison to the Proposed Action. Exclusion of fewer than eight WTGs would not allow Alternative C-1 to provide a buffer between WTGs in the Ocean Wind 1 Lease Area and the Atlantic Shores South Lease Area. Compression of the array layout to 0.99-nm by 0.8-nm spacing under Alternative C-2 could result in an 8-percent reduction in expected annual energy production in comparison to the Proposed Action. Any changes to the stated MW-hour allowance in the June 2019 Order would require the consent of both BPU and Ocean Wind.

Alternatives that relocate WTG positions or compress the WTG layout and require redesign of the inter-array cables may require additional site investigation. Collecting and processing the additional survey data could lead to a Project delay of up to 2 years.

[8] Figure 2-10 depicts a compressed array layout with the 1.08-nm (2,000-meter) buffer positioned on the centerline of the shared boundary between the Ocean Wind 1 Lease Area and the Atlantic Shores South Lease Area.

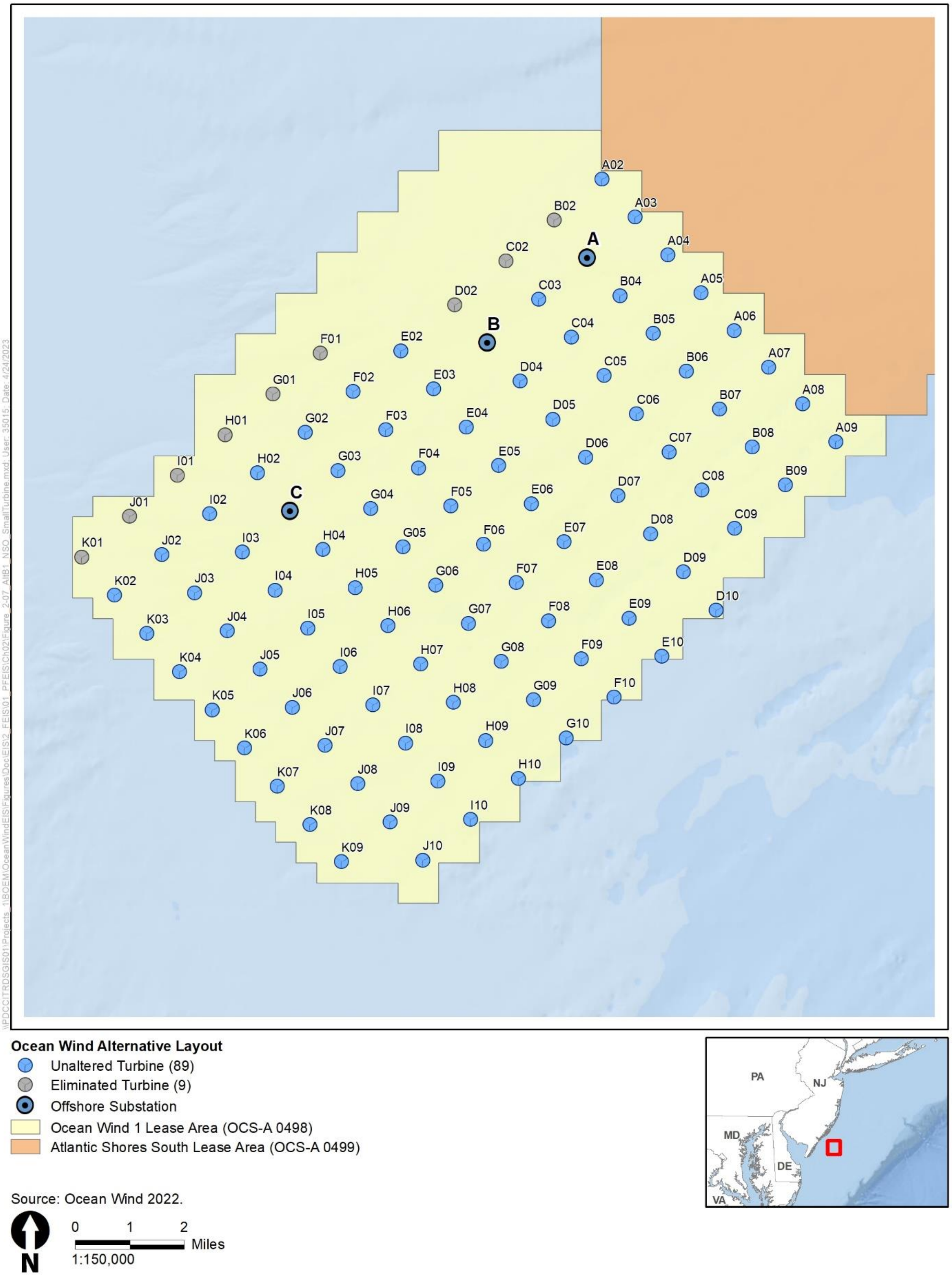


Figure 2-7 Alternative B-1: No Surface Occupancy at Select Locations to Reduce Visual Impacts (Smaller Turbine Model)

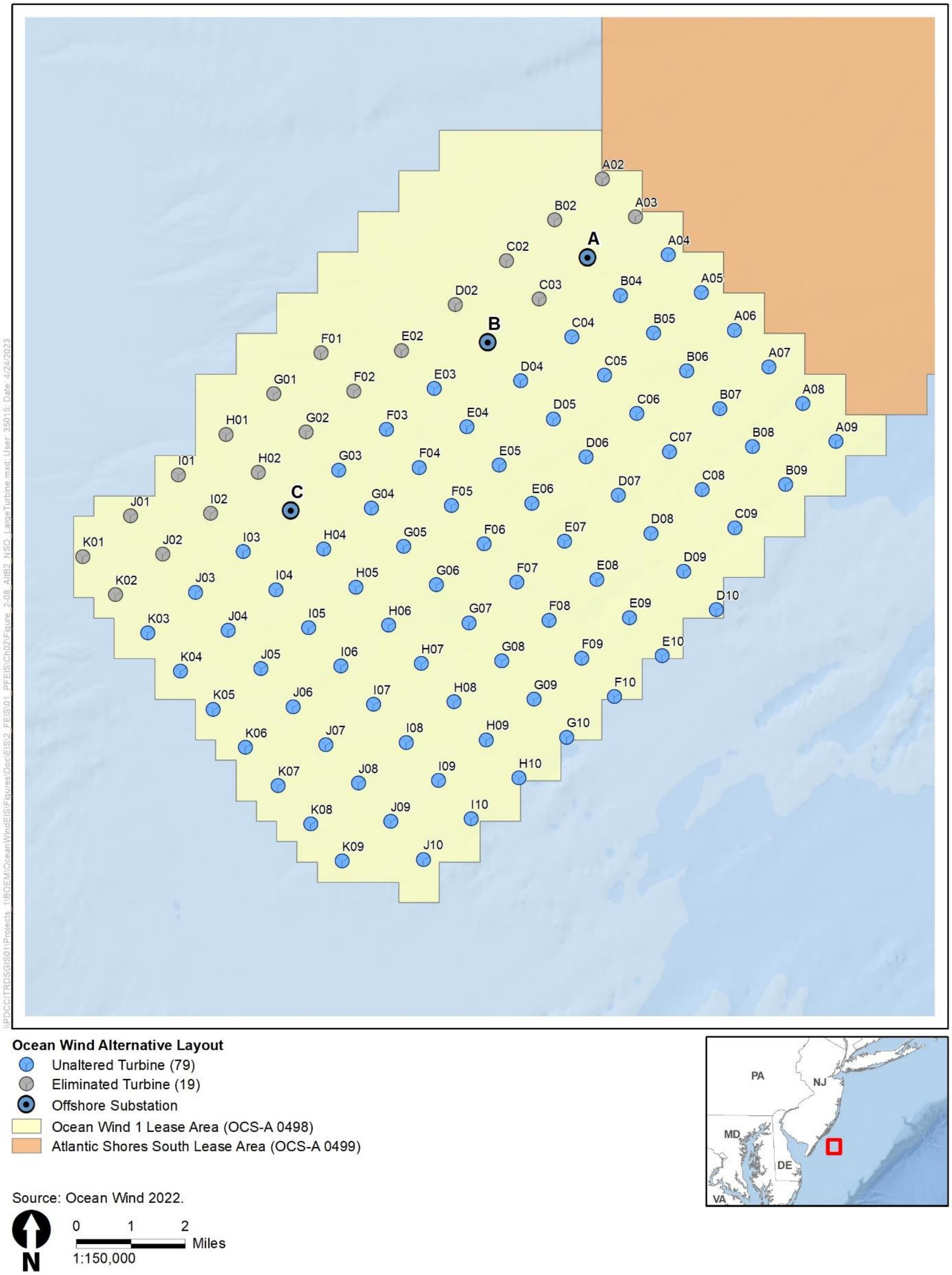


Figure 2-8 Alternative B-2: No Surface Occupancy at Select Locations to Reduce Visual Impacts (Larger Turbine Model)

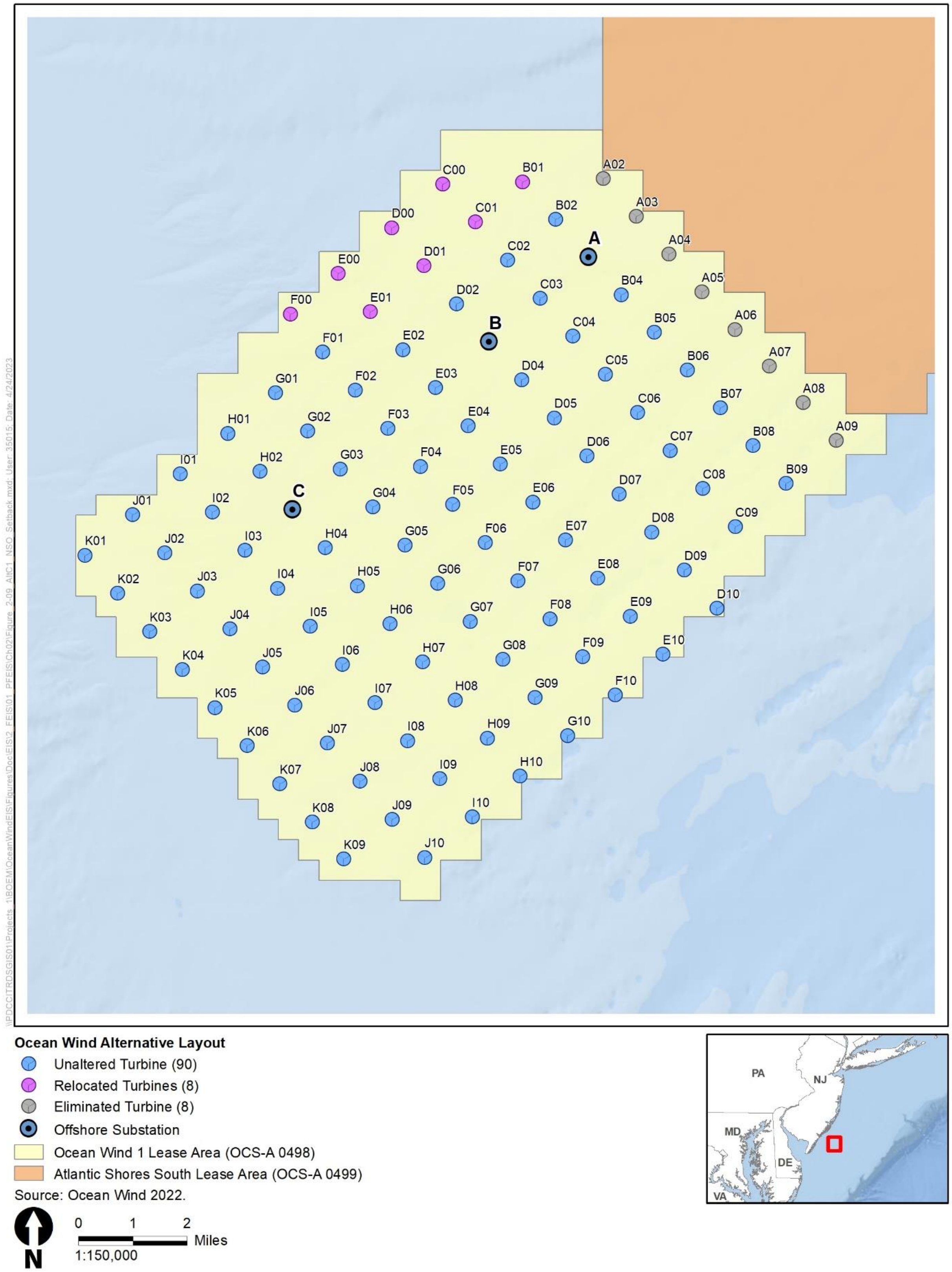


Figure 2-9 Alternative C-1: No Surface Occupancy to Establish a Buffer with Turbine Relocation

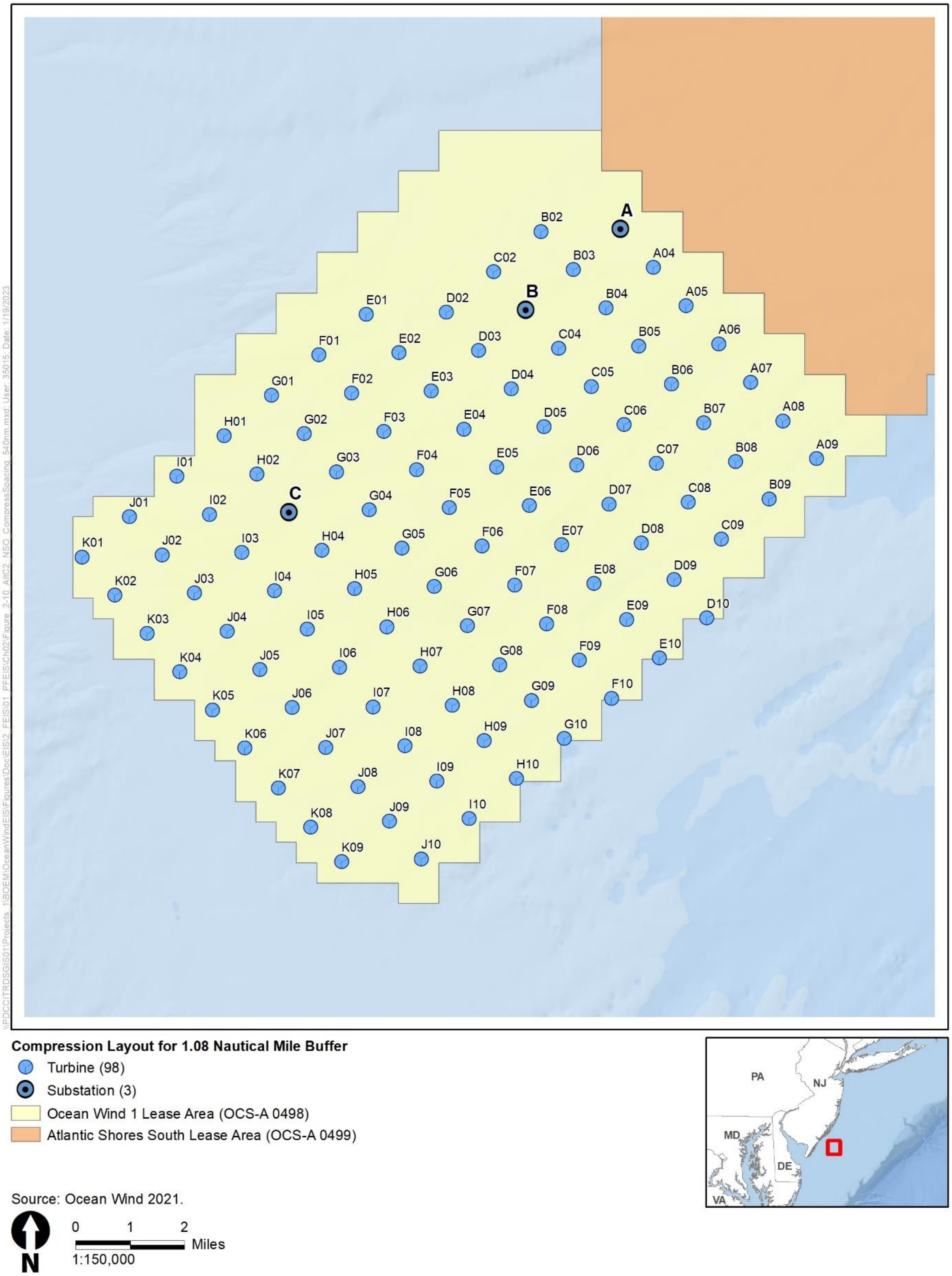


Figure 2-10 Alternative C-2: No Surface Occupancy to Establish a Buffer with Turbine Layout Compression (Compression Layout for Buffer)

2.1.5 Alternative D—Sand Ridge and Trough Avoidance

Under Alternative D (Figure 2-11), the construction, O&M, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the Ocean Wind 1 COP, subject to applicable mitigation measures. However, modifications would be made to the wind turbine array layout to minimize impacts on sand ridge and trough features in the northeastern corner of the Lease Area. This alternative would result in the exclusion of up to 15 WTG positions in the sand ridge and trough area. The identification of individual WTGs for exclusion, should the number excluded be fewer than 15, would be coordinated with NMFS. These physical features are found throughout the OCS in the mid-Atlantic and provide important habitat for several species. Ridge and swale habitat provide complex physical structures that affect the composition and dynamics of ecological communities, with increased structural complexity often leading to greater species diversity, abundance, overall function, and productivity. The sand ridges and troughs are areas of biological significance for migration and spawning of mid-Atlantic fish species, many of which are recreationally targeted in those specific areas. Although the overall artificial reef effect would be decreased by reducing the total number of WTGs in the Lease Area, the biological benefits of preserving natural fish habitat may be beneficial. Selection of this alternative with the exclusion of more than nine WTGs would be contingent on the larger turbine with a 240-meter rotor diameter being commercially available when BOEM issues its ROD as well as its technical and economic feasibility, and consistency with the purpose and need.

Exclusion of WTG positions would lead to a reduced expected annual energy production. For example, removal of 15 12-MW WTGs could result in a 19-percent reduction to expected annual energy production as measured in MW-hours per year in comparison to the Proposed Action. Removing fewer than 15 WTGs would decrease the reduction in expected annual energy production; however, there would be a corresponding decrease in the ability for Alternative D to minimize impacts of the Project on sand ridge and trough features in the northeastern corner of the Lease Area. Any changes to the stated MW-hour allowance in the June 2019 Order would require the consent of both BPU and Ocean Wind. Alternative D would require redesign of the inter-array cables and may require additional site investigation. Collecting and processing the additional survey data could lead to a Project delay of up to 2 years.

2.1.6 Alternative E—Submerged Aquatic Vegetation Avoidance (Preferred Alternative)

Under Alternative E (Figure 2-12), the construction, O&M, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the Ocean Wind 1 COP, subject to applicable mitigation measures. However, the Oyster Creek export cable route option traveling directly across the barrier island would not be used and the export cable route would be limited to the option developed to minimize impacts on submerged aquatic vegetation (SAV) in Barnegat Bay. The SAV avoidance export cable route option would make landfall within an auxiliary parking lot of Swimming Area 2 in Island Beach State Park and then continue north within parking lots, then northwest under Shore Road before entering Barnegat Bay. Upon entering Barnegat Bay, the export cable route would run west within a previously dredged channel and then reconnect to the Oyster Creek export cable route in Barnegat Bay. This alternative would narrow the design envelope so that the Applicant could only select the northernmost export cable route; the northernmost export cable route would not function independently but is intended to be combined with another alternative or sub-alternative, subject to the combination meeting the purpose and need.

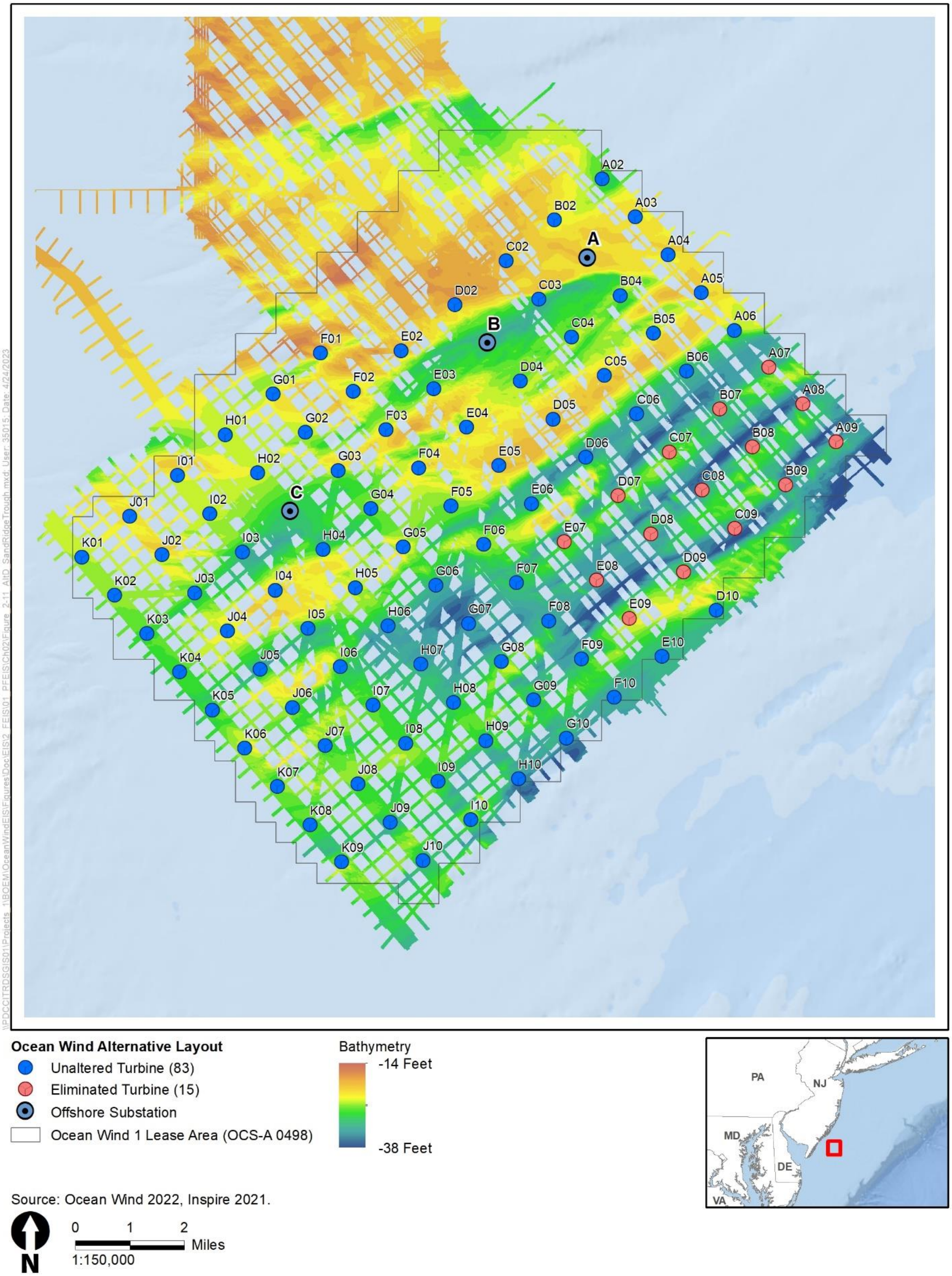


Figure 2-11 Alternative D: Sand Ridge and Trough Avoidance

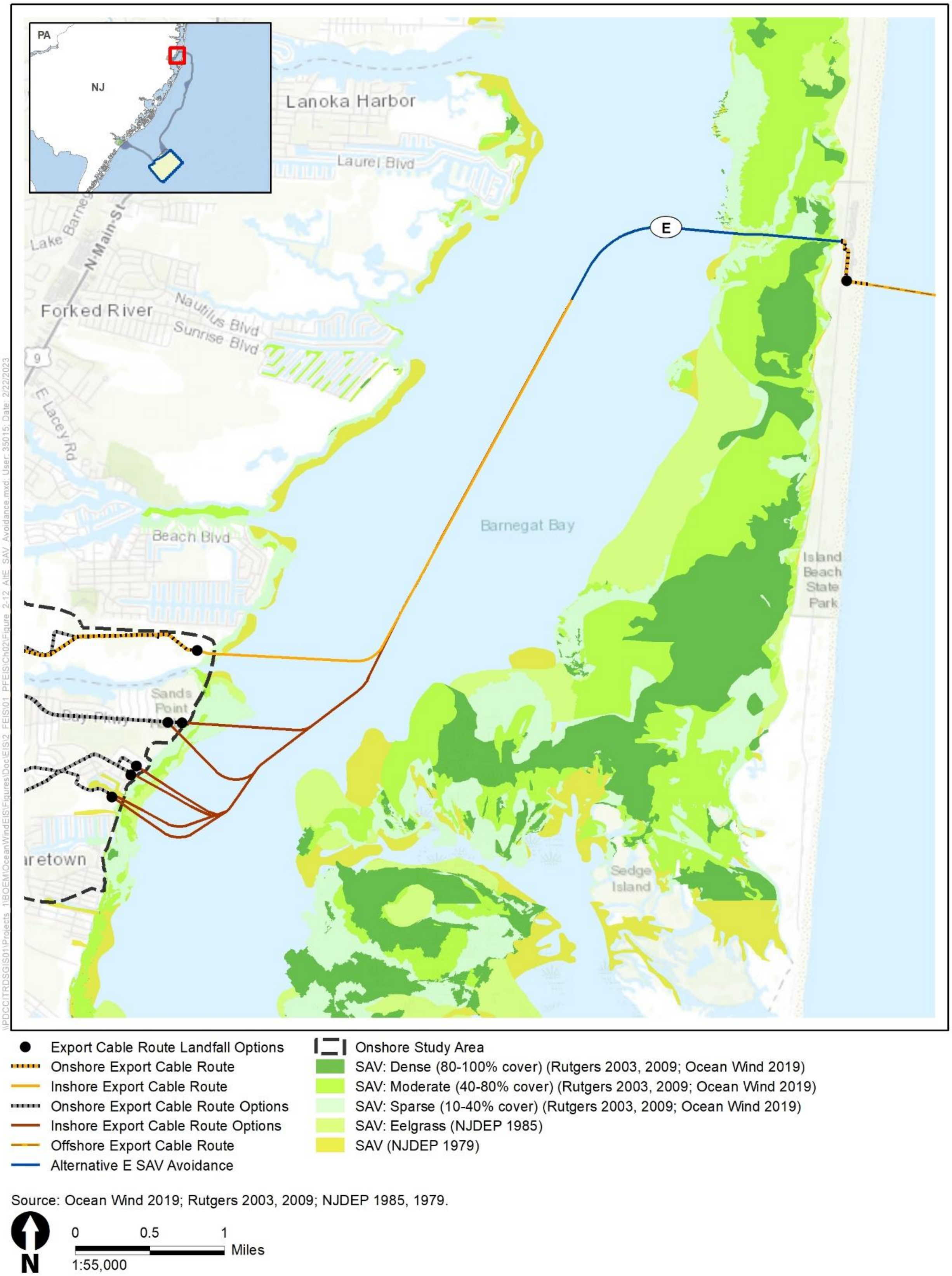


Figure 2-12 Alternative E: SAV Avoidance (Preferred Alternative)

2.1.7 Alternatives Considered but not Analyzed in Detail

Under NEPA, a reasonable range of alternatives framed by the purpose and need must be developed for analysis for any major federal action. The alternatives should be "reasonable," which the Department of the Interior has defined as those that are "technically and economically practical or feasible and meet the purpose and need of the proposed action."[9] There should also be evidence that each alternative would avoid or substantially lessen one or more potential, specific, and significant socioeconomic or environmental effects of the project.[10] Alternatives that could not be implemented if they were chosen (for legal, economic, or technical reasons), or do not resolve the need for action and fulfill the stated purpose in taking action to a large degree, are therefore not considered reasonable.

BOEM considered alternatives to the Proposed Action that were identified through coordination with cooperating and participating agencies and through public comments received during the public scoping period for the EIS. BOEM then evaluated the alternatives and dismissed from further consideration alternatives that did not meet the purpose and need, did not meet the screening criteria, or both. The screening criteria are provided in Appendix C, *Additional Analysis for Alternatives Dismissed*. Additional analysis was necessary to determine the economic and technical feasibility of several possible SAV avoidance alternatives. This analysis, as well as analysis conducted for other dismissed alternatives, is described in Appendix C.

Table 2-3 lists the alternatives and the rationale for their dismissal. These alternatives are presented below with a brief discussion of the reasons for their elimination as prescribed in CEQ regulations at 40 CFR 1502.14(a) and Department of the Interior regulations at 43 CFR 46.420(b–c).

Table 2-3 Alternatives Considered but not Analyzed in Detail

Alternative	Rationale for Dismissal
Wind Farm Location and Generating Capacity	
Alternate locations for the wind energy facility outside the Lease Area (i.e., farther north, farther offshore, or in a different WEA [including in the Hudson South WEA])	Evaluating an alternate location for the wind energy facility outside of the Lease Area would constitute a new Proposed Action and would not meet BOEM's purpose and need to respond to Ocean Wind's proposal and determine whether to approve, approve with modifications, or disapprove the COP to construct, operate and maintain, and decommission a commercial-scale offshore wind energy facility within the Lease Area. BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Lease Area. BOEM would consider proposals on other existing leases through a separate regulatory process. This alternative would effectively be the same as selecting the No Action alternative.
Project with lower nameplate capacity than 1,100 MW, requiring fewer turbine positions that would be located in specific sections of the Lease Area	An 1,100-MW nameplate capacity is necessary to fulfill the terms of BPU's 2019 Order. BOEM is analyzing several alternatives (B, C, and D) in detail that could require fewer WTG positions or restrict WTGs in specific sections of the Lease Area while still meeting the proposed 1,100-MW nameplate capacity. Moreover, this alternative does not address a specific concern or provide sufficient detail to meaningfully analyze impacts; therefore, this alternative was not carried forward for separate analysis.

[9] 43 CFR 46.420(b). The terms "practical" and "feasible" are not intended to be synonymous (73 *Federal Register* 61331, October 15, 2008).
[10] 43 CFR 46.415(b)

Alternative	Rationale for Dismissal
Phased Development/Pilot Facility/“Go Slow Alternative”	BOEM received comments expressing concern for the reliability of offshore wind power and several commenters suggested building the Project in a phased approach or building a much smaller pilot facility to confirm the benefits and impacts before building out the complete Project as proposed. This alternative would negate Ocean Wind’s ability to fulfill the terms of BPU’s 2019 Order to construct and operate an 1,100-MW commercial-scale wind energy facility within the Lease Area with operations targeted to begin in 2024 and does not address a specific environmental or socioeconomic concern. This alternative would effectively be the same as selecting the No Action alternative.
Wind Turbine Array Layout and Spacing	
Using a 2-nm by 2-nm wind turbine layout to provide safe access for fishing vessels	Commenters suggested that BOEM should analyze an alternative WTG layout with a 2-nm spacing between WTGs. As illustrated on Figure C-1, a 2-nm spacing would only provide for 30 WTG positions with a nameplate capacity of between 360 and 420 MW if a 12-MW or 14-MW WTG is selected, respectively. A WTG layout with 2-nm spacing between WTGs would not provide enough WTG positions in the Wind Farm Area to fulfill BPU’s solicitation award for 1,100 MW of offshore wind. This alternative was not carried forward for detailed analysis because it would negate Ocean Wind’s ability to fulfill the terms of BPU’s 2019 Order and would not meet BOEM’s purpose and need.
Consistent wind turbine spacing and layout across the Ocean Wind 1 and Atlantic Shores South projects	Commenters, including USCG, requested that BOEM consider an alternative that would create a uniform WTG spacing and layout across the adjacent Ocean Wind 1 and Atlantic Shores South projects to minimize impacts on vessel users and search and rescue operations, and to facilitate straight-line routes and consistent marking and lighting for navigation safety. The WTG spacing and layouts presented in the Ocean Wind 1 and Atlantic Shores South COPs were designed to accommodate the predominant vessel traffic patterns in each lease area, and vessel traffic patterns differ within each lease area. A uniform spacing and layout across the two adjacent projects would not align with the predominant vessel traffic patterns established by vessel users; therefore, this alternative was not carried forward for detailed analysis

Alternative	Rationale for Dismissal
2- to 4-nm separation between the Ocean Wind 1 and Atlantic Shores South projects	USCG commented that in the absence of a common spacing and layout between the two projects, setbacks from the shared border are recommended to provide a distinct visual separation and facilitate safe navigation between and across the two adjacent projects. Another commenter recommended that a 2- to 4-nm transit corridor be established between the Ocean Wind 1 and Atlantic Shores South projects to preserve traditional transit paths through the lease areas to access fishing grounds. BOEM evaluated separation distances between the Ocean Wind 1 and Atlantic Shores South projects. As the length traveled along the boundary between the Ocean Wind 1 and Atlantic Shores South projects would be approximately 7 nm and there would be additional paths along the predominant inshore-offshore routes through the array to allow for traffic dispersal, BOEM, through coordination with USCG, determined that an 0.8-nm to 1.08-nm separation between the Ocean Wind 1 and Atlantic Shores South projects was adequate to accommodate inshore-offshore vessel traffic, as well as changes in path or orientation as vessels transit between the two adjacent projects. According to USCG, 0.8 nm to 1.08 nm is also an acceptable distance for its sea and air assets to adjust their path as they move between the two adjacent projects. BOEM, in consultation with USCG, developed Alternative C (Wind Turbine Layout Modification to Establish a Buffer Between Ocean Wind 1 and Atlantic Shores South), which analyzes a 0.81-nm to 1.08-nm buffer with the intent that both the Ocean Wind 1 and Atlantic Shores South projects would implement wind turbine array layout modifications to result in a combined separation distance of 0.8 nm to 1.08 nm. Alternative C analyzes a buffer while maintaining a layout orientation that accommodates the predominant vessel traffic patterns in the Ocean Wind 1 Lease Area. Therefore, this alternative was not carried forward for detailed analysis.
Wind Turbine Technology	
Alternative wind turbine foundations	Commenters suggested that BOEM consider alternatives for WTG foundations that avoid the use of pile driving, such as gravity-based, suction bucket, or floating foundations. During Project development, Ocean Wind considered multiple design alternatives for WTG foundations that were ultimately not selected for inclusion in the PDE for the COP. Alternative foundations considered but not carried forward included monopod suction caisson foundations, suction caisson jacket foundations, gravity-based turbine and OSS foundations, and floating platforms. Ocean Wind determined that these alternative foundation types were not suitable for development of the Project due to local site conditions as well as technical and supply chain considerations (see Table 5.2-1, *Technology Considered for the Project*, in Volume I of the COP for additional information on alternative foundation types considered). Because these foundation types were already reviewed by Ocean Wind and determined not to be suitable as documented in the COP, this alternative was eliminated from detailed analysis.

Alternative	Rationale for Dismissal
Offshore and Onshore Export Cables	
Alternative export cable route with landfall in Sea Isle City	Ocean Wind evaluated an export cable route corridor, extending from the Ocean Wind 1 Offshore Wind Farm to a landfall in Sea Isle City to connect to the BL England interconnection point, as an alternative to the export cable route corridor that would landfall in Ocean City to connect to BL England. The Sea Isle City route corridor was dismissed from detailed analysis because it is a longer offshore export cable route that would extend the construction schedule and result in additional impacts over a longer period of time. Specifically, the offshore export cable route would traverse USACE borrow areas, prime fishing areas, and artificial reef. The longer onshore cable route would have greater impacts on residential areas due to prolonged construction adjacent to residential areas and involve several stream crossings, including a major tributary of Ludlam Bay (intracoastal waterway). The longer onshore corridor would potentially affect additional National Heritage Priority Sites, historic buildings, historic districts, and archaeological grid sites; wetlands; and vernal pool habitat. The Sea Isle City export cable route is expected to result in greater impacts overall compared to the Ocean City landfall, and so the Sea Isle City export cable route was dismissed from detailed analysis.
Alternatives for cable construction methods and protection including burying the cable deeper and remote monitoring of cables	BOEM received comments suggesting alternative methods of cable installation be analyzed that allow for full cable burial to minimize permanent habitat impacts and potential hazardous interactions with fishing gear. The fishing industry requested a minimum burial of 8–10 feet to avoid interactions with fishing gear or, if a shallower depth is permitted, it must be paired with remote monitoring to ensure the cable remains adequately buried. Ocean Wind has proposed a target burial depth of 4 to 6 feet with the final burial depth dependent on the CBRA and coordination with agencies. The target burial depth is determined based on an assessment of seabed conditions integrated from geophysical and geotechnical surveys, seabed mobility, and the risk of interaction with external hazards such as fishing gear and vessel anchors, while also considering other factors such as maintained navigational channels and thermal conductivity. Project impacts associated with cable construction methods and protection are disclosed in Chapter 3 of the Final EIS for relevant affected resources. As applicable, BOEM could also choose to implement additional mitigation measures to further reduce or avoid impacts. Cable burial depth and use of remote monitoring to ensure that cable burial is maintained can be addressed as mitigation in the EIS, if warranted, rather than as an EIS alternative. Therefore, this alternative was not carried forward for detailed analysis.

Alternative	Rationale for Dismissal
Alternative offshore cable routes to reduce impacts on tug-tow traffic routes	A commenter requested that BOEM evaluate different alignments to the Oyster Creek cable corridor to minimize the area that cables occupy within the existing tug-tow traffic route. Various alignments should be evaluated, including crossing perpendicular to the prevailing north-south coastwise tug-tow traffic route, rather than parallel and within it; and shifting the cable corridor to be predominantly west of the traffic route. Submarine cables have been installed in the Atlantic Ocean for over 100 years starting with telegraph cables. There are numerous active and inactive cables along the New Jersey shore and throughout the Mid-Atlantic areas, including in the existing tug and towing traffic routes. There are well-established best management practices and laws that have allowed for the mutual coexistence of submarine cables with vessel operations including current federal and boating laws that require that (1) submarine cables be included on NOAA nautical charts, (2) vessel owners have proper navigational equipment on board, including up-to-date nautical charts, and (3) vessel owners avoid charted hazards, such as submarine cables. A CBRA will be developed and will assess potential hazards such as fishing gear snags on cables; anchored vessel drags onto cable; vessels suffering engine failure anchors onto the cable; vessels inadvertently anchoring onto the cable; foundering vessels sinking onto or damaging cable; dredging activity damaging cable or causing cable(s) to become exposed; military activity damage the cable(s); and recreational activities damage the cable(s). In terms of natural hazards, the following are also assessed: seabed mobility causes cable to become exposed; and seabed obstructions/boulders. As such, a specific alternative to reduce the potential for impacts on tug and tow traffic routes would not address a significant impact from the Project.
Reducing the number of offshore cable routes	One commenter noted that the COP proposes connecting the Project to shore via two distinct cable routes to reduce impacts on the onshore power grid and requested that the EIS explain why the use of multiple cables is needed, develop and analyze alternatives to this approach, and acknowledge that the use of two cable routes greatly increases offshore impacts, including habitat disturbance and modification, as well as safety concerns for fisheries that use bottom-tending mobile gear. As outlined in the COP, Ocean Wind is utilizing available points of interconnection to the onshore grid at Oyster Creek and BL England, and proposes to split the power injection between these two interconnection points. An alternative that reduces the number of offshore export cable routes would not be technically or economically practicable because it would result in a need for extensive upgrades to the onshore power grid, and so this alternative was dismissed from detailed analysis. These factors outweigh any potential future decrease in offshore impacts that may result from having one cable corridor instead of two.

Alternative	Rationale for Dismissal
Shared cable corridor	Commenters recommended that BOEM consider offshore export cable routing alternatives that would have adjacent projects (i.e., Ocean Wind 1 and Atlantic Shores South) use a shared cable corridor. BOEM cannot dictate that a lessee use a shared cable corridor. 30 CFR 585.200(b) states, "A lease issued under this part confers on the lessee the rights to one or more project easements without further competition for the purpose of installing gathering, transmission, and distribution cables; pipelines; and appurtenances on the OCS as necessary for the full enjoyment of the lease." While BOEM could require a lessee to use a previously existing shared cable corridor established by a BOEM-issued Right-of-Way grant when the use of the shared cable corridor is technically and economically practical and feasible alternative for the project, BOEM cannot limit a lessee's right to a project easement when such a cable corridor does not exist and there is no way of determining if the use of a future shared cable corridor would be a technically and economically practical and feasible alternative for the project. Therefore, BOEM cannot require Ocean Wind to use a non-existent shared cable corridor for this Project. Furthermore, Ocean Wind 1's export cables would connect to the power grid via different onshore substations than Atlantic Shores South. Developing a shared export cable corridor would not be technically or economically practicable because the Ocean Wind 1 and Atlantic Shores South projects have distinct interconnection points to the electric power grid.
SAV Avoidance Alternative E-1	NMFS requested that BOEM consider an offshore export cable routing alternative that would avoid impacts on SAV. The Oyster Creek export cable route would make landfall on Island Beach State Park within an auxiliary parking lot of Swimming Area #2 and then follow Shore Road north approximately 2.67 miles before entering Barnegat Bay to reconnect to the Oyster Creek export cable route in Barnegat Bay (refer to Figure C-2 in Appendix C, *Additional Analysis for Alternatives Dismissed*). Alternative E-1 would increase the export cable route by approximately 6.2 miles, which would likely require installation of a reactive compensation station approximately 3 to 5 miles offshore of Island Beach State Park due to energy dissipation and consequent limits in the distance that active power can be carried. An SAV avoidance alternative identified in the COP as the Prior Channel Route Option was developed by Ocean Wind in November 2021. The Prior Channel Route Option was developed following the same premise of Alternative E-1; however, the export cable would not travel as far north on Shore Road prior to entering Barnegat Bay and reconnecting to the export cable route identified under the Proposed Action. Because the Prior Channel Route Option was developed with the same premise as Alternative E-1, would have substantially similar effects on SAV, and would result in fewer resource impacts, the Prior Channel Route is carried forward in the Draft EIS as Alternative E, and Alternative E-1 was not carried forward for separate analysis.

Alternative	Rationale for Dismissal
SAV Avoidance Alternative E-2	NMFS requested that BOEM consider an offshore export cable routing alternative that would avoid impacts on SAV. The Oyster Creek export cable route would make landfall on Island State Beach Park within an auxiliary parking lot of Swimming Area #2 and then follow Central Avenue/Shore Road north approximately 2.7 miles before crossing Barnegat Bay to make landfall within a parking lot at Berkeley Island County Park and would then follow existing roads to the onshore substation. Alternative E-2 would increase the export cable route by approximately 4.3 miles, which would likely require installation of a reactive compensation station approximately 3 to 5 miles offshore of Island Beach State Park due to energy dissipation and consequent limits in the distance that active power can be carried. BOEM's regulations and guidance under 30 CFR 585.626 and 585.627 require the lessee to submit detailed geotechnical and geophysical data and analysis, benthic survey data and analysis, socioeconomic data and analysis, biological data and analysis, and initial cable installation feasibility information as well as MEC and UXO supplemental information. Alternative E-2 identifies significant new route areas (2.8 miles offshore/nearshore and 9.3 miles onshore) for which the lessee has not collected and analyzed the required data. Without the required data and analysis, BOEM cannot confirm that Alternative E-2 is technically feasible. Obtaining the required data would require additional desktop analysis, development of survey plans, survey, lab analysis, and reporting for BOEM to review. Additional survey could result in up to 2 years of Project delays. Alternative E-2 has substantially similar benefits to SAV as Alternative E, which is analyzed in detail in this Final EIS. Alternative E also greatly minimizes impacts on SAV in comparison to the impacts expected from the Proposed Action. Furthermore, Alternative E does not have the same feasibility concerns and resource impacts as Alternative E-2. Additional detail regarding the feasibility concerns and resource impacts associated with Alternative E-2 are provided in Appendix C, *Additional Analysis for Alternatives Dismissed*. Therefore, Alternative E-2 was dismissed from further consideration in the Draft EIS.

Alternative	Rationale for Dismissal
SAV Avoidance Alternative E-3	NMFS and NJDEP requested that BOEM consider an offshore export cable routing alternative that would avoid impacts on SAV. The Oyster Creek export cable route would make landfall in an existing parking lot in Ship Bottom, New Jersey, and then follow Route 72 and U.S. Highway 9 to the onshore substation. BOEM's regulations and guidance under 30 CFR 585.626 and 585.627 require the lessee to submit detailed geotechnical and geophysical data and analysis, benthic survey data and analysis, socioeconomic data and analysis, biological data and analysis, and initial cable installation feasibility information as well as MEC and UXO supplemental information. Alternative E-3 identifies significant new route areas (7.3 miles offshore and 13.7 onshore) for which the lessee has not collected and analyzed the required data. Without the required data and analysis, BOEM cannot confirm that Alternative E-3 is technically feasible. Obtaining the required data would require additional desktop analysis, development of survey plans, survey, lab analysis, and reporting for BOEM to review. Additional survey and analysis could result in up to 2 years of delay, which would result in delays to the anticipated commencement of commercial operations and may result in a determination that Alternative E-3 is not feasible or results in unacceptable unavoidable impacts. Alternative E-3 has substantially similar benefits to SAV as Alternative E, which is analyzed in detail in this Final EIS. Alternative E also greatly minimizes impacts on SAV in comparison to the impacts expected from the Proposed Action. Furthermore, Alternative E does not have the same feasibility concerns and resource impacts as Alternative E-3. Additional detail regarding the feasibility concerns and resource impacts associated with Alternative E-3 are provided in Appendix C, *Additional Analysis for Alternatives Dismissed*. Therefore, Alternative E-3 was dismissed from further consideration in the Draft EIS.

Alternative	Rationale for Dismissal
Onshore Export Cables	
Alternatives to onshore export cable routes	Commenters requested that BOEM consider alternative export cable routes to reduce disturbance to local communities. Suggestions for alternatives included utilizing vacant land across from Oyster Creek Power Plant, running cables under the Forked River or Oyster Creek, or utilizing the Corson’s and Egg Harbor inlets to access the BL England interconnection point. An alternative to utilize the vacant land across from the Oyster Creek Power Plant for the onshore cable route will not be carried forward for separate analysis because it would not be substantially different in design or effects than the analysis of the Proposed Action and other action alternatives. Moreover, there is no evidence that the alternative would avoid or substantially lessen one or more significant socioeconomic or environmental effects of the Project. The Holtec Property route from the landfall location in Lacey Township to the Oyster Creek substation travels west across undeveloped land, taking advantage of previously disturbed areas where possible, before following abandoned roadways associated with the existing confined disposal facility and Holtec property. To minimize potential impacts on wetlands and vegetation, the route would follow existing berms, paths, and trails where practical. This route crosses through the vacant land across from the Oyster Creek Power Plant before following existing roadways, State Route 9, and a private road to the Oyster Creek substation parcel. Ocean Wind reviewed potential export cable routes within the Forked River and the Oyster Creek channel and determined they were not technically feasible or practical options to carry forward for detailed analysis in the PDE. The route within the Forked River was not carried forward because it would require additional regulatory approval to install a cable within the federally maintained navigation channel, and its implementation would have greater environmental impacts than the proposed routes. Additionally, there are design and construction constraints due to the Forked River’s narrow channel and shallow water depths outside the channel. The Oyster Creek route was not carried forward for analysis due to constraints related to cable construction and maintenance, including that very deep cable burial would be required at the channel entrance that is currently dredged. The use of Great Egg Harbor inlet for the export cable route was also evaluated by Ocean Wind. This alternative was not carried forward for the following reasons: sediments in the inlet are dynamic, requiring additional cable protection such as cable mattresses, which would result in additional impacts on natural resources; access to the inlet by other vessels would be restricted during construction, which would result in additional impacts on other marine uses and navigation; and there is an existing USACE borrow area at the mouth of the inlet and USACE does not typically authorize crossing of borrow areas. Additional detail regarding the feasibility concerns associated with the Great Egg Harbor inlet export cable route are provided in Appendix C.

Alternative	Rationale for Dismissal
Alternative maximizing protection of natural resources/locate Project outside known habitat for federal or state-listed species	BOEM received comments to consider a Project alternative that maximizes the protection of natural habitats and minimizes the impact on those habitats and associated flora and fauna, particularly avoiding potential cable landing on Island Beach State Park and other barrier island locations that are prime ecological assets containing populations of several globally rare, federal and state rare, endangered, and threatened animals, plants, and natural communities. Ocean Wind has coordinated with NJDEP to identify the preferred location for a crossing of Island Beach State Park that would minimize impacts on park operations and resources. The proposed export cable would make landfall within an existing auxiliary parking lot for Swimming Area #2, and the main parking lot for Swimming Area #2 would be used for equipment staging. Use of existing parking lots for the cable landfall and equipment staging would minimize impacts on natural habitats and associated flora and fauna. Because impacts on Island Beach State Park have already been reviewed extensively and Ocean Wind is using NJDEP's preferred location for crossing the barrier island, consideration of other alternative cable landing locations within Island Beach State Park is not warranted.
Alternative to minimize impacts on NARW	A commenter requested that BOEM include a range of alternatives to prohibit HRG during seasons when protected species are known to be present in the Project area, in addition to any dynamic restrictions due to the presence of NARW or other endangered species. Additionally, the EIS should include alternatives that require clearance zones for NARW that extend at least 1,000 meters with requirements for HRG survey vessels to use Protected Species Observers and Passive Acoustic Monitoring to establish and monitor these zones with requirements to cease surveys if a NARW enters the clearance zone. BOEM reviewed this request for an alternative and determined that it would be more suitable to address potential impacts of HRG surveys through mitigation and monitoring rather than as an EIS alternative. Refer to Appendix H, *Mitigation and Monitoring*, for BOEM's recommended measures to avoid or minimize impacts on marine mammals during construction and operation of the Project.
Maximum-case alternative	One commenter requested that BOEM include an alternative that combines the most-disruptive components for each option included in the PDE. When BOEM conducts an environmental review of a lessee's COP, BOEM considers the maximum-case scenario for each design parameter that is defined in the COP. Because BOEM already considers the maximum-case scenario as part of its review of the Proposed Action, the analysis of a maximum-case alternative and the Proposed Action would reach the same impact conclusion. This alternative was not carried forward for separate analysis because it is already analyzed in detail as the Proposed Action.

Alternative	Rationale for Dismissal
Alternate Energy Source	
Alternative energy source to meet the demand	Commenters suggested BOEM analyze alternative energy options such as onshore wind, electrical generation from tidal movements, solar energy, small modular nuclear reactors, or natural gas. Renewable Energy Lease Number OCS-A 0498 only authorizes the submission of a COP for offshore wind energy. Generation of any other form of energy would not be permitted under this lease. In order for BOEM to analyze other renewable energy options on the OCS (e.g., marine hydrokinetics (including tidal energy), a new leasing process would need to occur specifically for that energy source. In addition, analyzing onshore conventional and alternative energy development is outside BOEM's jurisdiction. Finally, this alternative is not responsive to the purpose and need and would not address BOEM's regulatory need to determine whether to approve, approve with modifications, or disapprove the COP to construct, operate, and conceptually decommission a commercial-scale wind energy facility within the Lease Area. Therefore, this alternative was not carried forward for detailed analysis.

HRG = high-resolution geophysical; NARW = North Atlantic right whale; NJDEP = New Jersey Department of Environmental Protection

2.2. Non-Routine Activities and Events

Non-routine activities and events associated with the proposed Project could occur during construction and installation, O&M, or decommissioning. Examples of such activities or events could include corrective maintenance activities, collisions involving vessels or vessels and marine life, allisions (a vessel striking a stationary object) involving vessels and WTGs or OSS, cable displacement or damage by anchors or fishing gear, chemical spills or releases, severe weather and other natural events, seismic activity, fires, and terrorist attacks. These activities or events are difficult to predict with certainty. This section provides a brief assessment of each of these potential events or activities.

- *Corrective maintenance activities:* These activities could be required as a result of other low-probability events, or as a result of unanticipated equipment wear or malfunctions. Ocean Wind anticipates housing spare parts for key Project components at an O&M facility to initiate repairs expeditiously.
- *Collisions and allisions:* These could result in spills (described below) or injuries or fatalities to wildlife (addressed in Chapter 3). Collisions and allisions are anticipated to be unlikely based on the following factors that would be considered for the proposed Project:
  - USCG requirement for lighting on vessels
  - NOAA vessel speed restrictions
  - The proposed spacing of WTGs and OSS
  - The lighting and marking plan that would be implemented, as described in Section 2.1.2.2.3
  - The inclusion of proposed Project components on navigation charts
- *Cable displacement or damage by vessel anchors or fishing gear:* This could result in safety concerns and economic damage to vessel operators and may require corrective action by Ocean Wind such as the need for one or more cable splices to an export or inter-array cable(s). However, such incidents are unlikely to occur because the proposed Project area would be indicated on navigational charts and the cable would be buried at least 4 feet (1.2 meters) deep or protected with hard armor.

- *Chemical spills or releases:* For offshore activities, these include inadvertent releases from refueling vessels, spills from routine maintenance activities, and any more significant spills as a result of a catastrophic event (which could include spills or releases from the WTG or OSS structures). All vessels would be certified by the Project to conform to vessel O&M protocols designed to minimize risk of fuel spills and leaks. Ocean Wind would be expected to comply with USCG and BSEE regulations relating to prevention and control of oil spills. Onshore, releases could potentially occur from construction equipment or HDD activities. All wastes generated onshore shall comply with applicable state and federal regulations, including the Resource Conservation and Recovery Act and the Department of Transportation Hazardous Materials regulations.
- *Severe weather and natural events:* Extratropical storms, including northeasters, are common in the Lease Area from October to April. These storms bring high winds and heavy precipitation, which can lead to severe flooding and storm surges. Hurricanes that travel along the coastline of the eastern U.S. have the potential to affect the Lease Area with high winds and severe flooding. On average, hurricanes occur every 3 to 4 years within 90 to 170 miles of the New Jersey Coast (Ocean Wind 2023). The return rate of hurricanes may become more frequent than the historical record, and the future probability of a major hurricane will likely be higher than the historical record of these events due to climate change. The engineering specifications of the WTGs and their ability to sufficiently withstand weather events is independently evaluated by a certified verification agent when reviewing the Facility Design Report and Fabrication and Installation Report according to international standards, which include withstanding hurricane-level events. One of these standards calls for the structure to be able to withstand a 50-year return interval event. An additional standard also includes withstanding 3-second gusts of a 500-year return interval event, which would correspond to Category 5 hurricane windspeeds. If severe weather caused a spill or release, the actions outlined above would help reduce potential impacts. Severe flooding or coastal erosion could require repairs, with impacts associated with repairs being similar to those outlined in Chapter 3 for construction activities. While highly unlikely, structural failure of a WTG (i.e., loss of a blade or tower collapse) would result in temporary hazards to navigation for all vessels, similar to the construction and installation impacts described in Chapter 3. As discussed in Section 2.1.2.2.2, *Onshore Activities and Facilities*, the design of onshore facilities, including the TJBs and substations, accounts for erosion, more frequent high-intensity storm events, tidal surge, and sea level rise associated with climate change. Refer to Appendix I, *Supplemental Information*, for additional information regarding climate resiliency.
- *Seismic activity:* Three fault lines existing within northern New Jersey. Within 160 kilometers of the Project area, only minor (less than or equal to magnitude 4: non-damaging but felt) earthquakes have been recorded since 1783. Fault rupture is considered unlikely because no active or potentially active faults have been identified within or near the Project (Ocean Wind 2023). The impacts from seismic activity would be similar to those assessed for other non-routine events or activities.
- *Fires:* Malfunction of WTGs or OSS could potentially cause a fire. An Emergency Response Plan has been prepared by Ocean Wind as part of the COP (Ocean Wind 2023) to provide clear instructions regarding procedures during emergency incident scenarios, which include fires. The impacts from fires would be similar to those assessed for severe weather and natural events.
- *Terrorist attacks:* BOEM considers these unlikely, but impacts could vary depending on the magnitude and extent of any attacks. The actual impacts of this type of activity would be the same as the outcomes listed above. Therefore, terrorist attacks are not analyzed further.

2.3. Summary and Comparison of Impacts Among Alternatives

Table 2-4 provides a summary and comparison of the impacts under the No Action Alternative and each action alternative assessed in Chapter 3. Under the No Action Alternative, any potential environmental and socioeconomic impacts, including benefits, associated with the proposed Project would not occur; however, impacts could occur from other ongoing and planned activities. Section 3.1 provides definitions for **negligible**, **minor**, **moderate**, and **major** impacts.

Table 2-4 Summary and Comparison of Impacts Among Alternatives with No Mitigation Measures

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.4 Air Quality	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **moderate** impacts on air quality. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **moderate** adverse cumulative impacts due to emissions of criteria pollutants, VOCs, HAPs, and GHGs, mostly released during construction and decommissioning, and **minor** to **moderate beneficial** cumulative impacts on regional air quality after offshore wind projects are operational.	*Proposed Action:* The Proposed Action would have **minor** to **moderate** adverse impacts attributable to air pollutant and GHG emissions and accidental releases. The Project may lead to reduced emissions from fossil-fueled power-generating facilities and consequently **minor beneficial** impacts on air quality and climate. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute a noticeable increment to the **moderate** adverse and **moderate beneficial** cumulative impacts on air quality.	Alternatives B-1, B-2, and D could have slightly less adverse but not materially different impacts on air quality compared to the Proposed Action due to a reduced number of WTGs. Similarly, Alternatives B-1, B-2, and D could have slightly less beneficial impacts on air quality from displacement of fossil-fueled power generation compared to the Proposed Action. However, the overall impact level would be the same as for the Proposed Action: **minor** to **moderate** adverse and **minor beneficial**. Alternatives C-1 and C-2 would have the same number of WTGs as the Proposed Action and, therefore, the same anticipated emissions and impact levels. Under Alternative E, the offshore and onshore cable lengths, and thus the construction emissions, would be slightly greater than for the Proposed Action. However, the impact levels would be the same as for the Proposed Action: **minor** to **moderate** adverse and **minor beneficial**. The cumulative impacts associated with Alternatives B, C, D, and E when each is combined with the impacts from ongoing and planned activities (including offshore wind activities) would be the same as for the Proposed Action: **moderate** adverse and **moderate beneficial**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.5 Bats	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **negligible** to **minor** impacts on bats. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **negligible** to **minor** adverse cumulative impacts because bat presence on the OCS is anticipated to be limited and onshore bat habitat impacts are expected to be minimal.	*Proposed Action:* The Proposed Action would have **negligible** to **minor** impacts on bats, especially if tree clearing is conducted outside of the active season. The primary risks would be from potential onshore removal of habitat and operation of offshore WTGs (e.g., collision, barotrauma); however, occurrence of bats offshore is low and mortality is anticipated to be rare in the onshore or offshore environment. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute an undetectable increment to the **negligible** to **minor** cumulative impacts on bats.	Alternatives B-1, B-2, and D may result in slightly less, but not materially different, negligible impacts on bats than those described under the Proposed Action. Alternative C-1 would have the same WTG number and overall Wind Farm Area footprint as the Proposed Action and, therefore, would have similar impacts on bats. Alternative C-2 would have the same number of WTGs as the Proposed Action, but compressed in a smaller footprint, and, therefore, would have similar impacts on bats. Alternative E would limit the export cable route to the more northerly route, which is analyzed as part of the Proposed Action and so impacts would be the same. Therefore, the impact levels of Alternatives B, C, D, and E would be the same as for the Proposed Action: **negligible** to **minor**. The cumulative impacts associated with Alternatives B, C, and D, when each combined with the impacts of ongoing and planned activities (including offshore wind activities), would be the same as for the Proposed Action: **negligible** to **minor**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.6 Benthic Resources	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **negligible** to **moderate** impacts on benthic resources. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **moderate** adverse cumulative impacts and could potentially include **moderate beneficial** impacts resulting from emplacement of structures (habitat conversion).	*Proposed Action:* The Proposed Action would have **negligible** to **moderate** adverse impacts and **moderate beneficial** impacts on benthic resources. Adverse impacts would primarily result from new cable emplacement, pile-driving noise, anchoring, and the presence of structures. Beneficial impacts would result from the presence of new structures. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute an undetectable to noticeable increment to the **moderate** adverse and **moderate beneficial** cumulative impacts on benthic resources.	Alternatives B-1 and B-2 would reduce the number of WTGs compared to the Proposed Action, and so the impacts would be reduced compared to the Proposed Action. There would be fewer foundations and less inter-array cable, which would reduce impacts associated with the presence of structures and conversion of habitat from soft-bottom to scour protection. These alternatives would have impact levels of **negligible** to **minor** adverse and **moderate beneficial**. Under Alternatives C-1 and C-2, the overall impact level would be the same as for the Proposed Action (**negligible** to **minor** adverse and **moderate beneficial**), as the number of WTGs would remain the same and the overall footprint would remain the same or slightly less. Alternative D would remove 15 WTGs from the northeastern corner of the Wind Farm Area to minimize impacts on the sand ridge and trough features. Under this alternative, avoidance of the sand ridge and trough features would potentially benefit benthic communities. Alternative D would result in **negligible** to **minor** impacts and **moderate beneficial** impacts. Under Alternative E, impacts on SAV would be reduced and the overall impact level would be the same as for the Proposed Action: **negligible** to **minor** adverse and **moderate beneficial**. The cumulative impacts associated with Alternatives B, C, D, and E when each combined with the impacts from ongoing and planned activities (including offshore wind activities) would be the same as for the Proposed Action: **moderate** adverse and **moderate beneficial**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.7 Birds	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **minor** impacts on birds. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **moderate** adverse cumulative impacts but could include **moderate beneficial** impacts because of the presence of offshore structures.	*Proposed Action:* The Proposed Action would have **minor** adverse impacts on birds, primarily associated with habitat loss and collision-induced mortality from rotating WTGs and permanent habitat loss and conversion from onshore construction. **Minor beneficial** impacts would result from increased foraging opportunities for marine birds. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute an undetectable increment to the **moderate** adverse and **moderate beneficial** cumulative impacts on birds.	Alternatives B-1, B-2, and D would reduce the number of WTGs compared to the Proposed Action, which may result in slightly less impacts on species with high collision sensitivity and high displacement sensitivity, but would not change the impact level: **minor** with **minor beneficial** impacts. Alternatives C-1 and C-2 would have the same number of WTGs as the Proposed Action and, therefore, would have same **minor** with **minor beneficial** impacts on birds. Under Alternative E, the rerouting of the Oyster Creek export cable in Barnegat Bay to avoid SAV would benefit bird species that use this habitat. Alternative E would slightly increase the length of the onshore cable route compared to the Proposed Action, but the cable would mostly be placed along the parking area and Central Avenue/Shore Road, minimizing impacts on vegetation and bird foraging and nesting habitat. Alternative E would have the same **minor** with **minor beneficial** impacts on birds as the Proposed Action. The cumulative impacts associated with Alternatives B, C, D, and E when each combined with the impacts from ongoing and planned activities (including offshore wind activities) would be the same as for the Proposed Action: **moderate** adverse and **moderate beneficial**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.8 Coastal Habitat and Fauna	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **moderate** impacts on coastal habitat and fauna. Currently, there are no other offshore wind activities proposed in the geographic analysis area. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **moderate** cumulative impacts on coastal habitat and fauna, primarily driven by climate change.	*Proposed Action:* The Proposed Action would have **moderate** impacts on coastal habitat and fauna, primarily driven by climate change. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute an undetectable increment to the **moderate** cumulative impacts on coastal habitat and fauna.	Because Alternatives B, C, and D involve modifications only to offshore components, impacts on coastal habitat and fauna from those alternatives would be the same as those under the Proposed Action: **moderate**. Alternative E could affect slightly more habitat on Island Beach State Park than the Proposed Action and Alternatives B, C, and D, but impacts would remain limited overall. The impacts would be the same as those under the Proposed Action: **moderate**. The cumulative impacts of Alternatives B, C, D, and E when each combined with the impacts from ongoing and planned activities (including offshore wind) would be the same as those of the Proposed Action: **moderate**.
3.9 Commercial Fisheries and For-Hire Recreational Fishing	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **minor** to **major** impacts for commercial fisheries and **minor** to **moderate** impacts on for-hire recreational fishing. The impacts could also include long-term **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined	*Proposed Action:* The Proposed Action would have **minor** to **major** adverse impacts on commercial fisheries and **minor** to **moderate** adverse impacts on for-hire recreational fishing. The major impact rating for some fisheries and fishing operations is primarily driven by regulated fishing effort and climate change because of the potential disruptions to fishing operations in the Project area. The impacts of the Proposed Action could also include long-term **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute an appreciable increment to the	Alternatives B-1 and B-2, and D would reduce the number of WTGs compared to the Proposed Action, providing fishing vessels in the Lease Area with more area to operate and fish and reducing the potential for gear entanglement and loss. However, the impact level is anticipated to be the same as for the Proposed Action: **minor** to **major** for commercial fisheries and **minor** to **moderate** for for-hire recreational fishing operations, with long-term **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations. Alternatives C-1 and C-2 would have the same number of WTGs as the Proposed Action and, therefore, would have the same overall impact levels as the Proposed Action: **minor** to **major** for commercial fisheries and **minor** to **moderate** for for-hire recreational fishing operations, with

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
	with all planned activities would result in a **minor** to **major** adverse cumulative impact on commercial fisheries and **minor** to **moderate** adverse cumulative impact on commercial fisheries because some commercial fisheries and fishing operations would experience substantial long-term disruptions. There would be a **minor** to **moderate** adverse cumulative impact on for-hire recreational fishing. This impact rating is primarily driven by the presence of offshore structures, regulated fishing effort, and climate change. The cumulative impacts could also include long-term **minor** to **moderate** **beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect.	**minor** to **major** adverse cumulative impacts on commercial fisheries and **minor** to **moderate** adverse cumulative impact on for-hire recreational fishing. Cumulative impacts could also include long-term **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations.	long-term **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations. Alternative E would provide a slight benefit to commercial and for-hire recreational fisheries by reducing the impact on SAV, a nursery habitat for targeted species, but the impact level would be the same as for the Proposed Action: **minor** to **major** for commercial fisheries and **minor** to **moderate** for for-hire recreational fishing operations, with long-term **minor** to **moderate** **beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations. The cumulative impacts of Alternatives B, C, D, and E when each combined with the impacts from ongoing and planned activities would be the same as for the Proposed Action: **minor** to **major** for commercial fisheries and **minor** to **moderate** for for-hire recreational fishing operations, with long-term **minor** to **moderate** **beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.10 Cultural Resources	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **moderate** impacts on cultural resources, primarily as a result of dredging, cable emplacement, and activities that disturb the seafloor. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **moderate** cumulative impacts on cultural resources.	*Proposed Action:* The Proposed Action would have **moderate** impacts on cultural resources primarily from the introduction of intrusive visual elements, which alter character-defining ocean views of historic properties onshore that contribute to the resource's eligibility for the NRHP and result in a loss of historic or cultural value; and dredging, cable emplacement, and activities that disturb the seafloor, which result in damage to or destruction of submerged archaeological sites or other underwater cultural resources (e.g., shipwreck, debris fields, ancient submerged landforms) from offshore bottom-disturbing activities, resulting in a loss of scientific or cultural value. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute an appreciable increment to the **moderate** cumulative impacts on cultural resources.	Alternatives B-1, B-2, C-1, C-2, and D would have the same **moderate** impact level on cultural resources as the Proposed Action. While the degree of visual impacts on cultural resources under Alternatives B-1 and B-2 would be lower than under the other alternatives, these impacts would still require comparable mitigation. Alternative E would have the same overall **moderate** impact level on cultural resources as the Proposed Action. The cumulative impacts of Alternatives B-1, B-2, C-1, C-2, and D when each combined with the impacts from ongoing and planned activities (including other offshore wind activities) would be the same as for the Proposed Action: **moderate**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.11 Demographics Employment, and Economics	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **minor** adverse impacts and **minor beneficial** impacts on demographics, employment, and economics. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **minor** adverse and **moderate beneficial** cumulative impacts.	*Proposed Action:* The Proposed Action would have **minor** adverse and **moderate beneficial** impacts on demographics, employment, and economics. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute an undetectable to noticeable increment to the **minor** adverse and **moderate beneficial** cumulative impacts on demographics, employment, and economics.	Alternatives B-1, B-2, and D would result in a slight reduction in both adverse and beneficial impacts on demographics, employment, and economics compared to the Proposed Action because of the reduced number of WTGs, but the overall impact would be the same: **minor** adverse impacts and **moderate** beneficial impacts. Alternatives C-1, C-2, and E would not change the number of WTGs and therefore the impacts are anticipated to be the same as those of the Proposed Action: **minor** adverse and **moderate** beneficial. The cumulative impacts of Alternatives B, C, D and E when each combined with the impacts from ongoing and planned activities (including other offshore wind activities) would be the same as for the Proposed Action: **minor** adverse and **moderate beneficial**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.12 Environmental Justice	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in impacts on environmental justice populations ranging from **minor** to **moderate** adverse to **minor beneficial**. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **moderate** cumulative impacts because environmental justice populations would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts.	*Proposed Action:* The Proposed Action would have a range of impacts, such as minor impacts resulting from the disruption of marine activities during offshore cable installation and impacts of noise on commercial and for-hire fishing, and moderate impacts due to the long-term presence of structures in the offshore environment and secondary impacts on fishing vessels or at onshore seafood processing and distribution facilities. Potential minor beneficial impacts would result from port utilization and the enhanced employment opportunities. Overall, BOEM expects that impacts of the Proposed Action on environmental justice populations would be **moderate** because environmental justice populations would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts. The Proposed Action would not result in disproportionately “high and adverse” impacts on environmental justice populations. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute a noticeable increment to the **moderate** cumulative impacts on environmental justice populations.	Impacts of Alternatives B-1, B-2, C-1, C-2, D, and E would be the same as those of the Proposed Action for environmental justice populations and would range from minor to moderate adverse to minor beneficial, and are anticipated to be **moderate** overall. These action alternatives would not result in disproportionately “high and adverse” impacts on environmental justice populations. The cumulative impacts of Alternatives B, C, D, and E when each combined with the impacts from ongoing and planned activities (including other offshore wind activities) would be the same as for the Proposed Action: **moderate**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.13 Finfish, Invertebrates, and Essential Fish Habitat	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **moderate** impacts on finfish, invertebrates, and EFH. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **moderate** cumulative impacts on finfish, invertebrates, and EFH. It is anticipated that the greatest impact on finfish and invertebrates would be caused by ongoing regulated fishing activity and climate change.	*Proposed Action:* The Proposed Action would result in **negligible** to **moderate** impacts for finfish, invertebrates, and EFH. The primary impacts on finfish would be from noise during construction and operation of the proposed Project. Long-term impacts on EFH from construction and installation of the Proposed Action would be minor, as the resources would likely recover naturally over time. The Proposed Action would have negligible to minor impacts on invertebrates through temporary disturbance and displacement, habitat conversion, and behavioral changes, injury, and mortality of sedentary fauna. The presence of structures may have a minor beneficial effect on invertebrates through an "artificial reef effect." Despite invertebrate mortality and varying extents of habitat alteration, BOEM expects the long-term impact on invertebrates from construction and installation of the Proposed Action to be minor, as the resources would likely recover naturally over time. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute a noticeable increment to the **negligible** to **moderate** cumulative impacts on finfish, invertebrates, and EFH.	Alternatives B-1, B-2, and D would reduce the number of WTGs and would slightly reduce impacts on finfish, invertebrates, and EFH compared to the Proposed Action, given that there would be fewer foundations developed and, therefore, less permanent loss of habitat and lower noise impacts during associated pile driving; however, the impact level would be the same as for the Proposed Action: **negligible** to **moderate**. Alternatives C-1 and C-2 would have no significant change to the **negligible** to **moderate** impacts under the Proposed Action, as the number of WTGs would remain the same and the overall footprint would remain the same or slightly less. Alternative E would result in impacts similar to those described under the Proposed Action: **negligible** to **moderate**. The cumulative impacts of Alternatives B, C, D, and E when each combined with the impacts from ongoing and planned activities (including other offshore wind activities) would be the same as for the Proposed Action: **negligible** to **moderate**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.14 Land Use and Coastal Infrastructure	*No Action Alternative:* Continuation of existing environmental trends and activities under the No Action Alternative would result in **negligible** adverse and **minor beneficial** impacts on land use and coastal infrastructure**.** *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **minor** adverse cumulative impacts and **minor beneficial** cumulative impacts.	*Proposed Action:* The Proposed Action would result in **minor** adverse with **minor beneficial** impacts on land use and coastal infrastructure. Beneficial impacts would result from port utilization. Adverse impacts would primarily result from land disturbance during onshore installation of the cable route and substation, accidental spills, and construction noise and traffic. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute a noticeable increment to the **minor** adverse and **minor beneficial** cumulative impacts.	Alternatives B-1, B-2, C-1, C-2, and D would have the same impacts on land use and coastal infrastructure as the those of Proposed Action—**minor** adverse with **minor beneficial** impacts. Because there would be fewer WTGs under these alternatives, there would be less potential for contamination from unforeseen spills or accidents, less light being emitted from offshore, and less need for port facilities for shipping, berthing, and staging. However, under all of these alternatives, the majority of the WTGs would still be visible and there would be no meaningful difference in impacts on land use and coastal infrastructure. Alternative E would have the same impacts on land use and coastal infrastructure as the those of Proposed Action: **minor** adverse with **minor beneficial** impacts. Alternative E would slightly increase the onshore portion of the Oyster Creek export cable route, resulting in increased impacts on land use associated with temporary construction activity compared to the Proposed Action. The overall impact magnitudes would be the same because the cable corridors would follow existing right-of-way and the primary impacts would be limited to the duration of construction. The cumulative impacts of Alternatives B, C, D, and E when each is combined with the impacts from ongoing and planned activities (including offshore wind activities) would be the same as for the Proposed action: **minor** adverse and **minor beneficial**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.15 Marine Mammals	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **minor** to **moderate** impacts on mysticetes (with exception of NARW), odontocetes, and pinnipeds. For NARW, the No Action Alternative would result in **moderate** to **major** impacts. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities (including other offshore wind activities) would result in **moderate** impacts on mysticetes, odontocetes, and pinnipeds, except for the NARW, on which impacts could be **moderate** to **major**.	*Planned Action:* BOEM anticipates that the impacts resulting from the Proposed Action would result in **moderate** impacts for mysticetes, except for the NARW, which would be **moderate** to **major**. BOEM anticipates that impacts from the Proposed Action would result in **minor** adverse impacts for odontocetes and pinnipeds and could include **minor beneficial** impacts due to the presence of structures. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute an undetectable to noticeable increment to the **moderate** adverse impact for mysticetes, **minor** adverse impact for odontocetes and pinnipeds, and **moderate** to **major** impact for NARW.	Alternatives B-1, B-2, C-1, and D would result in the same impacts on marine mammals as described for the Proposed Action, with some impacts being minimally decreased in duration and geographic extent. The impacts resulting from the alternatives individually would be **minor** and **minor beneficial** for odontocetes and pinnipeds, **moderate** for most mysticetes, and **moderate** to **major** for NARW. Alternative C-2 would install the same number of WTGs as the Proposed Action; therefore, the impacts would be similar to those of the Proposed Action and would range from **minor** to **major** and could include beneficial impacts. Alternative E would likely have the same **minor** to **major** adverse impacts and could also result in beneficial impacts on marine mammals as the Proposed Action. While Alternative E could result in reduced acreage of SAV potentially affected, the overall impacts on marine mammals from the alternative would not be materially different from those of the Proposed Action. The cumulative impacts of Alternatives B, C, D, and E when each combined with the impacts from ongoing and planned activities (including offshore wind activities) would be the same as for the Proposed action: **moderate**, except for the NARW, which would be **moderate** to **major**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.16 Navigation and Vessel Traffic	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **moderate** impacts on navigation and vessel traffic. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **moderate** impacts primarily due to the presence of structures and increased vessel traffic, leading to congestion at affected ports, an increased likelihood of collisions and allisions, and increased risk of accidental releases.	*Proposed Action:* The Proposed Action would result in **moderate** impacts on navigation and vessel traffic. Impacts include changes in navigation routes due to the presence of structures and cable emplacement, delays in ports, degraded communication and radar signals, and increased difficulty of offshore SAR or surveillance missions within the Wind Farm Area. Some commercial fishing, recreational, and other vessels would choose to avoid the Wind Farm Area, leading to potential congestion of vessels along the Wind Farm Area borders. The increase in potential for marine accidents, which may result in injury, loss of life, and property damage, could produce disruptions for ocean users in the geographic analysis area. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute a noticeable increment to the **moderate** cumulative impacts on navigation and vessel traffic.	Alternatives B-1, B-2, and D would reduce the number of WTGs, incrementally decreasing impacts on navigation and vessel traffic safety compared to the Proposed Action, but would not change the overall impact level from **moderate**. The proposed buffer (0.81- to 1.08-nm) between Ocean Wind 1 and Atlantic Shores South would improve vessel navigation and SAR by providing additional space for transiting between the two lease areas. While Alternative C-2 would compress the WTG layout, the spacing between structures would be within USCG's preferred range for safe navigation of vessels less than 200 feet in length, and would not have a substantive change in impacts on navigation and vessel traffic. With Ocean Wind 1's adoption of a separation agreement with Atlantic Shores South into the Proposed Action, impacts of Alternatives C-1 and C-2 would be the same as for the Proposed Action: **moderate.** Under Alternative E, the rerouting of the Oyster Creek export cable in Barnegat Bay would not result in a discernable difference in impacts on navigation and vessel traffic compared to the Proposed Action. Alternative E would result in the same **moderate** impacts. The cumulative impacts associated with Alternatives B, C, D, and E when each is combined with the impacts from ongoing and planned activities (including other offshore wind activities) would be the same as for the Proposed Action: **moderate**.
3.17 Other Uses	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result	*Proposed Action:* The Proposed Action would result in **negligible** impacts for marine mineral extraction and cables and pipelines; **minor** impacts for aviation and air traffic, radar systems, and most	Impacts of Alternatives B-1 and B-2 would be similar to those of the Proposed Action for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, and scientific research and surveys,

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
	in **negligible** impacts for marine mineral extraction, marine and national security uses, aviation and air traffic, cables and pipelines, and radar systems and **moderate** impacts on scientific research and surveys. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **negligible** to **minor** cumulative impacts for marine mineral extraction, aviation and air traffic, and cables and pipelines; **moderate** cumulative impacts for radar systems due to WTG interference; **minor** cumulative impacts for military and national security uses except for USCG SAR operations, which would have **moderate** cumulative impacts; and **major** cumulative impacts for scientific research and surveys.	military and national security uses; **moderate** impacts for USCG SAR operations; and **major** impacts for NOAA's scientific research and surveys. The installation of WTGs in the Project area would result in increased navigational complexity and increased allision risk for vessel traffic and low-flying aircraft and would result in line-of-sight interference for radar systems. Additionally, the presence of structures would exclude certain areas within the Project area occupied by Project components (e.g., WTG foundations, cable routes) from potential vessel and aerial sampling and affect survey gear performance, efficiency, and availability for NOAA surveys supporting commercial fisheries and protected-species research programs. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute a noticeable increment to the **negligible** to **minor** cumulative impacts for aviation and air traffic, cables and pipelines, marine mineral extraction, and most military and national security uses; **moderate** cumulative impacts for radar systems and USCG SAR operations; and **major** cumulative impacts for NOAA's scientific research and surveys.	with the overall impact ratings of **negligible** to **major**. Alternatives B-1 and B-2 could potentially decrease impacts on radar systems by removing the WTGs closest to the shore, which would possibly reduce line-of-sight impacts; however, localized, long-term, **minor** impacts on radar systems are still anticipated. Impacts of Alternative C-1 would be similar to those of the Proposed Action for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, and scientific research and surveys, with the overall impact ratings of **negligible** to **major**. Alternative C-1 could potentially increase adverse impacts on radar systems by adding an additional 8 WTGs to the northern portion of the Lease Area closest to the shore, which would possibly increase line-of-sight impacts; however, localized, long-term, **minor** impacts on radar systems are still anticipated. Impacts of Alternative C-2 would be similar to those of the Proposed Action for marine mineral extraction, aviation and air traffic, cables and pipelines, and radar, with the overall impact ratings of **negligible** to **major**. Although Alternative C-2 would reduce the array spacing to no less than 0.99 nm between rows, the overall magnitude of impacts on scientific research and surveys would remain similar to those described for the Proposed Action and would result in **major** impacts, as the area would still likely be excluded from survey operations because the spacing between WTGs would be less than 1 nm. Impacts of Alternative D would be similar to those of the Proposed Action for cables and pipelines, marine mineral extraction, military and

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
			national security uses, radar, and aviation and air traffic, with the overall impact ratings of **negligible** to **major**. Alternative D could potentially reduce localized impacts on scientific research and surveys by avoiding placing structures in sand ridges and troughs; however, the structures present throughout the remainder of the Lease Area would exclude certain portions of the Project area from potential vessel and aerial sampling, resulting in **major** impacts on scientific research and surveys. Impacts of Alternative E would be similar to those of the Proposed Action for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, radar, and scientific research and surveys, with the overall impact ratings of **negligible** to **major**. While Alternative E would limit the onshore export cable route on Island Beach State Park to the northern option, there are no mapped mineral extraction areas or pipelines reasonably close to the offshore export cable route that could be affected by this alternative. The cumulative impacts associated with Alternatives B, C, D, and E when each is combined with the impacts from ongoing and planned activities (including offshore wind activities) would be the same as for the Proposed Action.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.18 Recreation and Tourism	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **negligible** impacts on recreation and tourism. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **moderate** adverse and **minor beneficial** cumulative impacts on recreation and tourism.	*Proposed Action:* The Proposed Action would result in **moderate** adverse and **minor beneficial** impacts on recreation and tourism. Impacts would result from short-term impacts during construction: noise, anchored vessels, and hindrances to navigation from the installation of the export cable and WTGs; and the long-term presence of cable hardcover and structures in the Wind Farm Area during operations, with resulting impacts on recreational vessel navigation and visual quality. Beneficial impacts would result from the reef effect and sightseeing attraction of offshore wind energy structures. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute an undetectable to noticeable increment to the **moderate** adverse, and **minor beneficial** cumulative impacts on recreation and tourism.	Impacts of Alternatives B-1, B-2, and D would be similar to those of the Proposed Action for recreation and tourism except for the impact of the presence of structures. Construction would install fewer WTGs and associated inter-array cables, which would slightly reduce the construction footprint and installation period. The impact level is anticipated to remain the same as for the Proposed Action: **moderate** adverse and **minor beneficial**. Impacts of Alternatives C-1 and C-2 would be similar to those of the Proposed Action for recreation and tourism except for the impact of the presence of structures. Under these alternatives, the change in the WTG positions is not anticipated to be noticeable to the observer or affect recreational boating to a meaningful degree. The impact level is anticipated to remain the same as for the Proposed Action: **moderate** adverse and **minor beneficial**. Under Alternative E would not result in a discernable difference in impacts on recreation and tourism compared to the Proposed Action. Alternative E would result in the same **moderate** adverse and **minor beneficial** impacts. The cumulative impacts associated with Alternatives B, C, D, and E when each is combined with the impacts from ongoing and planned activities (including offshore wind activities) would be the same as for the Proposed Action: **moderate** adverse and **minor beneficial**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.19 Sea Turtles	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **minor** impacts on sea turtles. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **minor** cumulative impacts on sea turtles. Potential impacts on sea turtles from multiple construction activities within the same calendar year could affect migration, feeding, breeding, and individual fitness. The foundations from WTG and OSS may provide foraging and sheltering opportunities; however, the significance of this reef effect is unknown and any beneficial impacts would be negligible.	*Proposed Action:* The Proposed Action would result in **negligible** to **minor** adverse impacts and could include potentially **minor beneficial** impacts. Beneficial impacts are expected to result from the presence of structures creating an artificial reef effect. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute an undetectable to noticeable increment to the **minor** cumulative impact on sea turtles. The main drivers are pile-driving noise and associated potential for auditory injury, the presence of structures, ongoing climate change, and ongoing vessel traffic posing a risk of collision.	Alternatives B-1, B-2, C-1, and D would include exclusion of proposed WTGs and lead to the same types of impacts on sea turtles as described for the Proposed Action. The impacts resulting from the alternatives individually would be similar to those of the Proposed Action and would range from **negligible** to **minor** adverse and could include potentially **minor beneficial** impacts. Alternative C-2 would compress the layout and have the same types of impacts on sea turtles. Although this alternative would result in a decreased construction and operational footprint, the impacts resulting from the alternative would be similar to those of the Proposed Action and range from **negligible** to **minor** and could potentially include **minor beneficial** impacts. Alternative E would result in reduced acreage of SAV affected by cable emplacement; the impacts resulting from the alternative alone would be similar to those of the Proposed Action and range from **negligible** to **minor** and could include potentially **minor beneficial** impacts. The cumulative impacts associated with Alternatives B, C, D, and E when each is combined with the impacts from ongoing and planned activities (including offshore wind activities) would be the same as for the Proposed Action: **minor**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.20 Scenic and Visual Resources	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **minor** to **moderate** impacts on scenic and visual resources. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all other planned activities would result in **major** cumulative impacts on visual and scenic resources due to addition of new structures, nighttime lighting, onshore construction, and increased vessel traffic.	*Proposed Action:* Impacts of the Proposed Action on scenic and visual resources would range from **negligible** to **major.** The main drivers for this impact rating are the major adverse impacts associated with the presence of structures, lighting, and vessel traffic. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute an appreciable increment to the **major** adverse cumulative impact on scenic and visual resources.	Alternatives B-1 and B-2 would reduce the number of WTGs visible from the seascape and landscape compared to the Proposed Action, which may result in diminished impacts on scenic and visual resources but would not change the overall impact level of **negligible** to **major** impacts. The impacts of Alternatives C-1, C-2, D, and E on scenic and visual resources would be similar to the impacts of the Proposed Action: **negligible** to **major**. The cumulative impacts associated with Alternatives B, C, D, and E when each is combined with the impacts from ongoing and planned activities (including other offshore wind activities) would be the same as for the Proposed Action: **major**.
3.21 Water Quality	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **moderate** impacts on water quality. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **moderate** impacts, primarily driven by the unlikely event of a large-volume, catastrophic release.	*Proposed Action:* The Proposed Action would result in **moderate** impacts on water quality primarily due to sediment resuspension and accidental releases. The impacts are likely to be temporary or small in proportion to the geographic analysis area and the resource would recover completely after decommissioning. *Cumulative Impacts of the Proposed Action:* The Proposed Action would result in **moderate** cumulative impacts.	Alternatives B-1, B-2, and D may result in slightly less, but not materially different, moderate impacts on water quality due to a reduced number of WTGs that would need to be constructed and maintained. Alternatives C-1 and C-2 would have the same WTG number as the Proposed Action and, therefore, would have similar moderate impacts on water quality. Alternative E would result in similar, but not materially different, moderate impacts on water quality in relation to sediment disturbance and turbidity and onshore ground disturbance. Therefore, the **moderate** impacts would be the same as those of the Proposed Action. The cumulative impacts of Alternatives B, C, D, and E when each combined with impacts from ongoing and planned activities (including offshore wind activities) would be the same as those of the Proposed Action: **moderate**.

Resource	No Action Alternative	Alternative A Proposed Action	Differences Among Action Alternatives
3.22 Wetlands	*No Action Alternative:* Continuation of existing environmental trends and ongoing activities under the No Action Alternative would result in **moderate** impacts on wetlands. *Cumulative Impacts of the No Action Alternative:* The No Action Alternative combined with all planned activities would result in **moderate** cumulative impacts, primarily through land disturbance.	*Proposed Action:* The Proposed Action may affect wetlands through short-term or permanent disturbance from activities within or adjacent to these resources. Considering the avoidance, minimization, and mitigation measures required under federal and state statutes (e.g., CWA Section 404), construction of the Proposed Action would likely have **moderate** impacts on wetlands. *Cumulative Impacts of the Proposed Action:* The Proposed Action would contribute a noticeable increment to the **moderate** cumulative impact on wetlands.	Because Alternatives B, C, and D involve modifications only to offshore components, and offshore components would not contribute to impacts on wetlands, impacts on wetlands from those alternatives would be the same as those under the Proposed Action: **moderate**. Alternative E would have the same **moderate** impacts on wetlands as the Proposed Action. Impacts on wetlands would not be materially different because land disturbance would remain small, and implementation of mitigation measures and regulatory compliance would minimize impacts related to onshore ground disturbance. The cumulative impacts from Alternatives B, C, D, and E when each combined with impacts from ongoing and planned activities (including offshore wind activities) would be the same as those of the Proposed Action: **moderate**.

GHG = greenhouse gas; HAP = hazardous air pollutant; IPF = impact-producing factor; NARW = North Atlantic right whale; SAR = search and rescue; VOC = volatile organic compound

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3. Affected Environment and Environmental Consequences

This chapter analyzes the impacts of the Proposed Action and alternatives by establishing the baseline (or existing condition) of affected resources, predicting the direct and indirect impacts,[1] and then evaluating those impacts when added to the existing baseline and considered in the context of the reasonably foreseeable impacts of future planned activities. This chapter thus addresses the affected environment, also known as the existing baseline, for each resource area and the potential environmental consequences to those resources from implementation of the alternatives described in Chapter 2, *Alternatives*. In addition, this section addresses the impact of the alternatives when combined with other past, present, or reasonably foreseeable planned activities, i.e., cumulative impacts, using the methodology and assumptions outlined in Chapter 1, *Introduction*, and Appendix F, *Planned Activities Scenario*. The geographic analysis area for each resource is described and depicted in the beginning of each resource section, and Appendix F describes other ongoing and planned activities within the geographic analysis areas. These actions may be occurring on the same time scale as the proposed Project or could occur later in time but are still reasonably foreseeable.

In accordance with Section 1502.21 of the CEQ regulations implementing NEPA, BOEM identified information that was incomplete or unavailable for the evaluation of reasonably foreseeable impacts analyzed in this chapter. The identification and assessment of incomplete or unavailable information is presented in Appendix D, *Analysis of Incomplete or Unavailable Information*.

The No Action Alternative is first analyzed to predict the impacts of the baseline (as described in Section 1.6.1), the status quo. A subsequent analysis is conducted to assess the cumulative impacts on baseline conditions as future planned activities occur (as described in Section 1.6.2). Separate impact conclusions are drawn based on these separate analyses. This Final EIS also conducts separate analyses to evaluate the impacts of the action alternatives when added to the baseline condition of resources (as described in Section 1.6.1) and to evaluate cumulative impacts by analyzing the incremental impacts of the action alternatives when added to both the baseline (as described in Section 1.6.1) and the impacts of future planned activities (as described in Section 1.6.2).

BOEM has identified Alternative A (Proposed Action) in combination with Alternative E as the Preferred Alternative. Alternative E narrows the export cable route options in the PDE and cannot be implemented independently. Analysis of the impacts of the Preferred Alternative is the analysis as it is presented under Alternative A (Proposed Action) and Alternative E.

3.1. Impact-Producing Factors

BOEM has completed a study of impact-producing factors (IPF) on the North Atlantic OCS to consider in an offshore wind development planned activities scenario (BOEM 2019). That study is incorporated in this document by reference. The IPF study:

[1] Direct and indirect effects are defined in CEQ's NEPA implementing regulations (40 CFR 1508.1(g)). *Effects* or *impacts* means changes to the human environment from the proposed action or alternatives that are reasonably foreseeable and include the following: (1) direct effects, which are caused by the action and occur at the same time and place; and (2) indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems.

- Identifies cause-and-effect relationships between renewable energy projects and resources potentially affected by such projects.
- Classifies those relationships into IPFs through which renewable energy projects could affect resources.
- Identifies the types of actions and activities to be considered in a cumulative impacts scenario.
- Identifies actions and activities that may affect the same physical, biological, economic, or cultural resources as renewable energy projects and states that such actions and activities may have the same IPFs as offshore wind projects.

The BOEM (2019) study identifies the relationships between IPFs associated with specific past, present, and reasonably foreseeable future actions in the North Atlantic OCS. BOEM determined the relevance of each IPF to each resource analyzed in this Final EIS. If an IPF was not associated with the proposed Project, it was not included in the analysis. Table 3.1-1 provides a brief description of the primary IPFs involved in this analysis, including examples of sources and activities that result in each IPF. The IPFs cover all phases of the Project, including construction, O&M, and conceptual decommissioning. Each IPF is assessed in relation to ongoing activities, planned activities, and the Proposed Action. Planned activities include planned non-offshore wind activities and future offshore wind activities.

In addition to adverse effects, beneficial effects may accrue from the development of the proposed Project and renewable energy sources on the OCS in general. The study *Evaluating Benefits of Offshore Wind Energy Projects in NEPA* (BOEM 2017) examines this in depth. Benefits from the development of offshore wind energy projects, in particular offshore wind projects, can accrue in three primary areas: electricity system benefits, environmental benefits, and socioeconomic benefits, which are further examined throughout this chapter.

Table 3.1-1 Primary Impact-Producing Factors Addressed in this Analysis

IPF	Sources and Activities	Description
Accidental releases	• Mobile sources (e.g., vessels) • Installation, operation, and maintenance of onshore or offshore stationary sources (e.g., renewable energy structures, transmission lines, cables)	Refers to unanticipated release or spills into receiving waters of a fluid or other substance such as fuel, hazardous materials, suspended sediment, trash, or debris. Accidental releases are distinct from routine discharges, the latter typically consisting of authorized operational effluents controlled through treatment and monitoring systems and permit limitations.
Discharges/intakes	• Vessels • Structures • Onshore point and non-point sources • Dredged material ocean disposal • Installation, operation, and maintenance of submarine transmission lines, cables, and infrastructure	Generally, refers to routine permitted operational effluent discharges to receiving waters. There can be numerous types of vessel and structure discharges, such as bilge water, ballast water, deck drainage, gray water, fire suppression system test water, chain locker water, exhaust gas scrubber effluent, condensate, and seawater cooling system effluent, among others. These discharges are generally restricted to uncontaminated or properly treated effluents that may have best management practice or numeric pollutant concentration limitations imposed through USEPA National Pollutant Discharge Elimination System permits or USCG regulations.
Air emissions	• Internal combustion engines (such as generators) aboard stationary sources or structures • Internal combustion engines within mobile sources such as vessels or vehicles	Refers to the release of gaseous or particulate pollutants into the atmosphere. Releases can occur on- and offshore.
Anchoring	• Anchoring of vessels • Attachment of a structure to the sea bottom by use of an anchor, mooring, or gravity-based weighted structure (i.e., bottom-founded structure)	Anchors, anchor chain sweep, mooring, and the installation of bottom-founded structures can alter the seafloor.

IPF	Sources and Activities	Description
Electric and magnetic fields	• Substations • Power transmission cables • Inter-array cables • Electricity generation	Power generation facilities and cables produce electric fields (proportional to the voltage) and magnetic fields (proportional to flow of electric current) around the power cables and generators. Three major factors determine levels of the magnetic and induced electric fields from offshore wind energy projects: (1) the amount of electrical current being generated or carried by the cable, (2) the design of the generator or cable, and (3) the distance of organisms from the generator or cable.
Land disturbance	• Onshore construction • Onshore land use changes • Erosion and sedimentation • Vegetation clearance	Refers to land disturbances for any onshore construction activities.
Lighting	• Vessels or offshore structures above or under water • Onshore infrastructure	Refers to the presence of light above the water onshore and offshore as well as underwater associated with offshore wind development and activities that utilize offshore vessels.
Cable emplacement and maintenance	• Dredging or trenching • Cable placement • Seabed profile alterations • Sediment deposition and burial • Mattress and rock placement	Refers to disturbances associated with installing new offshore submarine cables on the seafloor, commonly associated with offshore wind energy.
Noise	• Aircraft • Vessels • Turbines • Geophysical (HRG surveys) and geotechnical surveys (drilling) • Construction equipment • Operations and maintenance • Vibratory and impact pile driving • Dredging and trenching • UXO detonations	Refers to noise from various sources. Commonly associated with construction activities, geophysical and geotechnical surveys, and vessel traffic. May be impulsive (e.g., pile driving) or broad spectrum and continuous (e.g., from Project-associated marine transportation vessels). May also be noise generated from turbines themselves or interactions of the turbines with wind and waves.
Port utilization	• Expansion and construction • Maintenance • Use • Revitalization	Refers to effects associated with port activity, upgrades, or maintenance that occur only as a result of the Project. Includes activities related to port expansion and construction from increased economic activity and maintenance dredging or dredging to deepen channels for larger vessels.

IPF	Sources and Activities	Description
Presence of structures	• Onshore and offshores structures including towers and transmission cable infrastructure	Refers to effects associated with onshore or offshore structures other than construction-related effects, including the following: • Space-use conflicts • Fish aggregation/dispersion • Bird attraction/displacement • Marine mammal attraction/displacement • Sea turtle attraction/displacement • Scour protection • Allisions • Entanglement • Gear loss/damage • Fishing effort displacement • Habitat alteration (creation and destruction) • Migration disturbances • Navigation hazard • Seabed alterations • Turbine strikes (birds, bats) • Viewshed (physical, light) • Microclimate and circulation effects • Loss and displacement of survey sampling area
Traffic	• Aircraft • Vessels • Vehicles	Refers to marine and onshore vessel and vehicle congestion, including vessel strikes of sea turtles and marine mammals, collisions, and allisions. Vessels include those used for construction, O&M, and monitoring surveys.
Gear utilization	• Monitoring surveys	Refers to entanglement and bycatch from gear utilization during fisheries and benthic monitoring surveys.
Energy generation/ security	• Wind energy production	Refers to the generation of electricity and its provision of reliable energy sources as compared with other energy sources (energy security). Associated with renewable energy development operations.
Climate change	• Emissions of greenhouse gases	Refers to the effects of climate change, such as warming and sea level rise, and increased storm severity or frequency. Ocean acidification refers to the effects associated with the decreasing pH of seawater from rising levels of atmospheric carbon dioxide.

Source: BOEM 2019.

3.2. Mitigation Identified for Analysis in the Environmental Impact Statement

During the development of the EIS and in coordination with cooperating agencies, BOEM considered potential additional mitigation measures that could further avoid, minimize, or mitigate impacts on the physical, biological, socioeconomic, and cultural resources assessed in this document. Mitigation measures required through completed consultations with respect to environmental statutes such as Section 7 of the ESA are listed in Table H-2 in Appendix H, *Mitigation and Monitoring*, and incorporated in the preferred alternative.[2] Other measures identified during development of this EIS are listed in Table H-3 in Appendix H. BOEM has identified several of these additional measures as incorporated in the Preferred Alternative. Table H-4 identifies measures that may be required by authorizations and permits issued to the lessee. The measures identified in Tables H-2 and H-3 are analyzed in the relevant resource sections in Chapter 3. The additional mitigation measures presented in Tables H-3 and H-4 may not all be within BOEM's statutory and regulatory authority to require; however, other jurisdictional governmental agencies may potentially require them. Mitigation measures for completed consultations, authorizations, and permits are analyzed in each respective resource section in Chapter 3 of the Final EIS. BOEM may choose to incorporate additional measures identified in Table H-3 in the ROD and adopt those measures as conditions of COP approval. As previously discussed, all Ocean Wind-committed measures are part of the Proposed Action (see Section 2.1 for details).

3.3. Definition of Impact Levels

This Final EIS uses a four-level classification scheme to characterize potential beneficial and adverse impacts of alternatives, including the Proposed Action. Resource-specific adverse and beneficial impact level definitions are presented in each resource section.

When considering duration of impacts this Final EIS uses the following terms:

- Short-term effects are effects that may extend up to 3 years. Construction and conceptual decommissioning activities are anticipated to occur for a duration of 2 to 3 years. An example would be clearing of onshore shrubland vegetation during construction; the area would be revegetated when construction is complete and, after revegetation is successful, this effect would end. Short-term effects may be further defined as being temporary if the effects end as soon as the activity ceases. An example would be road closures or traffic delays during onshore cable installation. Once construction is complete, the effect would end.
- Long-term effects are effects that may extend for more than 3 years, and may extend for the life of the Project (35 years[3]). An example would be the loss of habitat where a foundation has been installed.

[2] While this EIS analyzes all of the mitigation measures expected to be required through consultations and MMPA authorization, BOEM anticipates that some necessary authorizations for the proposed Project may issue after BOEM reaches a decision on the COP, in which case BOEM can include conditions of approval to ensure that its approval remains consistent with the terms of those future approvals.

[3] As noted in Section 2.1.2.3, BOEM assumes in this Final EIS that the proposed Project would have an operating period of 35 years. Ocean Wind's lease with BOEM (Lease OCS-A 0498) has an operational term of 25 years that commences on the date of COP approval. (See https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NJ/NJ-SIGNED-LEASE-OCS-A-0498.pdf; see also 30 CFR 585.235(a)(3).) Ocean Wind would need to request and be granted an extension of its operational term from BOEM under the regulations at 30 CFR 585.425 et seq. in order to operate the proposed Project for 35 years. While Ocean Wind has not made such a request, this EIS uses the longer period in order to avoid possibly underestimating any potential effect.

- Permanent effects are effects that extend beyond the life of the Project. An example would be the conversion of land to support new onshore facilities or the placement of scour protection that is not removed as part of decommissioning.

The following terms are used to describe the incremental impact of the action alternative in relation to the cumulative impacts from all ongoing and planned activities, including both non-offshore wind and offshore wind activities.

- Undetectable: The incremental impact contributed by the action alternative to impacts from all ongoing and planned activities is so small that it is impossible or extremely difficult to discern.
- Noticeable: The incremental impact contributed by the action alternative, while evident and observable, is still relatively small in proportion to the impacts from all ongoing and planned activities.
- Appreciable: The incremental impact contributed by the action alternative constitutes a large portion of the impacts from all ongoing and planned activities.

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3.4. Air Quality (see Appendix G)

The reader is referred to Appendix G for a discussion of current conditions and potential impacts on air quality from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.5. Bats (see Appendix G)

The reader is referred to Appendix G for a discussion of current conditions and potential impacts on bats from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.6. Benthic Resources

This section discusses potential impacts on benthic resources, other than fishes and commercially important benthic invertebrates, from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The benthic geographic analysis area, as shown on Figure 3.6-1, includes both a 10-mile (16.1-kilometer) radius/buffer around the Wind Farm Area and a 330-foot buffer around the export cable route corridors. The geographic analysis area is based upon where the most widespread impact (namely, suspended sediment) from the proposed Project could affect benthic resources. This area would account for some transport of water masses and for benthic invertebrate larval transport due to ocean currents. Although sediment transport beyond 10 miles (16.1 kilometers) is possible, sediment transport related to proposed Project activities would likely be on a smaller spatial scale than 10 miles (16.1 kilometers). Finfish, invertebrates of commercial or recreational value, and EFH are addressed in Section 3.13.

3.6.1 Description of the Affected Environment for Benthic Resources

The description of benthic resources in this section is supported by studies conducted by Ocean Wind as well as other studies reviewed in the literature. Geophysical data were collected by multibeam echosounder and sidescan sonar (Inspire 2021). Site-specific benthic data from 2017 through 2020 were collected to verify the multibeam echosounder and sidescan sonar results. Baseline SAV mapping surveys to delineate the extent and percentage cover of SAV beds in the vicinity of the Project were conducted between 2019 and 2022 using aerial imagery and underwater drop-camera imagery. Six months prior to the commencement of cable-installation activities, and within the SAV growing season (late-April to October), an additional pre-construction SAV characterization survey will be conducted to refine and update the results from the baseline SAV mapping surveys (COP Volume II, Appendix E; Ocean Wind 2023). Survey methodologies included bottom grabs for grain-size analysis and habitat characterization, as well as drop-camera footage for habitat imagery. Geophysical data provide delineations of different types of surface sediments within the Project area. A SAV survey was completed for Barnegat Bay in two phases: aerial photography in 2019 and transect-based seagrass observations along the proposed cable route in 2020 (COP Volume II, Appendix E; Ocean Wind 2023). This study characterized the distribution, density, and species of SAV present within the proposed Oyster Creek export cable route where it crosses Barnegat Bay, a back-bay estuary. Phase 2 SAV survey was conducted in October 2020 to identify the presence, extent, density, and species composition of SAV beds within the southern export cable route at Island Beach State Park and the export cable routes making landfall at the Holtec property, Bay Parkway, and Lighthouse Drive. Supplemental field survey of the northern export cable route at Island Beach State Park was performed in October 2021.

Additional field surveys to characterize SAV were performed in June and July 2022 (Inspire 2022a) at the potential second Bay Parkway, Nautilus Drive, Lighthouse Drive, and marina landfalls on the west side of Barnegat Bay as well the prior channel area on the east side of Barnegat Bay to provide additional baseline SAV data to inform Project design and avoidance.

A larger-scale, non-project-specific study was also undertaken that characterized offshore wind lease areas in northeast WEAs (Guida et al. 2017). This study compiled data from numerous sources, including from NOAA-National Centers for Environmental Information for bathymetric data, Northeast Fisheries Science Center (NEFSC) for physical and biological oceanography, NEFSC fisheries independent trawl survey for demersal fish and shellfish, and U.S. Geological Survey’s usSEABED data for surficial sediment data.

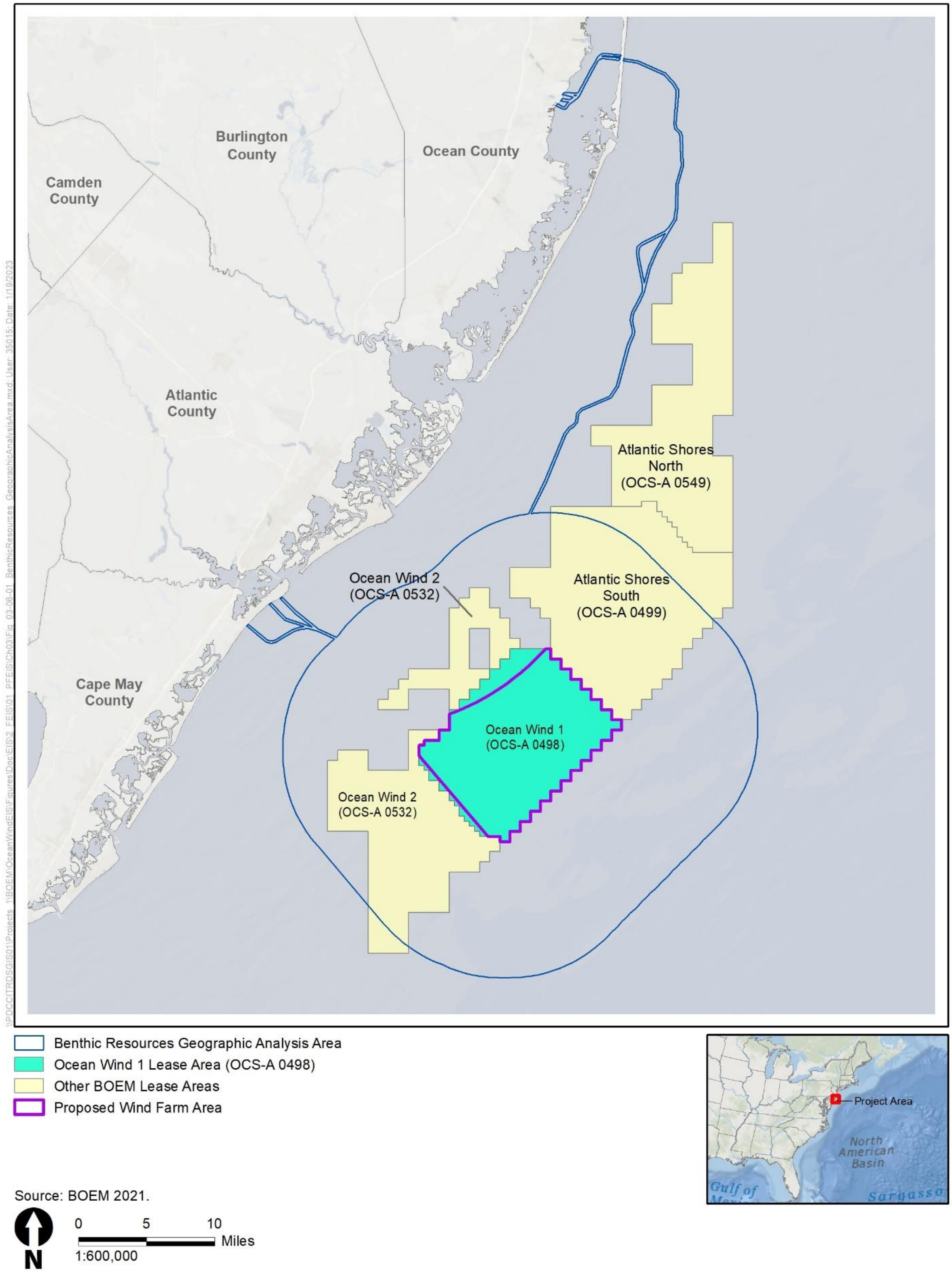

Figure 3.6-1 Benthic Resources Geographic Analysis Area

Offshore Project Area

The Wind Farm Area is on the Southern Mid-Atlantic Bight shelf, with the export cable routes extending from the Wind Farm Area to coastal and back-bay areas. The Wind Farm Area has low-degree seaward slopes and depth contours generally paralleling the shoreline. Predominant bottom features include a series of ridges and troughs that are closely oriented in a northeast-southwest direction, although side slopes are typically less than 1 degree, although vertical relief may be as much as 49 feet (15 meters). As such, cable installations would follow the contours of the ridges and troughs (Guida et al. 2017). Previous studies of the Mid-Atlantic Bight have described trough sediments as characterized by finer sediments and higher organic matter, while ridges are characterized by relatively coarser sediments. Differences in benthic invertebrate assemblages, likely driven by differences in sediment characteristics, have been observed that include increased diversity and biomass within troughs (Rutecki at al. 2014). This may subsequently influence distribution of fish and shellfish, as found by Vasslides and Able (2008) and Slacum et al. (2010). Ridge and trough habitat features are common in the mid-Atlantic OCS and not unique to the Project area (Pickens et al. 2020).

The Wind Farm Area is a relatively flat expanse of predominantly soft sediments. The Mid-Atlantic Ocean Data Portal and the Nature Conservancy (Greene et al. 2010) have characterized, through a small study, sediments of the Offshore Project area as ranging from fine (0.005 to 0.010 inch [0.125 to 0.25 millimeter]) to coarse (0.02 to 0.039 inch [0.5 to 1 millimeter]) sands at depths of 82 to 148 feet (25 to 45 meters).

Sand ridge and trough features provide macroscale habitats for finfish and macro-invertebrates on the inner continental shelf of the U.S. Mid-Atlantic region and the Gulf of Mexico. These habitat complexes are described as transition zones that may enhance biological productivity and concentrate organisms at several trophic levels and are a link between the invertebrate community and the demersal fish assemblage (Byrnes et al. 2000). Regionally, previous studies of the Mid-Atlantic Bight have found that ridge crests may be 5 meters or more higher than troughs (Byrnes et al. 2000), resulting in higher wave-generated currents and a graded substrate where much of the silt and clay have been removed, leaving a coarser substrate on the crests (when compared with the troughs). A 2022 survey (Inspire 2022a) of the ridge and trough habitats in the northeastern portion of the Lease Area also indicated physical and biological differences between the crests (ridges) and troughs of these habitats; however, compared to the regional study, ridge crests were more homogeneous than troughs, and the sediments on the crests were primarily fine to medium sands compared with troughs that exhibited greater variation in sediments, ranging from very fine sand to sandy gravel. Sands with shells (shelly sand) were also found along the troughs.

Based on sampling conducted on behalf of Ocean Wind (Inspire 2021), the Wind Farm Area is dominated by sand and muddy sand interspersed with small to large patches of coarse sediment and interspersed with small to large patches of coarse substrate such as pebbles or cobbles. Smaller areas of low-density boulders were also documented. The Inspire (2021) study describes the Oyster Creek and BL England export cable routes similarly, with increasing mud and sandy mud habitats near the Atlantic shore. Similar to the results of the 2021 survey, the vast majority of the impacts on habitats based on the 2022 survey would be to soft-bottom habitat, with a small portion of impacts on complex (inclusive of coarse) habitats. Except for SAV habitat, the composition of benthic habitats in potential permanent and temporary impact footprints was similar to the composition in the Project area, indicating little difference among alternatives with respect to overall composition of benthic habitats affected by the Project.

Benthic resources include the seafloor, substrate, and communities of bottom-dwelling organisms that live within these habitats. Benthic habitats include soft-bottom (i.e., unconsolidated sediments) and hard-bottom (e.g., cobble and boulder) habitats, as well as consolidated sediment (i.e., pavement), which can occur in scour zones, and biogenic habitats (e.g., eelgrass and worm tubes) created by structure-forming species. Typical epibenthic invertebrates in the region include sand shrimp and sand dollars while dominant infauna include polychaetes (primarily Spionidae), sand dollars, nemertean worms, and ascidians (sea squirts) (Guida et al. 2017). Amphipods are present but did not appear in samples as frequently as in WEAs to the north (New York, Rhode Island, Massachusetts).

Benthic assemblages within the Project area include small surface-burrowing fauna, small tube-building fauna, clam beds, and sand dollar beds. These communities perform important functions, such as water filtration and nutrient cycling, and are also a valuable food source for many species. Spatial and temporal variation in benthic prey organisms can affect growth, survival, and population levels of fish and other organisms. The region experiences seasonal variations in water temperature and phytoplankton concentrations, with corresponding seasonal changes in the densities of benthic organisms. The spatial and temporal variation in benthic prey organisms can affect the growth, survival, and population levels of fish and other organisms.

Coastal and Marine Ecological Classification Standard Biotic Subclasses within the Project area were generally composed of Soft Sediment Fauna with a few isolated areas of Worm Reef Biota and Attached Fauna. Greater variability was present at the Biotic Group classification level, with Biotic Groups well suited to dynamic sandy environments, such as the prevalence of Sand Dollar Beds. Within the Lease Area, Sand Dollar Beds and Larger Tube-Building Fauna were observed most frequently. Tunicate Beds and various mobile epifauna, such as gastropods and crustaceans, were also observed. Both Small and Large Tube-Building Fauna were observed along the BL England offshore export cable route corridor. Along the Oyster Creek offshore export cable route corridor, the most frequently observed Biotic Group was Small Tube-Building Fauna. Other notable Biotic Groups were Sand Dollar Beds and Sabellariid Reefs. The Sabellariid Reef Biotic Groups documented within the Offshore Project area were patchy in nature and did not form large, continuous seafloor features (Inspire 2021).

A number of benthic invertebrates in the Atlantic region support valuable commercial fisheries. Commercially important invertebrates present in the geographic analysis area include American lobster (*Homarus americanus*), sea scallop (*Placopecten magellanicus*), hard clam (*Mercenaria mercenaria*), Atlantic surfclam (*Spisula solidissima*), white shrimp (*Litopenaeus setiferus*), brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*F. duorarum*), ocean quahog (*Arctica islandica*), and blue crab (*Callinectes sapidus*). EFH has been designated for most of these species (i.e., sea scallop, Atlantic surfclam, ocean quahog, and brown, pink, and white shrimp) and the Project area includes EFH for quahog, surfclam, and sea scallop. In addition to their commercial value, the large, dominant species that support invertebrate fisheries play important ecological roles in benthic communities (see Section 3.13 for further discussion of EFH and commercially important species).

The location of existing artificial reef sites near the Project were identified from the NOAA Office of Coastal Management InPort library. Eleven artificial reefs were identified in the general vicinity of the Proposed Action; however, only four are entirely or in part within the geographic analysis area for benthic resources (Figure 3.6-2): Atlantic City reef, Great egg reef, Ocean City reef, and Deepwater reef. Collectively, these four reef areas represent approximately 6.5 square miles (16.8 km^2) of extensively modified seafloor due to the placement of structures such as ships, tanks, railroad cars, concrete debris, and reef balls.

Inshore Project Area

The estuarine portion of the Oyster Creek export cable route was primarily mud and sandy mud with SAV on the shorelines of the route and a small area of low-density boulders. A trend was identified by Taghon et al. (2017) of finer sediments near the western bank and coarser sediments toward the eastern shoreline. In addition, sand waves are present, which are small-scale microhabitats formed by prevailing currents and winds that are generally mobile slopes of sediment on the seabed (NYSERDA 2019). Sediment bedforms such as sand waves, sand bars, and ripples develop as a response of the seafloor to hydrodynamic conditions. Total organic content ranged from 0.02 to 5.7 percent (Taghon et al. 2017). Barnegat Bay is relatively shallow (average depth 3.6 feet [1.1 meters]) and poorly flushed (25 to 30 days), and, therefore, a highly eutrophic estuary (Kennish et al. 2007; Gilbert et al. 2010). Eutrophication is a result of surface water inflows, atmospheric deposition, and direct groundwater discharges and can lead to algal growth, altered invertebrate communities, and loss of SAV (Kennish et al. 2007). From 1980 to 2010, SAV declined by as much as 25 percent in Barnegat Bay (Gilbert et al. 2010). The estuarine portion of the BL England export cable route is a short (approximately 150-meter) crossing of Peck Bay at the Roosevelt Boulevard bridge. Peck Bay is generally shallow (1 to 2 feet deep) with a navigational channel along its eastern shore (NOAA chart 12316). A corridor through the northern end of Peck Bay/southern end of Great Egg Harbor Bay was included in the benthic habitat assessment (Inspire 2021). Sediment types along that corridor were sand and muddy sand or mud and sandy mud. The proposed crossing at the southern extent of Peck Bay is between two marinas and includes a dredged channel into Crook Horn Creek. SAV is an EFH habitat area of particular concern (HAPC) and a Special Aquatic Site ("vegetated shallows") under the CWA. SAV provides three-dimensional physical structure and is important nursery habitat where juvenile vertebrates and invertebrates typically experience higher density, growth, and survival (Lefcheck et al. 2019). It also provides other ecosystem services such as primary production, nutrient cycling, carbon sequestration, stabilization of sediments, and shoreline protection (Lefcheck et al. 2019). It is a highly productive inshore habitat sensitive to physical disruption and degradation of water quality.

Eelgrass declines in distribution and abundance are also attributed to stress from invasive species such as green crabs (Neckles 2015) and invasive tunicates (Wong and Vercaemer 2012; Carman et al. 2019). Indirect impacts of anthropogenic activities include global warming (e.g., seagrass wasting disease), sea-level rise, carbon dioxide (CO_2) and ultraviolet increase (Duarte 2002), degraded water quality and increased turbidity, shading, altered currents, resuspension of contaminated sediments, contamination from spills or discharges, and altered food webs and competition (Nascimento et al. 2019; Waycott et al. 2022). More-intense rain events and coastal storms have been associated with climate change and are expected to increase in the future. Impacts of climate change such as reduced salinities, stronger storms, and more turbid water are also stressors for eelgrass (Short et al. 2016). The physical stress to organisms from climate change impacts can also increase the opportunity for disease. For example, eelgrass is threatened by seagrass wasting disease (in warmer ocean temperatures) (Graham et al. 2021).

CO_2 in the atmosphere results in global warming and climate change and is primarily a result of human activities such as fossil fuel burning and deforestation (Novak et al. 2020). Because coastal habitats, including SAV, are important mechanisms in reducing CO_2 emissions, potential impacts on these habitats result in increased emissions and climate change impacts.

Seagrass loss rates have increased from 0.9 percent per year before 1940 to 7 percent per year globally since 1990 and have therefore reduced the capacity for carbon storage by seagrass beds (Mcleod et al. 2011). Dramatic declines in SAV are also documented throughout New Jersey and Barnegat Bay in particular (for example, see Kennish et al. 2007, 2011). Although declines in water quality have been associated with SAV losses in New Jersey, direct losses through development, dredging, trenching, and other bottom-disturbing activities further exacerbates the widespread impacts. Consequently, seagrass conservation and restoration plans can contribute to blue carbon strategies to mitigate climate change (Duarte et al. 2013; Novak et al. 2020; Howard et al. 2017; Mcleod et al. 2011).

Loss of seagrass habitat is reportedly due primarily to reduced water quality from sediment and nutrient runoff from anthropogenic sources, and from direct impacts such as dredging and trawling (Pendleton et al. 2012). Regardless of the cause, the loss of SAV such as eelgrass results in the loss of ecosystem services they provide, including organic carbon sequestration, and potentially leads to CO_2 emissions when sediment organic carbon deposits are eroded and exposed to aerobic conditions (Novak et al. 2020).

While coastal vegetated ecosystems compose only 0.05 percent of the plant biomass on land, they store a comparable amount of carbon per year, making them one of the most important carbon sinks and mitigators of excess of CO_2 on the planet (Duarte et al. 2005; Nellemann et al. 2009; Mcleod et al. 2011). Seagrasses, like mangroves and tidal marshes, have been identified as important sources of biological carbon sequestration, known as “blue carbon” (Novak et al. 2020; Macreadie et al. 2019; Howard et al. 2017; Duarte et al. 2013; Mcleod et al. 2011). In addition, estuarine, ocean shelf, and deep sea sediment carbon stocks may approach 30 percent of the carbon in seagrass meadow sediments (Duarte et al. 2017). Loss of SAV (e.g., seagrasses) has been shown to result in increased CO_2 emissions due to the resulting decline in biological sequestration of carbon. Seagrass meadows accumulate large carbon stocks in both biomass and sediments and, although some carbon is used by fauna or remineralized in adjacent ecosystems, carbon is also buried or exported beyond the seagrass beds (Novak et al. 2020; Duarte et al. 2013, 2017; Howard et al. 2017). Novak et al. (2020) found that the average sediment organic carbon stock in the upper 30 centimeters for eelgrass in New England (2,832 ± 416 mass of carbon per m^2) was found to be similar to worldwide estimates for eelgrass (2,721 ± 989 mass of carbon per m^2), but lower than global estimates that include all seagrass species (19,420 ± 202 mass of carbon per m^2).

Howard et al. (2017) report that anthropogenic conversion and degradation of coastal wetlands such as SAV can lead to major emissions because much of the carbon stored in the soils is released back into the atmosphere and ocean (Howard et al. 2017; Pendleton et al. 2012), shifting the systems from net sinks to sources of carbon. Pendleton et al. (2012) report carbon storage in the top meter of sediment, including biomass, is an estimated 140 tons of carbon per hectare (14,000 mass of carbon per m^2) in seagrasses, a conservative estimate given that the carbon may be stored in as much as 6 meters of sediment and biomass) and the potential CO_2 emissions due to loss of seagrasses are an estimated 512 tons per hectare. Seagrasses, though having lower per-hectare carbon stocks than mangroves and salt marshes, contribute the second most to global blue carbon emissions based on current rates of global annual loss rate (land use conversion) of seagrasses of 0.4–2.6 percent (Pendleton et al. 2012).

Direct damage to seagrass blades may recover quickly; however, damage or uprooting of rhizomes may take years to recover naturally (Orth et al. 2017). Compensatory mitigation for impacts on seagrass are difficult and may not always result in restoration of SAV to pre-impact conditions (Bologna and Sinnema 2012). Therefore, avoidance and minimization of impacts on these habitats are important.

SAV in Barnegat Bay and Great Egg Harbor Bay was initially surveyed for the Project through aerial photography in 2019, followed by quadrat sampling in Barnegat Bay along transect lines in 2020) and subsequent surveys in summer 2022 (COP Volume II, Appendix E; Ocean Wind 2023). The quadrat surveys documented the outer extents of SAV beds identified from the aerial survey and obtained representative information on SAV species and density. The two most common species of seagrass in New Jersey back barrier lagoons are eelgrass (*Zostera marina*) and widgeon grass (*Rupia maritima*). Eelgrass was the dominant type of SAV identified and widgeon grass (*Rupia maritima*) was documented in less than 0.4 percent of all quadrats surveyed. The distribution of seagrass described from the aerial survey is generally consistent with New Jersey Department of Environmental Protection (NJDEP) survey results from 1986 (NJDEP 1986).

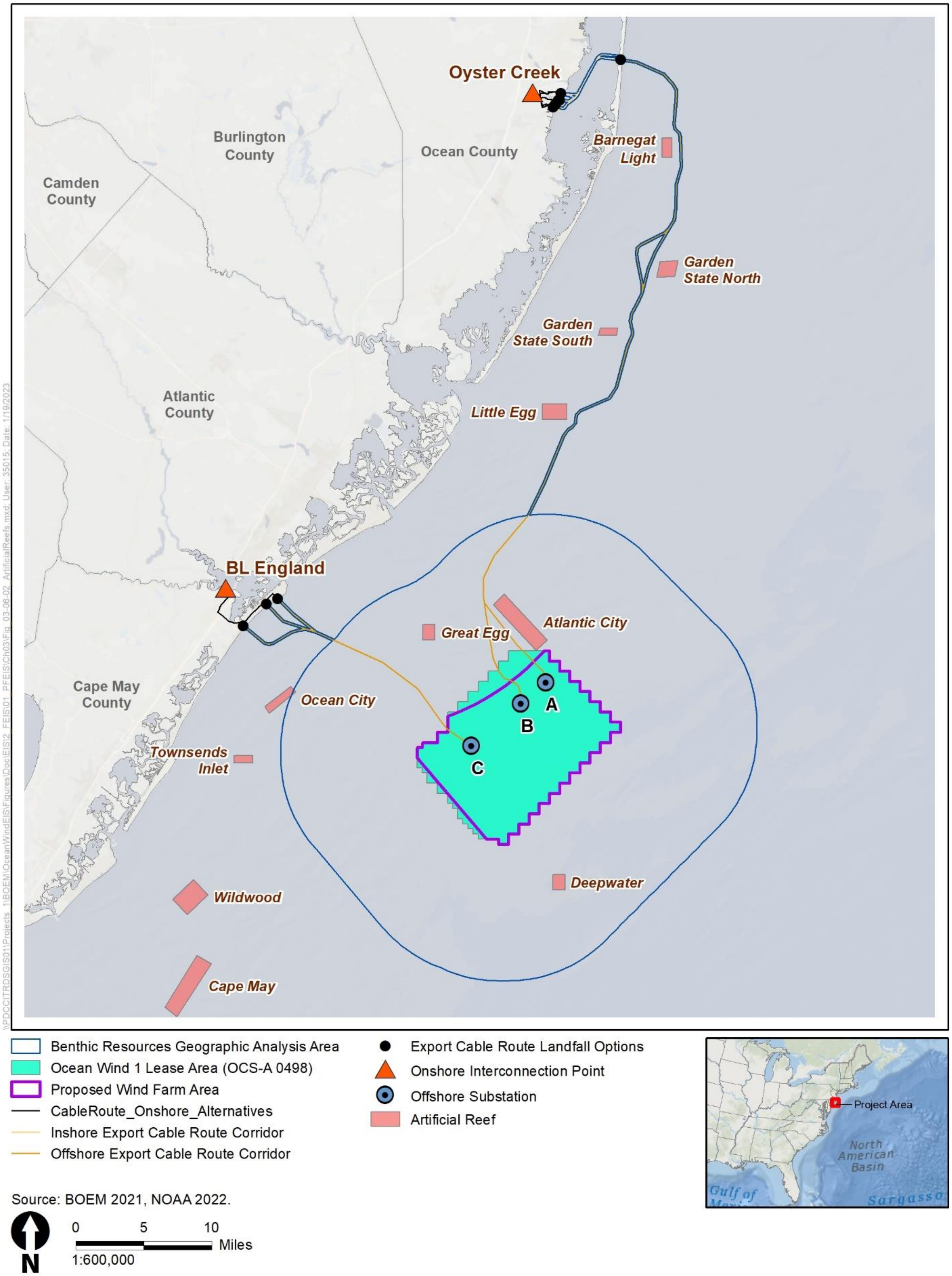

Figure 3.6-2 Artificial Reef Sites

In the fall of 2019, Ocean Wind conducted aerial SAV mapping surveys in Barnegat Bay and Great Egg Harbor. The survey was conducted to incorporate methodologies from previous studies (Lathrop and Haag 2011) and existing agency guidelines (Colarusso and Verkade 2016). The survey was conducted via aerial photography in October 2019 in Barnegat Bay and in Great Egg Harbor. The areas of SAV documented in the Phase 1 Survey were used to inform the more intensive Phase 2 Survey effort.

Sparse to moderate seagrass was identified near the proposed Peck Bay crossing during the 2019 aerial survey and was not identified at this location in historical imagery (NJDEP 1979). Survey results for Great Egg Harbor are mapped on Figure 2 of Appendix E of the COP (Ocean Wind 2023). Phase 2 surveys were not performed in Great Egg Harbor.

In July 2022, additional underwater video SAV data were collected at four areas in Barnegat Bay where SAV beds were delineated by aerial survey in 2019 (Inspire 2022a). In general, the SAV data collected in July 2022 corroborate Ocean Wind's previous SAV surveys. Within each survey area, acres of SAV from aeral imagery in 2019 are similar to the acres estimated from the 2022 underwater video transects, with the exception of the northernmost survey area on the western side of Barnegat Bay where no SAV beds were observed in the video data collected in 2022 (similar to the in-water data collected in 2020), although the aerial imagery from 2019 suggested about 9.5 acres of SAV. This discrepancy is likely due to challenges in discerning between SAV and macroalgal beds using aerial imagery and highlights the importance of verified in-water data. At the other survey areas, the SAV acreage estimated from the 2022 video transects was generally higher than what was derived from the 2019 delineations. This is likely due to the coarse spatial resolution of towed video transects, resulting in conservative polygon interpolations, compared to the aerial imagery approach. In the prior channel at Island Beach State Park, water depth limits SAV growth; however, SAV was observed with sparse coverage (single or double shoots) in the channel and with patchy or complete coverage along the shallow flanks of the channel (as also documented in the 2021 survey).

Additional discussion of previously conducted studies related to SAV presence and density is provided in the EFH Assessment (BOEM 2022a) and COP Volume III, Appendix E (Ocean Wind 2023).

SAV and other estuarine habitats such as shoals, mudflats, and inter-tidal marshes within the New Jersey coastal bays are important spawning, nursery, and feeding grounds for numerous aquatic species. Great Bay and the Mullica River estuary, which are between the Oyster Creek and BL England cable routes, for example are an HAPC (discussed further in the EFH Assessment) for sandbar shark (*Carcharhinus plumbeus*), which uses this area as nursery (pupping) grounds (Merson and Pratt 2007). Similarly, summer flounder (*Paralichthys dentatus*) HAPC includes SAV within Barnegat Bay and other designated summer flounder EFH.

Barnegat Bay also supports important invertebrate species such as hard clams (*Mercenaria mercenaria*), soft clams (*Mya arenaria*), blue mussels (*Mytilus edulis*), bay scallops (*Argopecten irradian*s), and eastern oyster (*Crassostrea virginica*) although population levels are markedly below historical levels (Ford 1997; Dacanay 2015). Hard clams within the Oyster Creek export cable route are primarily low density with a few patches of moderate and high density (NJDEP 2012). Commercially important invertebrate taxa are discussed in more detail in Section 3.13.

Barnegat Bay is an Estuary of National Importance and part of the National Estuarine Research Reserve System. It is one of 28 estuaries in the USEPA National Estuary Program, the aim of which is to restore and maintain the water quality and ecological integrity of estuaries of national significance (USEPA 2009). Under this program, a Comprehensive Conservation and Management Plan (Barnegat Bay Partnership 2021) for the estuary has been developed and is implemented by the Barnegat Bay Partnership.

Benthic invertebrate communities within Barnegat Bay are abundant and generally highly diverse and have shown few changes from 1965 to 2010 (Taghon et al. 2017). Samples collected from 2012 to 2014 were numerically dominated by Polychaeta followed by Malacostraca. BOEM Guidelines include identification of potentially sensitive seafloor habitats, such as corals, SAV beds, and ecologically valuable cobble and boulder habitat (BOEM 2019, 2020a). Of these, SAV was observed within Barnegat Bay and Peck Bay (Inspire 2021). Neither coral nor cobble and boulder habitat were observed within the Offshore Project area. Several artificial reefs are documented in the Offshore Project area. Four artificial reef areas (Barnegat Light) are mapped offshore, adjacent to the Oyster Creek offshore export cable corridor, and one is mapped offshore, adjacent to the BL England offshore export cable corridor (COP Volume II, Section 2.2.6.1.5; Ocean Wind 2023). No aquaculture leases presently occur in the vicinity of BL England. Four shellfish leases (37 acres) and one research lease occur in the vicinity of Oyster Creek with the primary shellfish growout of oysters and hard clams (COP Volume II, Section 2.3.4.1.3; Ocean Wind 2023). The offshore export cable to the southernmost landfall option for Oyster Creek traverses an aquaculture lease area on the west side of Barnegat Bay (COP Volume II, Figure 2.2.5-2; Ocean Wind 2023). A single obstruction/wreck was identified in the Wind Farm Area (COP Volume II, Appendix E; Ocean Wind 2023).

3.6.2 Environmental Consequences

3.6.2.1. Impact Level Definitions for Benthic Resources

Definitions of impact levels are provided in Table 3.6-1.

Table 3.6-1 Impact Level Definitions for Benthic Resources

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on species or habitat would be adverse but so small as to be unmeasurable.
	Beneficial	Impacts on species or habitat would be beneficial but so small as to be unmeasurable.
Minor	Adverse	Most adverse impacts on species would be avoided. Adverse impacts on sensitive habitats would be avoided; adverse impacts that do occur would be temporary or short term in nature.
	Beneficial	If beneficial impacts occur, they may result in a benefit to some individuals and would be temporary to short term in nature.
Moderate	Adverse	Adverse impacts on species would be unavoidable but would not result in population-level effects. Adverse impacts on habitat may be short term, long term, or permanent and may include impacts on sensitive habitats but would not result in population-level effects on species that rely on them.
	Beneficial	Beneficial impacts on species would not result in population-level effects. Beneficial impacts on habitat may be short term, long term, or permanent but would not result in population-level benefits to species that rely on them.
Major	Adverse	Adverse impacts would affect the viability of the population and would not be fully recoverable. Adverse impacts on habitats would result in population-level impacts on species that rely on them.
	Beneficial	Beneficial impacts would promote the viability of the affected population or increase population resiliency. Beneficial impacts on habitats would result in population-level benefits to species that rely on them.

3.6.3 Impacts of the No Action Alternative on Benthic Resources

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on benthic resources, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for benthic resources. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.6.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for benthic resources described in Section 3.6.1, *Description of the Affected Environment for Benthic Resources*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on benthic resources are generally associated with inshore dredging, coastal development, offshore construction including bottom disturbance and habitat conversion, and climate change. Impacts associated with climate change have the potential to alter species distributions and increase individual mortality and disease occurrence. There are no ongoing offshore wind activities within the geographic analysis area for benthic resources.

Accidental releases: Although USCG prohibits the dumping of environmentally damaging trash or debris (International Convention for the Prevention of Pollution from Ships, Annex V, Public Law 100−220 (101 Stat. 1458)), accidental releases would continue to occur as a result of ongoing activities. Impacts of accidental releases are relative to their magnitude. Smaller releases are expected to occur at a higher frequency and to be less severe, while major releases are expected to be rare but have more impacts. The impacts of accidental releases on benthic resources are likely to be negligible because large-scale releases are unlikely and impacts from small-scale releases would be localized and short term, resulting in little change to benthic resources.

Anchoring: Ongoing activities include vessels anchoring within the inshore and offshore geographic analysis area. Anchoring would cause increased turbidity levels and would have the potential for physical contact to cause mortality of benthic resources. Anchor drag would increase impacts, potentially resulting in scarring or additional damage to benthic habitats. Inshore activities additionally have the potential to affect SAV, which may take longer to recover. Impacts would therefore be moderate.

Electromagnetic fields (EMF): EMF would result from existing transmission or communication cables. There are four in-service cables along the offshore export cable corridor, although none have been identified near the Wind Farm Area. Specific impacts associated with EMF are described in detail in Section 3.6.3.2. Due to the small footprint of existing undersea transmission lines within the benthic geographic analysis area and the fact that EMF decreases rapidly with distance from the cable, impacts from EMF would be minor.

Cable emplacement and maintenance: Impacts from cables or undersea transmission lines may result from maintenance of existing cables, if needed. Cable maintenance activities infrequently disturb benthic resources and cause temporary increases in suspended sediment; these disturbances would be local and limited to the emplacement corridor. Sediment deposition could have adverse impacts on some benthic resources, especially eggs and larvae, including smothering and loss of fitness. Impacts may vary based on season. Benthic resources in the geographic analysis area are generally adapted to the turbidity and periodic sediment deposition that occur naturally in the geographic analysis area. Due to the limited footprint of existing cables and short duration of this type of activity, this would be a minor impact.

Noise: Underwater sound is a pervasive issue throughout the world's oceans. Vessel traffic, seismic surveys, and active naval sonars are the main anthropogenic contributors to low- and mid-frequency noises in oceanic waters (Henderson et al. 2008), with vessel traffic the dominant contributor to ambient sound levels in frequencies below 200 Hertz (Hz) (Arveson and Vendittis 2000; Veirs et al. 2016). Noise from construction occurs frequently nearshore of populated areas in the mid-Atlantic but infrequently offshore. The intensity and extent of noise from construction is difficult to generalize, but impacts are local and temporary. Ongoing site characterization surveys and scientific surveys produce noise around sites of investigation. These activities can disturb benthic resources in the immediate vicinity of the investigation. The extent depends on equipment used, noise levels, and local acoustic conditions. Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water or through the seabed can cause injury to or mortality of benthic resources in a small area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area. The extent depends on pile size, hammer energy, and local acoustic conditions. Infrequent trenching activities for pipeline and cable laying, as well as other cable burial methods, emit noise. These disturbances are localized and temporary and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension. Detectable impacts of noise on benthic resources would rarely, if ever, overlap from multiple sources.

These noise sources are intermittent and spatially limited and are not expected to have measurable impacts on benthic resources; therefore, impacts are expected to be negligible.

Port utilization: Ongoing sediment dredging for navigational purposes would occur in shallow and nearshore areas, resulting in localized, short-term impacts (habitat alteration, injury and mortality) on benthic resources through seabed profile alterations, as well as through the sediment deposition. Dredging typically occurs only in sandy or silty habitats, which are abundant in the geographic analysis area and are quick to recover from disturbance. Sediment deposition could have adverse impacts on some benthic resources, especially eggs and larvae, including smothering and loss of fitness. Impacts may vary based on season. Where dredged materials are disposed of, benthic resources are smothered. However, such areas are typically recolonized naturally in the short term. Most sediment-dredging projects have time-of-year restrictions to minimize impacts on benthic resources. Benthic resources in the geographic analysis area are generally adapted to the turbidity and periodic sediment deposition that occur naturally in the geographic analysis area. Individual projects would have benthic impacts associated with dredging, which may be moderate but localized.

Presence of structures: Pre-existing or small-scale structures include docks, artificial reefs, and potentially scour protection for existing submarine cables. These structures may entangle fishing gear, leading to benthic disturbance and also provide novel surfaces for colonization and recruitment of marine fauna that. This may have moderate adverse impacts for existing benthic resources as faunal assemblages shift, altering local food web dynamics, increasing the opportunity for invasive and nonnative species and potentially a resulting in regional changes due to shifts from soft-sediment to hard-substrate communities (described below). Structures may result in moderate benefits to colonizers. Benefits of structures occur due to the attraction of mobile organisms like decapods, demersal and pelagic fish, and apex predators, resulting in effects similar to those of artificial reefs or fish aggregating devices (Dannheim et al. 2019; Langhamer 2016). However, while underwater cables and armoring structures on the seafloor can act as artificial reefs, there is very little evidence of colonization by nonnative species (Taormina et al. 2018).

Discharges: The gradually increasing amount of vessel traffic is increasing the total permitted discharges from vessels. Many discharges are required to comply with permitting standards established to ensure potential impacts on the environment are minimized or mitigated. Impacts would therefore be negligible.

Regulated fishing effort: Ongoing commercial and recreational regulations for finfish and shellfish implemented and enforced by the State of New Jersey or NOAA, depending on jurisdiction, will affect benthic resources by modifying the nature, distribution, and intensity of fishing-related impacts, including those that disturb the seafloor (trawling, dredge fishing). Under adequate regulations, impacts of regulated fishing activities on benthic resources will be moderate.

Climate change: Ongoing emissions of CO_2 are leading to ocean acidification, which contributes to reduced growth and the inhibition of calcification, resulting in adverse impacts on benthic resources with calcareous shells. Laboratory experiments have shown the negative impacts of ocean acidification in several marine calcifiers, including echinoderm, bivalve, coral, and crustacean species (Kurihara 2008). Another study found the immune response of the sea urchin may be compromised under near-future ocean warming and acidification (Brothers et al. 2016). In seagrasses, combined increased water temperature and lower salinity associated with climate change can result in increased mortality (Salo and Pedersen 2014). Warmer waters also provide opportunities for invasive species to become established. Climate change is expected to continue to lead to warming of the oceans, which is altering the distribution of benthic resources and ecological relationships and providing opportunities for disease, invasives species establishments, and loss of habitat. Impacts from climate change are expected to be moderate.

3.6.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned activities (without the Proposed Action). Planned offshore wind projects in the geographic analysis area depicted on Figure 3.6-1 include Ocean Wind 2 and Atlantic Shores South. Planned non-offshore wind activities that may affect benthic resources include new submarine cables and pipelines, tidal energy projects, marine minerals extraction, dredging, military use, marine transportation, fisheries use and management, global climate change, and oil and gas activities (see Section F.2 in Appendix F for a complete description of planned activities). These activities may result in bottom disturbance and habitat conversion, but population-level effects would not be expected. The paragraphs below provide an overview of what is known regarding the IPFs described above. See Table F1-3 for a summary of potential impacts associated with planned non-offshore wind activities by IPF for benthic resources. Planned non-offshore wind activities would have the same types of impacts from accidental releases, anchoring, EMF, cable emplacement and maintenance, noise, port utilization, presence of structures, and regulated fishing effort that are described in detail in Section 3.6.3.1 for ongoing non-offshore wind activities.

BOEM expects planned offshore wind activities to affect benthic resources through the following primary IPFs.

Accidental releases: Accidental releases may increase as a result of planned non-offshore wind and planned offshore wind activities. The risk of any type of accidental release would be increased primarily during construction, but also during operations and decommissioning of offshore wind facilities. Accidental releases of hazardous materials mostly consist of fuels, lubricating oils, and other petroleum compounds. Because most of these materials tend to float in seawater, they are unlikely to make contact with benthic resources. The chemicals with potential to sink or dissolve rapidly are predicted to dilute to non-toxic levels before they would reach benthic resources. In most cases, the corresponding impacts on benthic resources are unlikely to be detectable unless there is a catastrophic spill (e.g., an accident involving a tanker ship). Large-scale spills may be accompanied by the use of chemical dispersants during post-spill response. Crude oil treated with dispersants (specifically Corexit 9500A) has been shown to have higher toxicity to marine zooplankton and meroplankton than either the crude oil or dispersant alone (Rico-Martinez et al. 2012; Almeda et al. 2014a, 2014b). Benthic resources with planktonic larval stages may be susceptible to this toxicity, which may affect subsequent recruitment.

Invasive species can be released accidentally, especially during ballast water and bilge water discharges from marine vessels. Increasing vessel traffic related to the offshore wind industry would increase the risk of accidental releases of invasive species, primarily during construction. Invasive species releases may or may not lead to the establishment and persistence of invasive species. Although the likelihood of invasive species becoming established as a result of offshore wind activities is very low, the impacts of invasive species on benthic resources could be strongly adverse, widespread, and permanent if the species were to become established and out-compete native fauna. Such an outcome, however, is considered highly unlikely. The increase in this risk related to the offshore wind industry would be small in comparison to the risk from ongoing activities (e.g., trans-oceanic shipping).

Accidental releases of trash and debris may occur from vessels primarily during construction, but also during operations and decommissioning. Lessees must conduct all authorized activities in a manner that prevents unauthorized discharge of pollutants including marine trash and debris into the offshore environment (30 CFR 285.105). USCG similarly prohibits the dumping of environmentally damaging trash or debris (International Convention for the Prevention of Pollution from Ships, Annex V, Public Law 100−220 (101 Stat. 1458)).

However, higher-volume spills of toxic materials could occur due to unanticipated events, such as a vessel allision with a WTG foundation. BOEM assumes all vessels would comply with laws and regulations to minimize releases. If a release were to occur, it would be an accidental, localized event in the vicinity of work areas. The greatest likelihood of releases would be associated with nearshore project activities (e.g., transmission cable installation and transport of equipment and personnel from ports). However, there is no evidence that the anticipated volumes and extents would have detectable impacts on benthic resources.

The cumulative impacts of accidental releases on benthic resources are likely to be minor because large-scale releases are unlikely and impacts from small-scale releases would be localized and short term, resulting in little change to benthic resources. As such, accidental releases from offshore wind development would not be expected to appreciably contribute to cumulative impacts on benthic resources.

Anchoring: Offshore wind activities would increase vessel anchoring during survey activities and during construction, installation, maintenance, and decommissioning of offshore components. In addition, anchoring or mooring of meteorological towers or buoys could be increased. Anchoring would cause increased turbidity levels and would have the potential for physical contact to cause mortality of benthic resources. Anchor drag would increase impacts, potentially resulting in scarring or additional damage to benthic habitats. Using the assumptions in Table F2-2 in Appendix F, anchoring could affect up to 274 acres (1.1 km^2). Most impacts would be minor because impacts would be localized, turbidity would be temporary, and mortality of benthic resources from contact would be recovered in the short term. Impacts from anchoring associated with planned non-offshore wind activities would be moderate. Degradation of sensitive habitats and resources, such as SAV beds and hard-bottom habitats, if it occurs, could be long term to permanent, resulting in moderate cumulative impacts.

EMF: The marine environment continuously generates a variable ambient EMF. EMF would also emanate from new transmission or communication cables and new offshore export cables and inter-array cables constructed for offshore wind projects. Offshore wind projects (including Atlantic Shores South and Ocean Wind 2) would add an estimated 1,318 miles (2,121 kilometers) of cable to the geographic analysis area that would produce EMF in the immediate vicinity of cables for each project during operation. The Atlantic Shores South PDE for offshore export cables includes options for 230- to 275-kV high-voltage alternating current (HVAC) or 320- to 525-kV high-voltage direct current (HVDC) designs. The Atlantic Shores South COP also includes HVAC cable design for inter-array cables. Cable design for Ocean Wind 2 is not known at this time and could include HVAC or HVDC cables. BOEM would require these future submarine power cables to have appropriate shielding and burial depth to minimize potential EMF effects from cable operation. Remedial protection measures would be installed wherever the target burial depths cannot be met. EMF and substrate heating effects from these projects on benthic habitats would vary in extent and significance depending on overall cable length, the proportion of buried versus exposed cable segments, project-specific transmission design (e.g., HVAC or HVDC, transmission voltage), and the proximity of the affected habitat to the cable. For example, species with life stages that are surface-oriented or use pelagic habitats would not be exposed to EMF effects and would experience no effects on this habitat component. In contrast, species that use bottom or near-bottom habitats along the potential cable paths during one or more life stages may be exposed to EMF effects. The significance of these potential effects is dependent on habitat use (i.e., likelihood of exposure) and species-specific sensitivity to magnetic and electrical fields and heating effects. EMF strength diminishes rapidly with distance, and EMF that could elicit a behavioral response in an organism would likely extend less than 50 feet (15.2 meters) from each cable. Impacts of EMF on benthic habitats is an emerging field of study; as a result, there is a high degree of uncertainty regarding the nature and magnitude of effects on all potential receptors (Gill and Desender 2020). Recent reviews by Bilinski (2021), Gill and Desender (2020), Albert et al. (2020), and Snyder et al. (2019) of the effects of EMF on marine organisms in field and laboratory studies concluded that measurable, though minimal, effects can occur for some species, but not at the relatively low EMF intensities representative of marine renewable energy projects. Behavioral impacts from EMF, though observed at higher levels than are representative of offshore wind projects, were documented for lobsters near a direct current cable (Hutchison et al. 2018) and a domestic electrical power cable (Hutchison et al. 2020), including subtle changes in activity (e.g., broader search areas, subtle effects on positioning, and a tendency to cluster near the EMF source). There was no evidence of the cable acting as a barrier to lobster movement and no effects were observed for lobster movement speed or distance traveled. Additionally, faunal responses to EMF by marine fauna, including crustaceans and mollusks, include attraction to the source, interference with navigation that relies on natural magnetic fields, predator/prey interactions, avoidance or attraction behaviors, increased burrowing by polychaetes, increased exploratory and foraging behavior, and physiological and developmental effects (Bilinski 2021; Jakubowska et al. 2019; Hutchison et al. 2018; Taormina et al. 2018; Normandeau et al. 2011). Burrowing infauna and finfish may be exposed to stronger EMF, but little information is available regarding the potential consequences. Non-mobile infauna would be unable to move to avoid EMF. Any effects, however, would be local and would not have population-level impacts due to the small spatial scale of the impact relative to the available benthic habitat in the geographic analysis area.

Other studies, however, have found that EMF does not affect invertebrate behavior. For example, Schultz et al. (2010) and Woodruff et al. (2012, 2013) conducted laboratory experiments exposing American lobster and Dungeness crab (*Metacarcinus magister*) to EMF fields ranging from 3,000 to 10,000 milligauss and found that EMF did not affect their behavior. Assuming the other wind projects with HVAC cables in the geographic analysis area have similar array and export cable voltages as the Proposed Action, the induced magnetic field levels expected for the offshore wind projects are two to three orders of magnitude lower than those tested by Schultz et al. (2010) and Woodruff et al. (2012, 2013). Similarly, a field experiment in Southern California and Puget Sound, Washington found no evidence that the catchability of two crab species was influenced by the animals crossing an energized low-frequency submarine alternating current power cable (35 and 69 kV, respectively) to enter a baited trap. Whether the cables were unburied or lightly buried did not influence the crab responses (Love et al. 2017). While these voltages are between two and eight times lower than those expected for the offshore wind projects, the array and export cables would be shielded and buried at depth to reduce potential EMF from cable operation.

EMF levels would be highest at the seabed near cable segments that cannot be fully buried and are laid on the bed surface under protective rock or concrete blankets. Invertebrates in proximity to these areas could experience detectable EMF levels and minimal associated behavioral effects. These unburied cable segments would be short and widely dispersed. CSA Ocean Sciences, Inc. and Exponent in 2019 found that offshore wind energy development as currently proposed would have negligible effects, if any, on bottom-dwelling species. The information presented above indicates that EMF impacts on benthic fauna would be biologically insignificant, highly localized, and limited to the immediate vicinity of cables, and would be undetectable beyond a short distance; however, localized impacts would persist as long as cables are in operation. The affected area would represent an insignificant portion of the available benthic habitat; therefore, cumulative impacts on benthic resources would be minor.

Cable emplacement and maintenance: Construction of offshore submarine cables would cause short-term disturbance of seafloor habitats and injury and mortality of benthic resources in the immediate vicinity of the cable emplacement activities. The cable routes for other offshore wind projects have not been fully determined at this time. However, both export and inter-array cables are anticipated to be constructed through 2030 for other offshore wind projects within lease areas that are within or overlap the geographic analysis area (see Table F2-1 in Appendix F). The total area of disturbance resulting from new cable emplacement is presented in Table F2-2 in Appendix F. The area presented would be a small fraction of available habitat in the geographic analysis area and would be expected to recover relatively quickly. Impacts associated with cable emplacement in sensitive habitats such as areas with SAV or complex habitat such as cobble or boulders, where present, may take longer to recover.

Prior to cable emplacement, obstructions along the cable route are mapped and may be removed. UXO (e.g., bombs, bullets, shells, grenades, mines) is often present on the ocean floor. If UXO cannot be avoided, removal or detonation may be required to avoid risks to human lives. Physical removal of UXO disturbs the seabed in much the same way as cable installation. UXOs that are exploded in place disturb the ocean floor and can result in habitat loss, reduced water quality, and physical disturbance, harm, and mortality in fish and marine invertebrates (noise from UXO detonations is discussed in the *Noise* IPF below). A UXO blast in a Scotland offshore wind farm mobilized sediments into the water column in the vicinity of the explosion, although high sediment suspension was reportedly short lived and smaller in magnitude than the effects of a storm event (Beatrice Offshore Windfarm 2016). Other effects reported for the same offshore wind farm included loss of benthic habitat due to sediment suspension and deposition in addition to the seafloor disturbance, although the recovery of the seafloor due to inputs from surrounding unaffected areas was anticipated to be rapid. An assessment of the sediments found no raised levels of any hydrocarbon or metals across the wind farm and concluded the potential effects of resuspended sediment contaminants on benthic resources were negligible.

UXO clearance activities during critical periods can affect spawning or migration behavior in fish. At the Beatrice Offshore Windfarm, UXO clearance was undertaken outside the spawning window and no impacts on cod spawning were anticipated. UXO clearance activities may result in temporary loss or disturbance of spawning, nursery, or feeding habitat. The clearance of UXO has the potential to result in the loss of benthic habitat in the vicinity of the blast site, which is of importance to benthic invertebrate species. This impact is, however, predicted to be highly localized and therefore will not result in substantial areas of seabed being disturbed. Following disturbance, levels of suspended sediment in the water column are not expected to be substantially higher than background levels and the sandy and coarse sand sediments will settle back to the seabed relatively rapidly. Given the relatively high susceptibility of eggs and larvae to suspended and resettling sediment, there is the potential for early life stages to be affected by UXO detonation.

Seabed preparations (e.g., sand wave clearance, boulder relocation, pre-lay grapnel run) made prior to installation of cables as well as dredging and mechanical trenching used during cable installation can cause localized, short-term impacts (e.g., habitat alteration, injury, mortality) on benthic resources through seabed profile alterations, as well as through the sediment deposition. The level of impact from seabed profile alterations could depend on the time of year that they occur, especially if these alterations overlap with times and places of high benthic organism abundance or reproductive activity. Locations, amounts, and timing of dredging for offshore wind projects are not known at this time. The need for dredging depends on local seafloor conditions, assuming the areal extent of such impacts is proportional to the length of cable installed (see Table F2-1 in Appendix F). Dredging typically occurs only in sandy or silty habitats, which are abundant in the geographic analysis area and are quick to recover from disturbance, although full recovery of the benthic faunal assemblage may require several years (Wilber and Clarke 2007). Mechanical trenching, used in more resistant sediments (e.g., gravel and cobble), causes seabed profile alterations during use, although the seabed is typically restored to its original profile after utility line installation in the trench. Sand and gravel substrates typically take longer to recover to pre-disturbance conditions than habitats with finer grain sizes (Wilber and Clarke 2007).

Disturbed seafloor from construction of these projects may affect benthic resources; assuming other offshore wind projects use installation procedures similar to those proposed in the COP, the duration and extent of impacts would be limited and short term, and benthic assemblages would recover from disturbance. Particularly where routes intersect sensitive or complex habitat, impacts may be long term to permanent. For SAV, damage to seagrass blades may be more quickly recovered; however, damage or uprooting of rhizomes may take years to recover (Orth et al. 2017). Increased turbidity due to bottom disturbances associated with cable emplacement would reduce light availability to SAV. This short- to long-term impact would be most pronounced in the immediate vicinity of the disturbance. Cable installation in nearshore areas where SAV habitat is present would result in short-term to long-term, and therefore moderate, impacts on SAV due to habitat loss. Loss of SAV beds would also reduce carbon sequestration and increase CO_2 emissions, leading to negligible to minor adverse impacts related to ongoing climate change (see climate change, above, for greater detail).

When new cable emplacement and maintenance causes resuspension of sediments, increased turbidity could have an adverse impact on filter-feeding fauna such as bivalves. Within the New Jersey WEA, sand is the predominant sediment type, which would settle out of the water column quickly (Guida et al. 2017). There are lower percentages of finer sediments (mud) that would stay suspended longer and, therefore, travel farther. The impact of increased turbidity on benthic fauna depends on both the concentration of suspended sediment and the duration of exposure. Plume modeling for other wind development projects within the region and with similar sediment characteristics (Vineyard Wind 1, Block Island Wind Farm, and Virginia Offshore Wind Technology Advancement) predict that suspended sediment should usually settle well before 12 hours have elapsed (COP Volume II, Section 2.1.2.2.1; Ocean Wind 2023). BOEM expects relatively little impact from increased turbidity (separate from the impact of sediment deposition).

If the sediment that would be disturbed by construction activities contains elevated levels of toxic contaminants, sediment disturbances could affect water quality and the physiology of benthic organisms. Contaminated sediments are not known to be a problem in the geographic analysis area for benthic resources.

Sediment resuspended as a result of cable emplacement and maintenance activities would be deposited on the seafloor. Sediment deposition can result in adverse impacts on benthic resources, including smothering and changes to sediment quality profiles. Benthic organisms’ tolerance to being covered by sediment (sedimentation) varies among species. Demersal winter flounder eggs were shown to have delayed hatching with as little as 0.04 inch (1 millimeter) of sedimentation (Berry et al. 2011). The sensitivity to sedimentation for shellfish varies by species and life stage. Some sessile shellfish may only tolerate 1 to 2 centimeters while other benthic organisms can survive burial in upward of 20 centimeters (Essink 1999). Areas closest to the disturbance would receive higher percentages of more coarse, rapidly settling sediments while finer sediments would settle over greater distances and be more diffuse. The greatest impacts would therefore be at the smallest spatial scales. The level of impact from sediment deposition and burial could depend on the time of year that it occurs, especially if it overlaps with times and places of high benthic organism abundance or reproductive activity.

Some types of cable installation equipment use water withdrawals, which can entrain planktonic larvae of benthic fauna (e.g., larval polychaetes, mollusks, crustaceans) with assumed 100-percent mortality of entrained individuals (COP Volume II, Section 2.2.5.2.1; Ocean Wind 2023). Due to the surface-oriented intake, water withdrawal could entrain pelagic eggs and larvae, but would not affect resources on the seafloor. However, the rate of egg and larval survival to adulthood for many species is very low (MMS 2009). Due to the limited volume of water withdrawn, BOEM does not expect population-level impacts on any given species.

Assuming the areal extent of such impacts is proportional to the length of cable installed (see Table F2-1 in Appendix F), such impacts from offshore wind activities would likely be on the order of 4.3 times more than the Proposed Action. Increased sediment deposition may occur during multiple years. The area with a greater sediment deposition from simultaneous or sequential activities would be limited, as most of the affected areas would only be lightly sedimented (less than 0.04 inch [1 millimeter]) and would recover naturally in the short term. Dredged material disposal during construction, if any occurs in the geographic analysis area, would cause localized, temporary turbidity increases and long-term sedimentation or burial of benthic organisms at the immediate disposal site. The impacts of burial would be mostly short term with less potential for long-term impacts. Sediment deposition and burial impacts on benthic resources from cable emplacement for other offshore wind projects would therefore be moderate.

Noise: Sound from offshore wind activities includes sound pressure, particle motion, and vibration. Sound pressure is the fluctuation in the density of the medium (e.g., sediments) due to the sound, particle motion refers to the movement of particles that make up the medium during that sound, and vibrations are initiated by direct contact of a sound source with the substrate, such as during pile driving, and by sound energy entering the substrate through the water from intense sources, such as seismic air guns (Popper et al. 2022). Sound pressure is heard by most terrestrial animals, including humans, and is not discussed further. However, most fishes, including all elasmobranchs and likely all sound-detecting invertebrates, hear via particle motion (Popper et al. 2022; Carroll et al. 2017). Fishes and aquatic invertebrates that live in, on, or close to the substrate (e.g., the seabed) may also be affected by vibrations. Sound pressure and particle motion can also emanate from the substrate back into the water column as a result of such vibrations (Hawkins et al. 2021). In a review of potential impacts of sound on fishes and aquatic invertebrates from offshore wind activities, Popper et al. (2022) identified substantial gaps in the understanding of these effects and concluded these gaps preclude an assessment of the potential impacts of sound from offshore development.

Noise can cause bivalves to close their valves and burrow deeper when subjected to noise and vibration stimuli, reducing respiration and other processes and potentially causing mortality (Roberts et al. 2016), although the duration of pile driving and small radius of potential effects on infaunal organisms is expected to be on the order of hours. With impulse impacts, such as those from pile driving, physiological sound thresholds may be exceeded for some species, resulting in injury or mortality, especially for affected species in the immediate vicinity. Noise transmitted through water or the seabed sediments would also be expected to affect benthic invertebrates. However, data are not available to adequately quantify these impacts (Popper et al. 2022).

Noise, in terms of sound pressure levels (SPL), from vessel traffic, construction, pile driving, seismic surveys, geophysical and geotechnical (G&G) survey activities, O&M, and trenching/cable burial could contribute to impacts on benthic resources. The most impactful noise is expected to result from pile driving. Noise from pile driving would occur during installation of foundations for offshore structures. This noise would be produced intermittently during installation of each foundation. One or more projects may install more than one foundation per day, either sequentially or simultaneously. Construction of offshore wind facilities in the geographic analysis area would likely occur over an assumed 5-year construction period (see Table F2-1 in Appendix F). Noise transmitted through water and through the seabed can cause injury to or mortality of benthic resources in a limited area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area. The extent depends on pile size, hammer energy, and local acoustic conditions. The affected areas would likely be recolonized in the short term. In the planned activities scenario, noise from pile driving that causes behavioral changes could affect the same populations or individuals multiple times in a year or in sequential years, although impacts are expected to be minor.

Noise from G&G surveys of cable routes and other site characterization surveys for offshore wind facilities could also disturb benthic resources in the immediate vicinity of the investigation and cause temporary behavioral changes. G&G noise would occur intermittently over an assumed 5-year construction period (see Table F2-1 in Appendix F). Potential impacts of G&G activities for renewable energy on the Atlantic OCS (BOEM 2018 rev. 2021) included evaluations of impacts on benthic resources as they relate to EFH (e.g., habitat for prey). HRG surveys may result in some localized disturbance due to a number of IPFs associated with data collection activities, including vessel operations, accidental release of marine debris, drilling noise, and other benthic sampling activities. These activities may affect benthic invertebrates that are prey items for listed species (e.g., sturgeon, sea turtles) and thus may alter the diet composition of these species. However, because the amount of benthic habitat affected by routine activities would be temporary and extremely small relative to the available foraging habitat in the renewable energy regions, any effects on listed species resulting from benthic disturbance would be insignificant. Adverse effects on benthic habitat and communities from G&G activities (including noise) on the Atlantic OCS targeting sand resources are expected to be reversible and no impacts on hard-bottom communities would be anticipated from G&G surveys (BOEM 2014). G&G noise resulting from offshore wind site characterization surveys is less intense than G&G noise from seismic surveys used in oil and gas exploration; while seismic surveys create high-intensity, impulsive noise to penetrate deep into the seabed, offshore wind site characterization surveys typically use sub-bottom profiler technologies that generate less-intense sound waves for shallow penetration of the seabed. Seismic surveys are not expected in the geographic analysis area for benthic resources. Detectable impacts of G&G noise on benthic resources would rarely, if ever, overlap from multiple sources, but may overlap with behavioral impacts of pile-driving noise. Overlapping sound sources are not anticipated to result in a greater, more-intense sound; rather, the louder sound prevents the softer sound from being detected. Noise from G&G surveys is therefore expected to have a minor impact on benthic resources.

Noise from trenching/cable burial, O&M, and construction activities other than pile driving are expected to occur but would have little impact on benthic resources. Noise from inter-array and export cable trenching would be temporary and localized and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise are typically less prominent than the impacts of the physical disturbances discussed above under the IPFs for new cable emplacement and maintenance and sediment deposition and burial. Finally, while noise associated with operational WTGs may be audible to some benthic fauna, this would only occur at relatively short distances from the WTG foundations and could cause physiological damage or avoidance responses (English et al. 2017). Proximity to the individual turbines is the strongest predictor of SPLs over factors such as wind speed and turbine size (Tougaard et al. 2020). Noise from construction activities other than pile driving may occur; however, little of that noise propagates for any substantial distance through the water, and, therefore, impacts on benthic resources are expected to be minor.

Mapped MEC/UXO disposal areas have already been excluded from potential offshore wind development, thereby reducing the likelihood of an encounter; the risk is further reduced or eliminated due to established protocols such as research, surveys, and risk analysis. While non-explosive methods may be employed to lift and move these objects, some may need to be removed by explosive detonation.

Underwater detonation explosions generate sound waves with high pressure levels that could cause disturbance and injury to marine fauna. Applying the "As Low as Reasonably Practical" risk mitigation process will help direct the investigation to identify MEC/UXO. A desktop analysis to investigate and identify UXO in unmapped areas will reduce risks and will be completed prior to equipment installation. Therefore, the potential for impacts from MEC/UXO would be negligible to minor, localized, and temporary or short term. The impacts of noise from offshore wind development would be expected to be moderate.

Information on noise impacts for benthic invertebrates is limited, but for fish species with particle motion detection, a recent study (Popper et al. 2014) provides information on temporary thresholds (temporary threshold shift [TTS]) (hearing loss), using 229 decibel (dB) re 1 micropascal (µPa) for mortality or potential mortal injury. Fish with swim bladders and particle motion detection ability had high likelihood of recoverable impairment at near and intermediate distances from explosions, but low levels of TTS at intermediate distances, while fish without swim bladders (particle motion detection) had a low likelihood of recoverable injury at intermediate distances, moderate likelihood of TTS at intermediate distances, and low levels of both effects at far distances of a few kilometers.

Port utilization: Port utilization and maintenance are expected to increase and there are several port improvement projects within the region. Increases in port utilization due to other offshore wind projects would also lead to increased vessel traffic. This increase in vessel traffic would be at its peak during construction activities over a period of 5 years and would decrease during operations but increase again during decommissioning (see Table F2-1 in Appendix F). In addition, any port expansion and construction activities related to the additional offshore wind projects would add to the total amount of disturbed benthic area (see Section F.2.6 in Appendix F), resulting in disturbance and mortality of individuals and short-term to permanent habitat alteration. Existing ports are heavily modified or impaired benthic environments, and future port projects would likely implement best management practices (BMP) to minimize impacts (e.g., stormwater management and turbidity curtains). Increased vessel traffic around ports would also increase physical impacts of vessel operation including impacts of wakes on shallow and shoreline habitats as well as erosion, scour, and turbidity impacts from vessels operating in shallower inshore waters. Impacts of increased port utilization, however, would be negligible because the degree of impacts on benthic resources would likely be undetectable outside the immediate vicinity of port expansion activities.

Presence of structures: The presence of structures can lead to impacts on benthic resources through entanglement and gear loss or damage, hydrodynamic disturbance, fish aggregation resulting in increased predation on benthic resources, and habitat conversion. These impacts may arise from foundations, scour/cable protection, and buoys and meteorological towers. Installation of major structures other than those supporting offshore wind projects are not anticipated within the geographic analysis area. There is the potential for new small-scale structures such as docks and coastal infrastructure to be constructed. Using the assumptions in Appendix F, the foreseeable offshore wind scenario would include up to 324 new foundations, 231 acres (0.9 km^2) of foundation scour protection, and 55 acres (0.2 km^2) of new hard protection atop cables. In the geographic analysis area, structures are anticipated predominantly on sandy bottom, with the exception of cable protection, which is more likely to be needed where cables pass through hard-bottom habitats. Projects may also install more buoys and meteorological towers. BOEM anticipates that structures would be added intermittently over an assumed 5-year period (see Table F2-1 in Appendix F) and that they would remain until decommissioning of each facility is complete. The potential locations of cable protection for other offshore wind activities have not been fully determined at this time; however, any addition of scour protection/hard-bottom habitat would represent substantial new hard-bottom habitat, as the geographic analysis area is predominantly composed of sand, mud, and gravel substrates. It is notable, however, that any new structures would be in addition to existing anthropogenic structures within the four artificial reef areas present, at least in part, in the geographic analysis area.

Installation of these structures would result in direct mortality of benthic organisms within the footprint of disturbance, suspension of sediments, increased turbidity, and burial of benthic organisms in immediate proximity to foundations or below scour/cable protection. The presence of structures would increase the risk of gear loss or damage by entanglement. The lost gear, moved by currents, can disturb, injure, or kill benthic resources. The intermittent impacts at any one location would likely be localized and short term, although the risk of occurrence would persist as long as the structures and debris remain.

Human-made structures, especially tall vertical structures such as foundations, alter local water flow (hydrodynamics) at a fine scale by potentially reducing wind-driven mixing of surface waters or increasing vertical mixing as water flows around the structure (Carpenter et al. 2016; Cazenave et al. 2016; Segtnan and Christakos 2015). Increased mixing may also result in warmer bottom temperatures, increasing stress on some shellfish and fish at the southern or inshore extent of the range of suitable temperatures. Finfish aggregate trends along the mid-Atlantic shelf have been shifting northeast into deeper waters (NOAA 2022); the presence of structures may reinforce these trends. The consequences for benthic resources of such hydrodynamic disturbances are anticipated to be undetectable to small, to be localized, and to vary seasonally. Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables, create uncommon vertical relief in a mostly soft-bottom landscape. Structure-oriented fishes would be attracted to these locations. Increased predation upon benthic resources by structure-oriented fishes could adversely affect benthic communities in the immediate vicinity of the structure. These impacts are expected to be local and to persist as long as the structures remain. Depending on the balance of attraction and production, newly placed structures may affect the distribution of fish and shellfish among existing natural habitat, artificial reef sites, and newly emplaced structures.

The presence of structures would also result in new hard surfaces that could provide new habitat for recruitment of hard-bottom species (Daigle 2011). The increased local density of fish and shellfish may result in changes to sediment quality through the bio-deposition of organic matter and sloughing off of shells and attached organisms from the structures. New structures also have the potential to facilitate range expansion of both native and nonnative aquatic species through the stepping-stone effect. Colonization and recruitment of marine fauna to structures can result in the dispersion and propagation of nonnative species, especially in nearshore habitats. Like other biofouling organisms, nonnative species might be transported to WTGs via construction and maintenance vessels (Bray et al. 2017; Wilding et al. 2017). Structures may serve as “stepping stones” that connect otherwise unconnected areas and provide a means for nonnative species to disperse and colonize new areas that may have previously been inaccessible due to biogeographical barriers (Adams et al. 2014; Wilding et al. 2017; Bray et al. 2017). Connectivity created among structures, especially where nonnative and invasive species may be present, can alter habitats and adversely affect native species, including federally protected species. At the scale of planned offshore wind activities, the artificial reef effect could lead to regional changes, including a shift from soft-sediment to hard-substrate communities and, potentially, intertidal communities (Causon and Gill 2018). Due to the pre-existing network of artificial reefs in the mid-Atlantic OCS, however, it is unlikely that additional structures would measurably increase the potential for this effect.

Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010). The potential effects of wind farms on offshore ecosystem functioning have been studied using simulations calibrated with field observations (Raoux et al. 2017; Pezy et al. 2018). These studies found increased biomass for benthic fish and invertebrates.

However, some impacts, such as the loss of soft-bottom habitat and increased predation pressure on forage species near the structures, may be adverse. In light of the above information, BOEM anticipates that the impacts associated with the presence of structures may be moderate adverse to moderate beneficial depending on the receptor. The impacts on benthic resources resulting from the presence of structures would persist at least as long as the structures remain.

Discharges: There would be increased potential for discharges from vessels during construction, operations, and decommissioning. Offshore-permitted discharges would include uncontaminated bilge water and treated liquid wastes. There would be an increase in discharges, particularly during construction and decommissioning when vessel traffic would be highest, and the discharges would be staggered over time and localized. Additionally, components of anti-fouling paints and anti-corrosives may leach into surface waters. Anti-corrosion and anti-biofouling contamination necessary to maintain offshore infrastructures can also result in contamination due to galvanic anodes emitting substantial amounts of metals, and organic coatings may release organic substances due to weathering or leaching (Kirchgeorg et al. 2018). Contaminations from chemical emissions may include organic compounds such as bisphenol A and metals such as aluminum, zinc, and indium from corrosion and biofouling protection measures and sacrificial anodes (Lloret et al. 2022). These substances are presently considered to have a low environmental impact, but monitoring data are not sufficient to assess the environmental impact of this new source (Lloret et al. 2022). Impacts would be negligible because there does not appear to be evidence that the volumes and extents anticipated would have any impact on benthic resources.

3.6.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue. Benthic resources would continue to respond to IPFs introduced by ongoing activities. BOEM anticipates ongoing activities, including climate change and seafloor disturbances caused by sediment dredging and fishing using bottom-tending gear, to result in negligible to moderate impacts (e.g., disturbance, injury, mortality, habitat degradation, habitat conversion) on benthic resources. The No Action Alternative would result in **negligible** to **moderate** impacts on benthic resources.

Cumulative Impacts of the No Action Alternative. BOEM anticipates that the impacts of planned activities other than offshore wind development such as increasing vessel traffic; increasing construction; marine surveys; port expansion; channel-deepening activities; and installing new towers, buoys, and piers would have minor impacts on benthic resources. BOEM expects planned offshore wind activities to have short-term to permanent impacts (e.g., disturbance, injury, mortality, habitat degradation, habitat conversion) on benthic resources, primarily through pile-driving noise, anchoring, new cable emplacement, and the presence of structures during operations of offshore facilities (i.e., foundations, cable, and scour protection). BOEM anticipates that the cumulative impacts of the No Action Alternative would be **moderate** adverse and could potentially include **moderate beneficial** impacts resulting from emplacement of structures (habitat conversion). Offshore wind activities are expected to contribute considerably to several IPFs, primarily new cable emplacement and the presence of structures, namely foundations and scour/cable protection.

3.6.4 Relevant Design Parameters and Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on benthic resources:

- The total amount of scour protection for the foundations, inter-array cables, and offshore export cable corridors that results in long-term habitat alteration;

- The installation method of the export cable in the offshore export cable corridors and for inter-array and inter-link cables in the Wind Farm Area and the resulting amount of habitat temporarily altered;
- The number and type of foundations used for the WTGs and OSS: Ocean Wind could construct a maximum of 98 WTGs (monopile foundations) and three OSS (monopile or piled jacket foundations);
- The methods used for cable laying and landfalls, as well as the types of vessels used and the amount of anchoring;
- The amount of pre-cable-laying dredging or preparation, if any, and its location; and
- The time of year when foundation and cable installations occur.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- The number, size, location, and amount of scour protection for WTG and OSS foundations: The level of impact related to foundations is proportional to the number of foundations installed; fewer foundations would present less hazard to benthic organisms.
- Offshore export cable routes and OSS footprints: The route chosen (including variants within the general route) and OSS footprints would determine the amount of habitat affected.
- Season of construction: Spring and summer are the primary spawning seasons for many benthic invertebrates as well as fish that lay demersal eggs. Project activities during these seasons would likely have greater impacts due to localized disruption of these processes and impacts on reproductive processes and sensitive early life stages.

Ocean Wind has committed to using standard underwater cables that have electrical shielding to control the intensity of EMF (BENTH-02) to minimize impacts on benthic resources. Ocean Wind has also committed to conducting surveys to identify potentially sensitive seabed habitats (BENTH-01) and areas of SAV along the proposed cable routes (BENTH-03) (COP Volume II, Table 1.1-2; Ocean Wind 2023).

Ocean Wind has developed a benthic monitoring plan to document the disturbance and recovery of marine benthic habitat and communities resulting from the construction and installation of Project components, including WTG scour protection as well as the inter-array cabling and offshore export cable corridor from the Wind Farm Area to shore (Inspire 2022b). The benthic survey would focus on seafloor habitat and benthic communities and make comparisons to areas unaffected by construction of the Project. Surveys would occur pre-construction and during construction, and at roughly the same time of year in years 1, 2, 3, and 5 post-construction. Potential equipment used during benthic surveys includes remotely operated vehicles, high-resolution video and photography, and sediment grabs. The underwater noise effects generated by the proposed multibeam echosounder and sidescan sonar methods used for habitat monitoring would be similar to, but of lower magnitude than, the HRG survey methods described in the COP (Ocean Wind 2023).

Ocean Wind has developed a Submerged Aquatic Vegetation Monitoring Plan (Inspire 2022b) and Submerged Aquatic Vegetation Preliminary Mitigation Plan (Ocean Wind 2022) to conduct baseline delineations and document conditions of SAV beds, assess potential impacts on these SAV beds as a result of the construction and operations of the inshore export cable(s) associated with the Project, and track recovery of these SAV beds over time to inform potential mitigation strategies.

SAV impacts from construction and installation of the Oyster Creek inshore export cables will be restored or mitigated to the greatest extent practicable, as described in the SAV Preliminary Mitigation Plan (Ocean Wind 2022). The scope of the plan is a result of discussions with NJDEP, NMFS, and BOEM and an evaluation of previous SAV restoration projects within Barnegat Bay. Restoration of SAV beds in areas where they have previously existed, or in areas disturbed by activity, have proven difficult to re-establish due to a number of biotic and abiotic factors, e.g., water quality and channel dredging. Without identifying and controlling for these factors, restoration activities are likely to have poor success. Ocean Wind is proposing a 3:1 mitigation ratio consisting of mapping efforts, monitoring activities, restoration of documented impacts at an in-situ 1:1 ratio, supplementary restoration to achieve the 3:1 mitigation ratio, and research to improve SAV mitigation in the future. Potential impacts on SAV habitat are anticipated due to cable installation and anchoring/mooring activities.

As part of the SAV Preliminary Mitigation Plan, existing SAV beds in Barnegat Bay along the impact corridor and their condition would be mapped and documented, using imagery where possible, and potential restoration areas would be identified. Pre- and post- construction monitoring would follow methods described in the SAV Monitoring Plan (Inspire 2022b). Data collection to characterize community composition of SAV will occur within three regions, the western bay site of cable installation, Island Beach State Park as the eastern bay site of cable installation, and a control site (Seaside Park). In-water surveys will take place within the SAV growing season (May–October) starting in 2023 (pre-construction and post-construction) and continuing annually during post-construction monitoring (2024–2033). The plan also includes a site-specific SAV Restoration Plan to monitor and evaluate abiotic factors relevant to SAV growth at each site, direct and indirect impacts to modify the spatial extent of restoration via a 4-year monitoring program, adaptive management refinement, restoration implementation. and continued monitoring of restored areas. Reporting will provide updates on progress and recommend future actions and a final synthesis report would be completed at the conclusion of SAV mitigation (anticipated in 2032).

3.6.5 Impacts of the Proposed Action on Benthic Resources

3.6.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.6.8, *Impacts of Alternative E on Benthic Resources*.

The sections below summarize the potential impacts of the Proposed Action on benthic resources during the various phases of the Proposed Action. Routine activities would include construction, O&M, and decommissioning of the Project, as described in Chapter 2, *Alternatives*.

Accidental releases: Accidental releases of trash and debris are discussed in Section 3.6.3.2. The Proposed Action would likely have negligible to no impact on benthic resources with respect to accidental release of trash and debris because both BOEM and USCG prohibit the discharge or disposal of solid debris into offshore waters under most circumstances.

Accidental releases would continue to occur as a result of ongoing activities. All vessels associated with the Proposed Action would comply with USCG requirements for the prevention and control of oil and fuel spills. However, higher-volume spills of toxic materials could occur due to unanticipated events, such as a vessel allision with a WTG foundation. Impacts of accidental releases are relative to their magnitude. Smaller releases are expected to occur at a higher frequency and to be less severe, while major releases are expected to be rare but have more impacts. As discussed in Section 3.6.3, non-routine events such as oil or chemical spills, potentially amplified by the use of chemical dispersants, can have adverse or lethal effects on marine life. However, modeling by Bejarano et al. (2013) predicts that the impact of smaller spills on benthic fauna would be low. Larger spills are unlikely but could have a larger impact on benthic fauna due to adverse effects on water quality (see Section 3.21, *Water Quality*). The impacts of accidental releases on benthic resources are likely to be negligible because large-scale releases are unlikely and impacts from small-scale releases would be localized and short term, resulting in little change to benthic resources. In the unlikely event that accidental spills should occur, adverse impacts on benthic habitats could range from minor to moderate adverse in significance depending on the size of the spill and the nature of the materials involved.

Accidental releases of invasive species could affect benthic resources; the risk of this type of release would be increased by the additional vessel traffic associated with the Proposed Action, especially traffic from foreign ports, primarily during construction. The potential impacts on benthic resources are described in Section 3.6.3.2.

Anchoring: Vessel anchoring would cause short-term impacts in the immediate area where anchors and chains meet the seafloor. Impacts on benthic resources would be greatest for sensitive benthic habitats (e.g., eelgrass beds, hard-bottom habitats). In addition to the anchoring disturbance that would occur under the No Action Alternative, the incremental impact of anchoring under the Proposed Action would affect 19 acres (0.08 km^2). All impacts would be localized, turbidity would be temporary, and mortality from physical contact would be recovered in the short term. Where SAV is present within the Oyster Creek export cable route, additional short-term impacts would result from anchor placement and retrieval. While anchor placement and chain sweep may damage seagrass blades, anchor drag and retrieval are likely to damage or uproot seagrass rhizomes, which may take years to recover (Orth et al. 2017). To minimize anchoring impacts, Ocean Wind has committed to an Applicant-proposed measure (APM) to avoid anchoring on sensitive habitat during construction activities (GEN-08; COP Volume II, Table 1.1-2; Ocean Wind 2023). Impacts are anticipated to be minor to moderate.

EMF: During operation, powered alternating current transmission cables would produce EMF (Taormina et al. 2018). To minimize EMF generated by cables, all cabling under the Proposed Action would include electric shielding (BENTH-02; COP Volume II Table 1.1-2; Ocean Wind 2023). The strength of the EMF increases with electrical current, but rapidly decreases with distance from the cable (Taormina et al. 2018). Ocean Wind would also bury cables to a target burial depth of up to 4 to 6 feet (1.2 to 1.8 meters) below the surface, well below the aerobic sediment layer where most benthic infauna live. Target burial depths would be determined following detailed design and the CBRA (COP Volume I, Section 6.1.1.6; Ocean Wind 2023). In some areas, it is anticipated that cable would be unable to be buried to the target depth and would instead be placed on or near the seafloor with overlying cable protection. Impacts of EMF are anticipated to be greater where this occurs, as the distance between the cable and biological receptors would be reduced.

The scientific literature provides some evidence of faunal responses to EMF by marine invertebrates, including crustaceans and mollusks (Hutchison et al. 2018; Taormina et al. 2018; Normandeau et al. 2011). A recent study of impacts of offshore wind EMF on crabs and lobster (Harsanyi et al. 2022) found that chronic exposure to 2.8-millitesla EMF throughout embryonic development may affect larval mortality, recruitment, and dispersal. Currents between 850 and 1,600 amperes are commonly used in subsea power cables, which would consequently produce an EMF of up to 3.20 milliteslas (1,600 amperes) on the cable surface in a perfect wire.

Some reviews (Gill and Desender 2020 and Albert et al. 2020) indicate the relatively low intensity of EMF associated with marine renewable projects would not result in impacts. Effects of EMF may include interference with navigation that relies on natural magnetic fields, predator/prey interactions, avoidance or attraction behaviors, and physiological and developmental effects (Taormina et al. 2018). Studies on the effects of EMF on marine animals have mostly been restricted to commercially important species (Section 3.9). The consequences of anthropogenic EMF have not been well studied in benthic resources (Gill and Desender 2020; Albert et al. 2020; Snyder et al. 2019). However, the EMF field intensity decreases with distance from the cable and thus the benthic component and the sediment closest to the cables have the most exposure (Albert et al. 2020). Exponent (2018) suggests that benthic invertebrates with limited mobility and occurring outside the sediments in which cables are buried would not be affected by Project-associated EMF. However, a preponderance of evidence suggests that inter-array and export cables could produce sufficient EMF to have potentially adverse effects on bivalve physiology, although the specific sensitivity of specific shellfish species likely to occur in the cable path remains unclear, as described in the EFH Assessment.

In the case of mobile species, an individual exposed to EMF would cease to be affected when it leaves the affected area. An individual may be affected more than once during long-distance movements; however, there is no information on whether previous exposure to EMF would influence the impacts of future exposure. Potential effects of EMF on fish and some invertebrates are detailed in Section 5.4 of the EFH Assessment. Benthic species such as the Atlantic sea scallop, Atlantic surfclam, and ocean quahog are likely to be exposed to EMF and heat effects from offshore export cable operation. The maximum induced magnetic field generated of 76.6 milligauss would attenuate to 1 milligauss within 32.8 feet (10 meters) of the cable. However, because the export cable would be buried to a minimum depth of 4 to 6 feet (1.2 to 1.8 meters) along the majority of its length, heat effects on juvenile and adult clams and other benthic infauna over buried cable segments would likely be insignificant. Cable segments at the transitions between fully buried and exposed cable segments would be buried at shallower depths, potentially exposing quahog and surfclam habitat and other benthic infauna to adverse thermal effects. As stated, however, these areas would be covered by concrete mattresses and rendered unsuitable habitat for benthic infauna so the two effect areas are not additive. In the absence of additional data, impacts on these resources cannot be quantified for EMF. However, based on available data, BOEM expects localized and long-term impacts on benthic resources from EMF from the Proposed Action.

Cable emplacement and maintenance: The primary infauna of ridge and trough habitat are polychaetes in the U.S. Atlantic and Gulf of Mexico, although a greater diversity of dominant taxa is reported for the Atlantic coast (Brooks et al. 2005). The polychaete worm *Spio filicornis* had the highest species ranking by abundance, followed by the amphipods *Unciola irrorata* and *Ampelisca vadorum*, in the Lease Area. In the Mid-Atlantic Bight, infaunal assemblages and productivity differ between ridges and troughs (Byrnes et al. 2000; Slacum et al. 2010). For example, sand dollars and filter-feeding epibenthos were more prevalent on shoal crests than in troughs (VIMS 2000). Similarly, data results from sediment profile camera/plan view camera and video collected at the sand ridge area in June 2022 indicated presence of sand dollars at both crests and troughs, with a distinctly higher average density along the crests (Inspire 2022a). In addition, the trough portions (or flat bottom) of the habitat generally have greater abundance, species richness, and species diversity, as well as greater abundance of benthic finfish, pelagic finfish, and pelagic invertebrates than ridges (or shoals); ridges with steeper elevation gradients had greater abundance than those with more gradual elevation changes (Slacum et al. 2010). Consequently, impacts would likely be greater in portions of the Lease Area with a greater concentration of steeper ridge and trough habitats.

Bathymetry data from the Lease Area (Inspire 2022a) indicate steeper elevation gradients in the eastern portion of the Lease Area; in addition, recent studies of the sediments found greater homogeneity in sediments of ridge crests, compared with the troughs, which had sediment types ranging from very fine sand to sandy gravel (Inspire 2022a). Therefore, impacts on ridge and trough habitats may be greater in the northeastern portion of the Lease Area.

In inshore areas, sand wave clearance may be required to install cables at a sufficient depth that they would not be uncovered as a result of sand wave mobility. Sand waves documented in the Wind Farm Area have wavelengths of up to 1,640 feet (500 meters) and heights up to 4.9 feet (1.5 meters). Cable emplacement and maintenance activities may flatten depressions and small sand waves, temporarily reducing benthic habitat suitability for species such as red and silver hake within the cable footprint. Prey organisms that use these habitats would also be displaced, potentially affecting habitat suitability for fish species. Trenching may leave behind temporary depressions. The extent of these natural features is difficult to quantify, as they are continually reshaped by natural sediment transport processes. Natural recovery from anthropogenic disturbance is likely to occur within several months of the disturbance, depending on timing relative to winter storm events. Due to their mobility, it is expected that the sand wave profiles would rapidly return after cable installation. Although it is anticipated that hydrodynamics would be altered by the presence of structures, it is not expected that this would be to a degree that prevents the processes of sand wave formation and migration.

Cable laying and construction would also result in the resuspension and nearby deposition of sediments as discussed in Section 3.6.3.2. In areas where displaced sediment is thick enough, organisms may be buried, which could result in mortality. Benthic species have a range of susceptibility to sedimentation based on life stage, mobility, and feeding mechanisms. Sediment within the Wind Farm Area is generally medium- to coarse-grained with areas of gravelly sand and gravel deposits near the Wind Farm Area (COP Volume I, Section 2.1.2.2.1; Ocean Wind 2023). Based on the grain sizes evaluated for similar projects in Massachusetts, Rhode Island, and Virginia, the medium- to coarse-grained sand deposits near the Wind Farm Area are likely to settle to the bottom of the water column quickly and sand re-deposition would be minimal and close, estimated within 525 feet (160 meters) of the trench centerline (COP Volume I, Section 2.1.2.2.1; Ocean Wind 2023). Finer sediments within the export cable route, closer to shore and in back-bay areas, would stay suspended longer and potentially be transported farther depending on local currents. Based on modeling for a similar project (BOEM 2015), maximum deposition would still be anticipated nearest to the disturbance. Within 328 feet (100 meters) of the trench, deposition would not be expected to exceed 0.4 inch (1 centimeter). Substantial impacts on seagrass outside of the immediate vicinity of the cable due to sedimentation from the one-time installation of cables are unlikely. Seagrasses have vertical structure that can accommodate a degree of burial greater than would be expected from the one-time resuspension and settling of dredged material (Lewis and Erftemeijer 2006). As with other impacts related to disturbance of benthic habitat, benthic assemblages would be expected to recover in the short term, resulting in negligible impacts on benthic resources.

Cable emplacement activities would result in mortality, injury, or displacement of benthic fauna in the path of construction as well as possible damage to sensitive habitats such as SAV, which is present within the Oyster Creek export cable route, and low-density boulder fields, which are present in the Wind Farm Area and Oyster Creek export cable route. Under the Proposed Action, multiple landings on the western shore of Barnegat Bay and two export cable routes west of Island Beach State Park are under consideration for the Oyster Creek export cable route, with varying degrees of potential impacts on SAV. The seafloor would be disturbed by cable trenches, dredging (if required), anchoring, and cable protection. No disturbance or impacts are anticipated for beaches along any of the export cable routes. All beaches would be crossed by HDD at a minimum depth of 30 feet (9.1 meters). The BL England export cable route would pass under Crook Horn Creek to the south of Roosevelt Boulevard Bridge at Peck Bay via HDD. Entry/exit pits would be entirely within previously disturbed areas of the Roosevelt Boulevard right-of-way and SAV would not be affected (further detail provided in Section 3.22, *Wetlands*).

Two cable route options are proposed to cross Island Beach State Park and enter Barnegat Bay. The northern option, identified as the Prior Channel Route, reduces potential impacts on SAV beds by following a previously dredged channel. The depth and sediments of the approximately 122-foot-wide previously dredged channel is not conducive to supporting SAV growth and, as such, is largely devoid of SAV beds. HDD was considered for the Prior Channel Route, but the area needed for a 50-meter separation of the cables and adequate spacing for drills would extend beyond the channel and disturb adjacent SAV beds during cable installation. Other concerns include adequate room to reduce the risk of inadvertent returns of drilling fluids, and conflict with park operations due to the setback required for HDD for burial depth and avoidance of inadvertent returns from drilling fluids. Consequently, an open-cut method is proposed. For the southern route option, engineering constraints limit the maximum length of a potential HDD installation to approximately 360 meters, so HDD would require an exit pit location within intact SAV beds.

SAV impacts from construction and installation of the Oyster Creek inshore export cables would be restored or mitigated as described in the SAV Preliminary Mitigation Plan (Ocean Wind 2022).

BOEM expects the Proposed Action alone to lead to unavoidable, short- to long-term impacts on benthic resources from this IPF. Despite unavoidable mortality, damage, or displacement of invertebrate organisms, the area affected by the construction footprint for cable emplacement would be just 4 percent of the Wind Farm Area and the area affected within the export cable routes would similarly represent a small fraction of available benthic habitat. BOEM does not expect population-level impacts on benthic species (i.e., generally accepted ecological and fisheries methods would be unable to detect a change in population, which is the number of individuals of a particular species that live within the geographic analysis area) as a result of the Proposed Action. Benthic fauna would recolonize disturbed areas that have not been displaced by new structures in the short term (Byrnes et al. 2004). Within Barnegat Bay, emplacement of cables would have acute lethal impacts on benthic invertebrates, including shellfish such as the hard clam and bay scallop, within the footprint of disturbance. Ocean Wind estimates that cable emplacement for the Oyster Creek offshore export cable would result in up to 121 acres of benthic disturbance in shellfish habitat (COP Volume II Table 2.2.5-6; Ocean Wind 2023). Impacts may also result from associated sediment deposition and burial. Recovery of seagrass following benthic disturbance may occur over longer time frames, extending into long-term impacts over multiple years.

Offshore construction could also cause adverse impacts on benthic communities from loss or conversion of habitat. Based on the activities described in the COP, the Proposed Action could affect SAV in Barnegat Bay within the Oyster Creek export cable route. Monitoring of SAV around the Oyster Creek inshore export cable route is included in the benthic monitoring plan (GEN-06; COP Volume II Table 1.1-2; Ocean Wind 2023). Habitat features in the form of ridges and troughs, sand waves, and boulders (greater than 50 centimeters) are present in the Wind Farm Area and export cable route corridors; however, disturbance for cable emplacement would be temporary and short term. Ridge and trough formations are most conspicuous in the vicinity of 15 WTGs proposed in the northeastern portion of the Lease Area; impacts due to the foundations and installation of inter-array cable associated with these 15 WTGs would result in an estimated 728 acres of bottom impacts. Estimates of maximum impacts for sand wave (222 acres) and boulder clearance (2,220 acres) total 2,240 acres (refer to the EFH Assessment for more detail). Contractors and engineers for Ocean Wind would perform additional surveys and evaluation of geological conditions in the surface and shallow subsurface layers as a part of the CBRA (COP Volume I, Section 6.1.1.6; Ocean Wind 2023) prior to developing the precise route. Array cables would be installed via hydroplow where possible, with alternative methods to include surface lay, trenching, jetting, pre-plowing and plowing, vertical injection, and controlled-flow excavation as necessary. Several of these methods use water withdrawals that could entrain benthic larvae (MMS 2009). Due to the limited duration and area involved, BOEM does not expect population-level impacts. The consequences of increased turbidity caused by this IPF are discussed in Section 3.6.3.2.

Benthic recovery processes are relevant to understanding the likely duration of impacts on benthic resources. Neighboring benthic communities that have similar habitats and assemblages would recolonize disturbed areas. Succession would begin with more mobile, early-colonizer species with progression toward a mature assemblage over time. The restoration of marine soft-sediment habitats occurs through a range of physical (e.g., currents, wave action) and biological (e.g., bioturbation, tube building) processes (Dernie et al. 2003). Impacts and recovery times would vary depending on habitat types, which can generally be separated into the high-energy oceanic environment versus the low-energy estuarine environment. In general, physical processes are more important in high-energy environments, while biological processes dominate in low-energy environments. In high-energy environments, repopulation can often be largely attributed to bedload transport of adult and juvenile organisms. Recovery of invertebrate communities in low-energy environments is more dependent upon larval settlement and recruitment and adult migration. Therefore, rates of recolonization and succession can vary considerably among benthic communities. Recovery of the benthic species would likely require several months to a year or more (Dernie et al. 2003; Lewis et al. 2002). Recovery to a pre-construction state may take 2 to 4 years or more (Van Dalfsen and Essink 2001; Boyd et al. 2005). Fauna in dynamic environments are prone to natural sediment movement and deposition due to strong tidal currents and waves. Therefore, they are able to recover from disturbances more rapidly. Benthic meiofauna are known to recover from sediment disturbances more rapidly than the macrobenthos; recolonization up to pre-disturbance densities has occurred within weeks or less, and entire assemblages have recovered within 90 days (MMS 2009). Monitoring benthic function around cable installations is included in the benthic monitoring plan (GEN-06; COP Volume II Table 1.1-2; Ocean Wind 2023).

Although recovery times of invertebrates specific to disturbance from cable emplacement are not available, reported recovery times for sand removal (mining) from these habitats may offer some insight. Recovery times generally ranged from 3 months to 2.5 years at sand mining sites and varied by taxonomic group: polychaetes and crustaceans recovered most quickly (several months) while deep-burrowing mollusks were slowest to recover and occurred over several years (Brooks et al. 2005). Adverse impacts on infauna from sand removal were associated with depressions left in the sediments after dredging that collect fine sediments that may change the sediment composition (Byrnes et al. 2004), dredging during the peak recruitment period of spring and summer, and fragmentation of habitats that reduced opportunities for recolonization. Opportunistic species would likely colonize newly disturbed areas, followed by later successional species that have superior competitive abilities (Slacum et al. 2010). Adverse impacts from cable emplacement may affect ridge and trough habitats by reducing connectivity between and among ridge and trough areas, removal or alteration of sediments, and direct and indirect mortality of benthic invertebrates. Adverse impacts may be greater in ridge and trough habitats with steeper gradients, such as those in the northeastern portion of the Project area. Cable emplacement that results in depressions or fragmentation of habitat would be expected to have temporary, short- to long-term, negligible to minor impacts on the ridge and trough habitats, depending on the location of the cables. Habitats within the Oyster Creek inshore export cable route corridor are sand and mud with recent or historical SAV presence. Impacts from installation of the export cable would result from direct disturbance of benthic habitats, resuspension and nearby deposition of sediments, and emplacement of cable protection resulting in habitat conversion. Direct disturbance could result in the injury or mortality of organisms within the footprint of the export cable, primarily sessile or slow-moving benthic invertebrates such as hard clam and bay scallop, or non-motile early life stages such as the demersal, adhesive eggs and could damage SAV habitat present along both the eastern and western shorelines of Barnegat Bay. Benthic community structure is expected to recover rapidly, within a few months of the activity. Impacts from seabed disturbance due to open-cut trenching and HDD are anticipated to be localized and short term due to their temporary nature.

Ocean Wind has developed a SAV Monitoring Plan (Inspire 2022b) to document baseline delineations and conditions of SAV beds, assess potential impacts on these SAV beds as a result of the construction and operations of the inshore export cable(s) associated with the Project, and track recovery of these SAV beds over time to inform potential mitigation strategies. The proposed SAV Preliminary Mitigation Plan (Ocean Wind 2022) outlines Ocean Wind's proposed process to ensure that any impacts on SAV incurred during construction and installation activities of the Ocean Wind 1 export cable that cannot be avoided or minimized are adequately mitigated. The recontoured area would be replanted with native wetland vegetation and would be monitored for a minimum of 5 years post-construction to confirm shoreline stabilization and adequate vegetative cover.

Ocean Wind has committed to a benthic monitoring plan (GEN-06; COP Volume II Table 1.1-2; Ocean Wind 2023) that would apply to construction, operations, and decommissioning. Monitoring would be implemented to ensure that environmental conditions are monitored and reasonable actions are taken to avoid and minimize seabed disturbance and sediment dispersion, which would minimize potential impacts on benthic resources. Actions to avoid and minimize seabed disturbance and sediment dispersion would require the same tools used in installation and would have similar impacts via disturbance to the seafloor (e.g., mortality, sedimentation). However, the disturbance would not exceed that caused by the initial installation and the affected area should be substantially smaller.

Bathymetric profiles indicate sand ridge heights are approximately 8 meters, with a length of approximately 1.5 kilometers (Ocean Wind 2022). A higher spatial resolution of baseline conditions of the benthic habitat across sand ridges, including troughs and crests, will be acquired prior to construction to document baseline conditions. Triplicate transects of sediment profile imaging/plan view stations will be set up across the sand ridge features to follow planned inter-array cable routes and transects perpendicular to cable corridors will also be surveyed. A total of 25 sediment profile imaging/plan view stations along each transect will be sampled and results analyzed. Baseline data will be collected, in the first calendar year post-installation (year 0) and at year 1 and year 2 during operation. After year 2, if benthic function measured with sediment profile imaging/plan view is indistinguishable from baseline conditions, no further monitoring will occur. Alternatively, if benthic function is impaired and differences between baseline and post-construction persist, monitoring would continue at defined intervals until the benthos resemble baseline conditions or are no longer impaired (up to a maximum of 5 years of monitoring). Greater detail on monitoring is provided in the EFH Assessment.

Ocean Wind's conservative estimate of detonation in place of up to 10 UXOs would result in temporary habitat loss, reduced water quality, and physical disturbance, harm, and mortality in fish and marine invertebrates, as described in Section 3.6.3.2 (noise from UXO detonations is discussed in the *Noise* IPF below). If necessary, detonations would occur on up to 10 different days and would not occur from January 1 through April 30 to avoid impacts on marine mammals. The acres of physical disturbance to the seafloor as a result of detonating the UXO have not been estimated.

During construction, cable emplacement and maintenance activities could lead to short-term impacts including habitat alteration, injury, and mortality; however, impacts on benthic resources would be negligible.

Noise: Activities associated with the Proposed Action that could cause underwater noise effects are impact pile driving (installation of WTGs and OSS), vibratory pile driving (installation and removal of cofferdams at landfall sites), geophysical surveys (HRG surveys), detonations of UXO, vessel traffic, aircraft, cable installation, dredging, and WTG operation. The natures of the impacts of noise from G&G surveys, WTG O&M, pile driving, cable burial or trenching, and UXO on benthic resources are described in Section 3.6.3.2. Noise, in terms of SPL, from vessel traffic, construction, pile driving, seismic surveys, G&G survey activities, O&M, and trenching/cable burial would contribute to impacts on benthic resources, as described in Section 3.6.3.2. Impacts of G&G activities would include localized disturbance associated with data collection, vessel operations, drilling noise, and other survey activities. These activities would be temporary, short term, and small compared to the size of the Lease Area, resulting in negligible impacts on benthic resources under the Proposed Action. Additional discussion specific to G&G-related noise impacts is presented in the Biological Assessment (BA) (BOEM 2022b) and Appendix C of the acoustic modeling report (Küsel et al. 2021).

The most substantial noise produced from the Proposed Action would be from pile driving during installation of up to 101 foundations. Given that most benthic species in the region are either mobile as adults or planktonic as larvae, disturbed areas (either through injury or mortality) would likely be recolonized naturally. The highest levels of noise from offshore wind occur during construction and are associated with pile driving for fixed-bottom turbine installation and UXO detonations; noise produced during operation of the wind farm is expected to be lower than during construction (SEER 2022). Marine invertebrates have been considered less susceptible than mammals and fish to loud noise and vibration because they generally do not possess air-filled spaces like swim bladders or middle ears; however, noise at the levels associated with pile driving has been reported to cause short-term behavioral responses in marine invertebrates within approximately 10 meters of the disturbance (Brand and Wilson 1996, after BOEM 2020b). If injury or mortality occurred to benthic organisms, the affected areas would likely be recolonized in the short term, and no population-level impacts would be expected (SEER 2022). Impacts would therefore be localized, short term, and minor. The Underwater Acoustic and Exposure Modeling Report (COP Volume II, Appendix R-2; Ocean Wind 2023) describes operational noise as low frequency (60 to 300 Hz) and of relatively low SPLs. It concludes that, “It is unlikely that WTG operations will cause injury or behavioral responses to marine fauna, so the risk of impact is expected to be low.”

Overall, impacts on benthic resources from noise are anticipated to be localized and short term, and may be negligible to minor, depending on the duration of activities. The most impactful sub-IPFs for noise are pile driving and UXO detonation; the impacts would be proportional to the number of piles being driven and the number of UXOs being detonated. The Proposed Action includes installation of up to 101 foundations. The number of UXO detonations is estimated at ten and to occur over shorter periods of time than monopile installation, resulting in a smaller overall impact when compared with pile driving.

Port utilization: The Proposed Action would not directly result in any port expansion or construction activities and would therefore not have direct impacts on benthic resources from these activities. Likewise, any port improvements are not dependent on the Proposed Action being analyzed in this EIS. However, multiple projects are proposed to increase port capacity that may support the Proposed Action (see Section F.2.6 in Appendix F). Impacts on benthic resources from port construction or upgrades would be local to those ports and would support not just the Proposed Action but other offshore wind projects and general maritime activity as well. Any increase in port utilization would be highest during construction, minor during operation, and moderate during decommissioning. Impacts on benthic resources would be localized and minor.

Presence of structures: Under the Proposed Action, the presence of structures could result in various impacts. The natures of these impacts on benthic resources are described in Section 3.6.3.2. The Proposed Action could result in up to 101 foundations and 255 acres (1.0 km^2) of scour (84 acres) and cable (171 acres) protection that could cause temporary to permanent impacts of the types discussed in Section 3.6.3.2. Bathymetry data from the Lease Area (Inspire 2022a) indicate steeper-elevation gradients in the eastern portion of the Lease Area. Therefore, impacts on ridge and trough habitats may be greater in the northeastern portion of the Lease Area. However, based on the 2022 benthic survey (Inspire 2022a), the vast majority of the impacts would be on soft-bottom habitat, with a small portion of impacts on complex (inclusive of coarse) habitats. Impacts from the foundations and inter-array cable protection (if needed) associated with the 15 WTGs in the northeastern portion of the Lease Area, where impacts on ridge and trough habitats may be greater, would affect an estimated 728 acres of sea bottom. The presence of inter-array cable protection and WTGs (foundations and scour protection) may alter the vertical relief and bottom complexity important to forage species and serve as a refuge for prey. The presence of novel structures and hard substrates within the ridge and trough system could affect these ecosystem dynamics that support a more complex habitat and more diverse benthic and demersal fish assemblages. Impacts may include reduced habitat complexity and biodiversity as well as potential loss of trophic linkages between invertebrate and demersal fish assemblages that characterize these habitats. Impacts on benthic invertebrate assemblages can subsequently affect fish and shellfish assemblages, as described by Vasslides and Able (2008) and Slacum et al. (2010).

The presence of WTGs is expected to result in wind-wake alterations in and around the Wind Farm Area. Some authors have suggested this could result in changes to ocean stratification (mixing) that can reduce nutrient supplies to the surface ocean and alter net primary productivity. Numerical modeling by Daewel et al. (2022) shows the associated wind wakes in the North Sea provoke large-scale changes in annual primary production with local changes of up to ±10% not only at the offshore wind farm clusters, but also distributed over a wider region. Model simulations by Christiansen et al. (2022) show the emergence of large-scale wake effects that lead to changes in vertical and lateral flow sufficient to affect stratification in the southern North Sea and eventually enhance the stratification during the decline of the summer stratification toward autumn (more detail on the impacts of wind wake is presented in Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*). Importantly, net primary productivity is driven by photosynthesis in marine phytoplankton and accounts for half of global-scale photosynthesis and supporting major ocean ecosystem services (Field 1998). There are few empirical data showing the impact of WTGs on ocean stratification (Tagliabue et al. 2021), although recent models have demonstrated ocean mixing as a result of the wind-wake effect of WTGs in the North Sea (Carpenter et al. 2016; Floeter et al. 2017; Dorrell et al. 2022). Preliminary results from Chen et al. (2021) demonstrate the turbulent mixing in and around WTGs and subsequent significant reductions in horizontal larval dispersion and increased offshore dispersal. Model results suggest these changes could alter larval abundance in the Nantucket Lightship Closed Area off the southern New England coast (Chen et al. 2021). Hydrodynamic modeling to examine the impacts of WTGs on fish larvae in the Mid-Atlantic Bight showed changes in depth-averaged currents, wave height, and temperature associated with various build-out scenarios; however, subsequent shifts were not considered overly relevant to larval settlement in the three fish species examined (Johnson et al. 2021). However, interannual changes in net primary productivity in the North Atlantic are poorly correlated with parallel changes to stratification and emphasize the importance of other physical mechanisms, especially the Gulf Stream (Tagliabue et al. 2021). Potential impacts on net primary productivity in the North Atlantic from the Proposed Action may occur but, without additional data, impacts are considered negligible when compared with the effects of the Gulf Stream.

Once construction is complete, the presence of the WTG and OSS foundations could result in some alteration of local water currents, which could produce sediment scouring and alter benthic habitat. Local changes in scour and sediment transport close to a foundation may alter sediment grain sizes and benthic community structure (Lefaible et al. 2019), though this impact is expected to be minimal due to the use of scour protection for each foundation. These effects, if present, would exist for the duration of the Proposed Action and would be reversed only after the Project has been decommissioned, although they may be permanent if scour protection is left in place.

The presence of structures would also result in new hard surfaces that could provide new habitat for recruitment of hard-bottom species and structure-oriented communities (Daigle 2011). Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010). Results from ecosystem models that incorporate survey data indicate increased diversity and biomass for benthic fish and invertebrates around foundation structures in the offshore environment (Lefaible et al. 2019; Raoux et al. 2017; Pezy et al. 2018). This indicates that offshore wind farms can generate some beneficial impacts on local ecosystems. However, some impacts such as the loss of soft-bottom habitat may be adverse depending on the resource affected. BOEM anticipates that the impacts associated with the presence of structures would be long term and minor to moderate beneficial. The impacts on benthic resources resulting from the presence of structures would persist as long as the structures remain. Monitoring the colonization and succession of epifauna on novel surfaces (foundations, scour protection, and cable protection) as well as enrichment of surrounding soft-bottom habitats is included in the benthic monitoring plan (GEN-06; COP Volume II Table 1.1-2; Ocean Wind 2023).

The presence of structures would increase the risk of gear loss or damage by entanglement. The lost gear, moved by currents, can disturb, injure, or kill benthic resources. The impacts at any one location would likely be localized and short to long term, although the risk of occurrence would persist as long as the structures and debris remain. Overall, this is anticipated to have a minimal impact on benthic resources.

Discharges: The Proposed Action would result in an increased potential for discharges from vessels during construction, operations, and decommissioning. Offshore permitted discharges would include uncontaminated bilge water and treated liquid wastes. There would be an increase in discharges and chemical emissions, particularly during construction and decommissioning, and the discharges would be staggered over time and localized. Impacts on benthic resources from vessel discharges, if any, would be localized, short term, and negligible. Discharges may also include anti-corrosion and anti-biofouling contamination, the release of organic substances, and chemical emission from corrosion and biofouling protection measures (described in Section 3.6.3). These substances are presently considered to have a low environmental impact, but monitoring data are not sufficient to assess the environmental impact of this new source (Lloret et al. 2022). Impacts would be negligible because there does not appear to be evidence that the volumes and extents anticipated would have any impact on benthic resources.

3.6.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities.

Accidental releases: The Proposed Action would contribute an undetectable increment to the cumulative impacts of accidental releases, which would likely be negligible and short term. Most of the risk of accidental releases of invasive species comes from ongoing activities, and the impacts (mortality, decreased fitness, disease) due to other types of accidental releases are expected to be negligible and short term.

Anchoring: Cumulative anchoring impacts could collectively affect up to 293 acres (1.2 km^2) (although some of this may occur after the resource has recovered from the earlier impacts). Degradation of sensitive habitats such as SAV or hard-bottom habitats, if it occurs, could be long term to permanent. Therefore, the Proposed Action would contribute a noticeable increment to the minor to moderate anchoring impacts on benthic resources that could occur.

EMF: The undetectable incremental impact contributed by the Proposed Action would slightly increase the impacts of EMF in the geographic analysis area beyond those described under the No Action Alternative. However, the cumulative impact on benthic resources would likely still be minor and localized but long term.

Cable emplacement and maintenance: Locations, amounts, and timing of dredging for other offshore wind projects are not known at this time. Assuming the areal extent of such impacts is proportional to the length of cable installed (see Table F2-1 in Appendix F), such impacts from offshore wind activities would likely be on the order of 4.3 times more than under the Proposed Action. Additional impacts from this IPF may result from other non-offshore wind projects and maritime activities.

The Proposed Action would contribute a noticeable increment to cumulative impacts on benthic resources (i.e., disturbance, injury, and mortality) from new cable emplacement associated with other projects in the geographic analysis area. Cable emplacement and maintenance under the Proposed Action is estimated to affect up to 1,935 acres (7.8 km^2) of seafloor within the export cable routes and 1,850 acres (7.5 km^2) in the Wind Farm Area. This would be in addition to the impacts caused by cable emplacement and maintenance described under the No Action Alternative. Although cable routes and lengths for other offshore wind projects are not known at this time, using the assumptions in Appendix F, the total seafloor disturbance from new cable emplacement under the Proposed Action and other offshore wind projects is estimated to be 8,424 acres (34.1 km^2). In most locations, the affected areas are expected to recover naturally, and impacts would be short term because seabed scars associated with jet plow cable installation are expected to recover in a matter of weeks, allowing for rapid recolonization (MMS 2009). Mechanical trenching, which could be used in coarser sediments, could result in more intense disturbances and a greater width of the impact corridor, and is also expected to recover naturally. Overall impacts of cable emplacement on benthic habitats are anticipated to be negligible to moderate, depending on the location and the method of cable emplacement. Most adverse impacts would be avoided and adverse impacts that do occur would be temporary or short term in nature.

Noise: The Proposed Action includes installation of up to 101 foundations while other planned offshore activities include an additional 323 foundations. The Proposed Action would contribute an undetectable increment to the cumulative noise impacts because construction of the Proposed Action would have minimal overlap with construction of other offshore wind projects in the geographic analysis area and there would be limited potential for combined impacts on benthic resources.

Port utilization: The Proposed Action would contribute an undetectable increment to the cumulative impacts of increased port utilization on benthic resources, which would likely be negligible.

Presence of structures: There are two other offshore wind projects proposed in the geographic analysis area with up to an additional 324 foundations and 593 acres (2.4 km^2) of scour (231 acres) and cable protection (362 acres). The Proposed Action would contribute a noticeable increment to the cumulative impacts on benthic resources, which likely would be long term and moderate adverse to moderate beneficial.

Discharges: Maritime activity including offshore development, recreation, and shipping would likely increase in the foreseeable future. The Proposed Action would contribute an undetectable increment to the cumulative impacts of discharges wind on benthic resources, which would be negligible.

3.6.5.3. Conclusions

Impacts of the Proposed Action. Activities associated with the construction and installation, O&M, and conceptual decommissioning in the Wind Farm Area and export cable route corridors would affect benthic resources by causing temporary habitat disturbance; permanent habitat conversion; and behavioral changes, injury, and mortality of benthic fauna. BOEM anticipates the impacts resulting from the Proposed Action would range from **negligible** to **moderate** adverse to **moderate beneficial**. Accidental releases, discharges, and EMF would result in negligible impacts; cable emplacement, noise, and port utilization would result in minor impacts; anchoring would result in minor to moderate impacts; and the presence of structures would result in minor to moderate beneficial impacts. The most prominent IPFs are expected to be new cable emplacement, noise from pile driving, anchoring (particularly where it may affect SAV), and the presence of structures. In general, the impacts are likely to be local and to not alter the overall character of benthic resources in the geographic analysis area. Despite benthic mortality and temporary or permanent habitat alteration, BOEM expects the overall impact on benthic communities would be minor, because most adverse impacts that do occur would be temporary or short term in nature.

Cumulative Impacts of the Proposed Action. The incremental impacts contributed by the Proposed Action to the cumulative impacts on benthic resources would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts from the Proposed Action would be **moderate** and **moderate beneficial** for benthic resources in the geographic analysis area. The main drivers for this impact rating are bottom disturbance including the emplacement of cables/structures and the long-term presence of structures and scour/cable protection. The Proposed Action would contribute to the cumulative impact rating primarily through temporary impacts due to new cable emplacement and permanent impacts from the presence of structures (i.e., cable protection measures and foundations).

BOEM has considered the possibility of a significant impact resulting from invasive species and considers it unlikely; this level of impact could occur if an invasive species were to adversely affect benthic ecosystem health or habitat quality at a regional scale. While it is an impact that should be considered, it is also unlikely to occur and the incremental increase in this risk due to the Proposed Action is negligible. While moderate adverse impacts are anticipated from the Proposed Action, most resources would likely recover in the short term when the affecting agents were gone, with or without the use of remedial or mitigating actions. Although some of the proposed activities, IPFs, or both analyzed could overlap, BOEM does not anticipate that this would alter the impact rating.

Table 3.6-2 Maximum Design Impacts on Benthic Resources

Project Component	Duration	Project Element	Impact (acres)[1]				
			Maximum Impact				Anticipated Impact[2]
			Complex Habitat	Heterogenous Complex Habitat	Soft Bottom	Total	Total
WTG & OSS Foundations	Permanent	Foundations	1.6	0.05	4.36	6.01	Up to 7
		Foundation Scour Protection	6.2	0.7	29.7	36.57	Up to 37
	Temporary	WTG & OSS Seafloor Disturbance	651.3	54.2	4,030.0	4,735.5	Up to 474
Array & Substation Interconnection Cables	Permanent	Cable Protection	25.79	0.75	148.04	174.58	Up to 24
	Temporary	Cable Installation and Seafloor Preparation	214.25	6.25	1,232.89	1,453.39	Up to 2,035
BL England Offshore Export Cable & 35th Street Landfall	Permanent	Cable Protection	0.3	0	23.7	24.0	Up to 4
	Temporary	Cable Installation & Seafloor Preparation	2.3	0	198.0	200.3	Up to 320
		Cofferdam Excavation & Anchoring	1.3	0	22.5	23.8	Up to 5
Oyster Creek Offshore & Inshore Export Cable & Landfalls at Island Beach State Park and at the farm	Permanent	Cable Protection	66.36	0	80.41	146.77	Up to 17
	Temporary	Cable Installation & Seafloor Preparation	554.57	0	673.96	1,228.53	Up to 1,430
		Cofferdam Excavation & Anchoring	26.93	0	28.51	55.44	Up to 12

[1] Maximum acreages as presented in Attachment 1 of the *Ocean Wind Offshore Wind Farm Benthic Habitat Mapping and Benthic Assessment to Support Essential Fish Habitat Consultation*. Assumptions, context, and additional information are presented within the source table.
[2] Actual temporary impacts may be based on additional assumptions such as percentage of area to be affected or PDE maximums.

3.6.6 Impacts of Alternatives B and C on Benthic Resources

Impacts of Alternatives B and C. Alternatives B-1 and B-2 would remove up to 19 WTG from the two most shoreward (northwest) rows within the Wind Farm Area to reduce visual impacts.

Under Alternatives B-1 and B-2, the extent of permanent and temporary impacts would be reduced when compared with the Proposed Action, with the greater reduction occurring under Alternative B-1 (Table 3.6-3). Alternatives B-1 and B-2 would remove up to 19 WTGs from the two most shoreward (northwest) rows within the Wind Farm Area to reduce visual impacts. These alternatives would predominantly reduce impacts on soft-bottom habitats (Table 3.6-4). Although acres of total permanent impacts were lower for Alternative B-2 when compared with other alternatives, impacts on heterogeneous complex and complex habitat types were greater than those estimated for Alternative D (Table 3.6-4). Impacts on soft-bottom habitat were somewhat reduced for Alternative B-2 when compared with the Proposed Action and the other alternatives. Alternatives B-1, B-2, C-1, and C-2 had fewer acres of impacts on complex habitat but impacts on heterogeneous complex habitats for these alternatives were similar to impacts under the Proposed Action.

Under Alternative C-1, up to eight WTGs (the entirety of the most northeast row of WTGs) would be relocated to the northwest boundary of the Lease Area, and under Alternative C-2 the array of WTGs would be compressed such that inter-row spacing would be reduced. Alternative C-1 is a relocation of structures and would shift approximately 0.6 acre of permanent impacts from soft-bottom habitat to complex habitat. Alternative C-2 would involve minor shifts in structure locations; permanent habitat impacts are not expected to appreciably change from those of the Proposed Action.

For these alternatives, no changes would be made to the export cable routes; therefore, there would be no changes to impact evaluations outside the Wind Farm Area. Prior to construction of these alternatives, additional geotechnical or engineering surveys (necessary to determine the new WTG placements) may result in a small, temporary increase in vessel use and bottom disturbance (with associated impacts as described in Section 3.6.5) unaccounted for in the Proposed Action. BOEM anticipates that this disturbance would be short term and localized, particularly compared to other proposed Project activities, and have minimal incremental impacts on benthic resources relative to the Proposed Action.

Table 3.6-3 Maximum Potential Impacts (acres) on Benthic Habitat from WTG and OSS Foundations under Alternatives B-1, B-2, C-1, C-2,[1] and D

Alternative	Permanent		Temporary	Total
	Foundations	Scour Protection	Seafloor Disturbance	
Proposed Action	6.01	36.57	4,735.51	4,778.09
B-1	5.8	33.13	4,318.49	4,357.42
B-2	5.56	29.47	3,837.19	3,872.22
C-1	6.0	36.42	4,751.67	4,794.09
C-2	6.01	36.42	4,751.66[2]	4,794.09[2]
D	5.66	30.93	4,029.71	4,066.3

[1] Maximum acreages as presented in Attachment 1 of the *Ocean Wind Offshore Wind Farm Benthic Habitat Mapping and Benthic Assessment to Support Essential Fish Habitat Consultation*. Assumptions, context, and additional information are presented within the source table.
[2] Alternative C-2 is not evaluated in the source table. No difference is expected for permanent impacts, as the number of foundations would not change. Seafloor disturbance is expected to be slightly lower based on the reduction of WTG spacing in this alternative.

The removal of up to 19 WTGs from the Wind Farm Area under Alternatives B-1, B-2, or C-1 would proportionally reduce the area permanently affected by foundations and scour protection, although Alternative C-1 appears to have a minor reduction, as shown in Table 3.6-3. This removal of WTGs as well as the reduction of spacing between WTGs under Alternative C-2 would similarly reduce the total area of disturbance due to removal or reduction of required inter-array cables. Under Alternative C-1, if WTGs were relocated as opposed to removed, there would likely be a comparable total area of benthic impacts relative to the Proposed Action (subject to re-routing of inter-array cables). Alternative C-1 would also reduce the number of WTG and associated inter-array cables from within ridge and trough features in the northeast Lease Area. For Alternatives B-1, B-2, C-1, and C-2, the overall impact ratings associated with each of these alternatives are anticipated to be the same as under Proposed Action. The most substantial difference would be relative to the presence of structures, which would be reduced by as many as 19 foundations, although overall impacts from the presence of structures would have an equivalent impact rating.

Cumulative Impacts of Alternatives B and C. The incremental impacts contributed by these alternatives to the overall impacts on benthic resources would be similar to those under the Proposed Action. This impact rating is driven mostly by ongoing activities, such as climate change and bottom-tending fishing gear, as well as by the construction, installation, and presence of offshore wind structures.

3.6.6.1. Conclusions

Impacts of Alternatives B and C. The anticipated **negligible** to **minor** impacts and **moderate beneficial** impacts associated with Alternatives B-1, B-2, C-1, and C-2 would not be substantially different than those of the Proposed Action. While these action alternatives could slightly change the impacts on benthic resources, ultimately the same, or highly similar, construction, operation, and decommissioning impacts would still occur, with the most pronounced being related to foundation and cable emplacement, bottom disturbance, and the presence of structures. These alternatives may result in slightly less, but not significantly different, impacts on benthic resources relative to those described under the Proposed Action.

Cumulative Impacts of Alternatives B and C. The incremental impacts contributed by the alternatives to the cumulative impacts on benthic resources would range from undetectable to noticeable. Incremental impacts on benthic resources would be slightly less due to fewer WTGs or shorter inter-array cables but not substantially different from those of the Proposed Action. BOEM anticipates that Alternatives B-1, B-2, C-1, and C-2 when each combined with the impacts from ongoing and planned activities including offshore wind would result in **moderate** and **moderate beneficial** impacts on benthic resources in the geographic analysis area.

3.6.7 Impacts of Alternative D on Benthic Resources

Impacts of Alternative D. Alternative D would remove up to 15 WTGs from the northeastern corner of the Wind Farm Area to reduce impacts on sand ridge and trough features. Removing these WTGs would reduce impacts on the ridge and trough habitats. Slacum et al. (2010) concluded that steeper gradients are characterized by greater abundance of benthic finfish, pelagic finfish, and pelagic invertebrate and the flat-bottom habitats also have been reported to have more benthic invertebrates than the shoals themselves, which suggests that the gradient of productivity may represent an ecotone across these habitats. Impacts on benthic habitats from wind farm components are compared for Alternatives A through D in Table 3.6-4.

Overall, acres of impacts on heterogeneous complex and complex habitat under this alternative would be lower than all other action alternatives. Acres of impacts on soft-bottom habitat would be similar to acres of impacts for the Proposed Action. Differences due to inter-array cables are not apparent in calculations

(Alternative E is not included because it varies only between Island Beach State Park and landfall and may be combined with any of the other alternatives; impacts on SAV are presented for Alternative E in Section 3.6.8, below).

The sand ridge and trough features are stable features that provide habitat complexity and are common throughout the eastern OCS (Rutecki et al. 2014). Troughs are characterized by finer sediments and higher organic content, while ridges are characterized by coarser sediments. These characteristics subsequently influence infauna and meiofaunal assemblages, which subsequently may influence assemblages of higher trophic-level fish and shellfish. These features aid in trophic interactions, linking planktonic communities and higher-level predators. Sand ridges provide vertical relief and bottom complexity that are important to forage species and serve as a refuge for prey. The presence of novel structures and hard substrates within the ridge and trough system could affect these ecosystem dynamics.

Under Alternative D, impacts would be reduced from the Proposed Action due to as many as 15 fewer foundations (less foundation and scour protection) and fewer miles of inter-array cable would be required. Permanent impacts on complex habitat (NOAA habitat complexity category) would be reduced and soft-bottom habitat impacts would increase under Alternative D (Table 3.6-4). This would primarily reduce impacts (both adverse and beneficial) associated with the presence of structures and conversion of habitat from existing bottom to scour protection.

Other IPFs associated with installation (primarily anchoring and bottom disturbance) would similarly be reduced proportionally to the reduction in infrastructure required. Avoidance of the sand ridge and trough features would potentially benefit benthic communities, as they serve as a structural complex important in mediating physical and mechanical forces, predation, and providing refuge, resting, feeding, and spawning habitat. These sand ridge and trough complexes are generally characterized by higher fish production, benthic faunal density, and species diversity than adjacent benthic habitats.

Table 3.6-4 Comparison of Maximum Potential Impacts (acres) on Benthic Habitat from WTGs and Inter-array Cables under Alternatives A, B, C, and D

Project Component	Impact	Maximum Impact (acres)			
		Complex Habitat	Heterogenous Complex Habitat	Soft Bottom	Total
Inter-array Cables					
A–D	Protection (long-term)	25.48	0.75	141.78	169.48
	Installation (short-term)	211.48	6.25	1,180.61	1,410.67
Wind Turbine Generators					
A	Foundation	0.4	0.05	1.90	2.33
	Scour Protection	6.0	0.7	29.1	35.98
	Seafloor Disturbance	640.4	54.2	4,004.9	4,037.1
B-1	Foundation	0.3	0.1	1.8	2.12
	Scour Protection	5.2	0.7	26.6	32.54
	Seafloor Disturbance	622.2	54.3	3,607.0	3,635.3
B-2	Foundation	0.3	0.1	1.	1.88
	Scour Protection	5.0	0.7	23.1	28.88
	Seafloor Disturbance	576.0	54.3	3,172.0	3,196.7
C-1 and C-2	Foundation	0.3	0.1	1.9	2.32
	Scour Protection	5.7	0.7	29.4	35.83
	Seafloor Disturbance	696.8	54.3	3,965.6	3,997.0

Project Component	Impact	Maximum Impact (acres)			
		Complex Habitat	Heterogenous Complex Habitat	Soft Bottom	Total
D	Foundation	0.3	0.05	1.68	1.98
	Scour Protection	4.3	0.7	25.3	30.34
	Seafloor Disturbance	512.2	51.2	3,431.3	3,458.3

[1] Maximum acres as presented in *Ocean Wind EFH Assessment*, updated October 2022.

Cumulative Impacts of Alternative D. The incremental impacts contributed by Alternative D to cumulative impacts would be similar to those of the Proposed Action. This impact rating is driven mostly by ongoing activities, such as climate change and bottom-tending fishing gear, as well as by the construction, installation, and presence of offshore wind structures.

3.6.7.1. Conclusions

Impacts of Alternative D. The anticipated **negligible** to **minor** impacts and **moderate beneficial** impacts associated with Alternative D would not be substantially different than those of the Proposed Action with respect to most habitat types. Alternative D would eliminate impacts associated with installation, maintenance, and decommissioning of 15 new structures and associated inter-array cables on the ridge and trough formations and their associated benthic assemblages. The area that would be avoided is approximately 16 square miles (10,240 acres) and includes three ridge/trough formations.

Impacts on benthic resources in the remainder of the Wind Farm Area and export cable route corridors would not change. The most pronounced impacts on benthic resources would be related to foundation and cable emplacement, anchoring (particularly where it may affect SAV), and the presence of structures. This alternative may result in reduced impacts on heterogeneous complex habitat and benthic resources relative to those described under the Proposed Action but would have nearly the same overall acres of impacts on the seafloor as the Proposed Action.

Cumulative Impacts of Alternative D. The incremental impacts contributed by Alternative D to the cumulative impacts on benthic habitat would range from undetectable to noticeable. BOEM anticipates that the impacts of Alternative D when combined with ongoing and planned activities including offshore wind would be **moderate** and **moderate beneficial**. Incremental impacts on benthic resources would be slightly less due to fewer WTGs and inter-array cables within the ridge and trough formations but not substantially different from those of the Proposed Action.

3.6.8 Impacts of Alternative E on Benthic Resources

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. Under Alternative E, the Oyster Creek export cable route in the vicinity of Island Beach State Park would be limited to the northern option (Prior Channel Route) developed to minimize impacts on SAV in Barnegat Bay. This route would make landfall on Island Beach State Park and continue north before entering Barnegat Bay at a location where SAV impacts along the eastern shore of the bay could be minimized. Alternative E would continue to affect SAV at the landfalls on the western shore of Barnegat Bay, consistent with the Proposed Action. Table 3.6-5 compares the estimated acreage of SAV that could be affected under both route options based on five different data sources from 1979, 1985–1987, 2003, 2009, and from Ocean Wind's surveys. Although the acreage of SAV potentially affected by Alternative E would be reduced compared to the Proposed Action if Ocean Wind elected to use the southern crossing option (Table 3.6-5), recovery of seagrass where it is affected could still take multiple years.

Table 3.6-5 SAV Impacts of Alternative E Compared to the Proposed Action

Data	Proposed Action: Southern ECR Option (Acres)	Alternative E: Northern ECR Option (Acres)
1979 Data	15.25	0.89
1985–1987 Data	13.17	14.01
2003 Data	11.78	1.8
2009 Data	13.86	8.35
Ocean Wind Survey Data	15.25	0.89

Source: Ocean Wind 2023.
ECR = export cable route

Alternative E would have the same number of WTGs as the Proposed Action but a slightly different cable route to avoid SAV and would still require trenching except where trenchless methods are implemented. Impacts of Alternative E on benthic resources such as SAV would be reduced compared to the Proposed Action. However, impacts on benthic resources from other IPFs would be the same as for the Proposed Action.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on benthic resources would be similar to that of the Proposed Action. The main drivers for benthic impacts are bottom disturbance from cable emplacement, the installation of structures, and placement of scour and cable protection in combination with other ongoing and planned activities.

3.6.8.1. Conclusions

Impacts of Alternative E. The anticipated impacts associated with Alternative E would be similar to those of the Proposed Action but impacts on SAV within Barnegat Bay would be greatly reduced. Impacts on benthic resources in the remainder of the export cable route corridors and Wind Farm Area would be slightly higher than those of the Proposed Action, with the most pronounced impacts being related to foundation and cable emplacement, anchoring, and the presence of structures. Offshore impacts would be slightly greater based on a larger Oyster Creek export cable route footprint than under the Proposed Action. This alternative may result in less, but not significantly different, impacts on benthic resources relative to those described under the Proposed Action based on the lower acreage of SAV potentially affected (Table 3.6-5). Moderate impacts would still be associated with the presence of structures in the Wind Farm Area. However, this alternative would result in substantial reduction in impacts on SAV, primarily due to the revised cable alignment and use of HDD to avoid SAV impacts. BOEM anticipates the impacts resulting from Alternative E alone would range from **negligible** to **minor**, including the presence of structures, which may result in **moderate beneficial** impacts.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on benthic resources would be undetectable to noticeable. Incremental impacts on benthic resources from Alternative E would be lower than those of the Proposed Action based on SAV avoidance. BOEM anticipates that the impacts associated with Alternative E when combined with the impacts from ongoing and planned activities including offshore wind would be **moderate** and **moderate beneficial** on benthic resources.

3.6.9 Proposed Mitigation Measures

Several measures are proposed to minimize impacts on benthic resources (Appendix H, Table H-2 and H-3). In the Draft EIS, BOEM analyzed NMFS-proposed measures to minimize impacts on benthic habitat. After publication of the Draft EIS, BOEM conducted consultation with NMFS pursuant to Section 305(b) of the MSA (i.e., EFH consultation), which resulted in NMFS issuing EFH Conservation Recommendations that replace the NMFS-proposed measures analyzed in the Draft EIS. EFH Conservation Recommendations are analyzed collectively in Table 3.6-6. If one or more of the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts on benthic resources could be further reduced.

Table 3.6-6 Measures Resulting from Consultations (Also Identified in Appendix H, Table H-2): Benthic Resources

Measure	Description	Effect
Live and Hard Bottom Impact Monitoring	The Lessee would develop and implement a monitoring plan for live and hard-bottom features that may be affected by proposed activities, including assessing the recovery time for these sensitive habitats. BOEM recommends that all monitoring reports classify substrate conditions following the Coastal and Marine Ecological Classification Standards (CMECS), including live bottoms (e.g., SAV and corals and topographic features). The plan would also include a means of recording observations of any increased coverage of invasive species in the affected hard-bottom areas.	Monitoring impacts would document the extent of impacts, including invasive species; quantify the need for potential restoration activities, e.g., for SAV impacts; and help to inform the potential impacts of the proposed activities on live and hard-bottom habitat. This measure would not affect the impact determination for benthic habitats.
Live and Hard Bottom Mapping and Avoidance	Vessel operators would be provided with maps of sensitive hard-bottom habitat in OSW project area, as well as a proposed anchoring plan that would avoid or minimize impacts on the hard-bottom habitat to the greatest extent practicable. These plans would be provided for all anchoring activity, including construction, maintenance, and decommissioning.	Mapping sensitive areas would identify areas to be avoided or areas in which impacts would be minimized to the extent practicable and would reduce impacts on these areas during proposed construction, maintenance, and decommissioning activities.

Measure	Description	Effect
Intake Screens on Pump Intakes for In-shore Hydraulic Dredges	All hydraulic dredge intakes should be covered with a mesh screen or screening device that is properly installed and maintained to minimize potential for impingement or entrainment of fish species. The screening device on the dredge intake should prevent the passage of any material greater than 1.25” in diameter, with a maximum opening of 1.25”x 6”. Water intakes should be positioned at an appropriate depth to avoid or minimize the entrainment of eggs and larvae. Intake velocity should be limited to less than 0.5 ft/sec.	This measure minimizes potential for impingement or entrainment of eggs and larvae. While this would reduce the impact of hydraulic dredging on eggs and larvae, the measure would not reduce the impact level of minor for cable emplacement.
Scour and Cable Protection	To the extent technically and economically feasible, the Lessee must ensure that all materials used for scour and cable protection consist of natural or engineered stone that does not inhibit epibenthic growth. The materials selected for protective purposes should mirror the natural environment and provide similar habitat functions.	The use of natural or engineered stone would not inhibit epibenthic growth and would provide three-dimensional complexity. This type of scour protection would most nearly replicate natural habitat features. This measure would reduce impacts on benthic habitat composition and structural complexity and, in the case of cable protection, reduce the time required for colonization by habitat-forming organisms. While long-term impacts from these structures would remain, the time required to achieve beneficial effects would decrease.

Measure	Description	Effect
EFH Conservation Recommendations	EFH Conservation Recommendations from NMFS were transmitted by letter dated February 24, 2023. EFH Conservation Recommendations for activities under BOEM's jurisdiction were provided for WTG and cable removal and relocation (micrositing), habitat alteration minimization, noise mitigation, and contents of the Benthic Habitat and Fisheries Monitoring Plans. EFH Conservation Recommendations for activities under USACE's jurisdiction were provided for offshore impact minimization, inshore/estuarine habitat impact minimization, and compensatory mitigation.	WTG and cable removal and relocation (micrositing) would reduce benthic impacts on the most unique and spatially limited components of the ridge and trough features. While this would provide an incremental reduction of impacts on sensitive habitats, it would not reduce the impact rating for any of the Proposed Action's IPFs. Offshore habitat alteration minimization recommendations and inshore/ estuarine habitat recommendations would reduce impacts on benthic habitat composition and structural complexity and, in the case of cable protection, reduce the time required for colonization by habitat-forming organisms. While long-term impacts from these structures would remain, the time required to achieve beneficial effects would decrease. Noise mitigation recommendations of additional noise dampening at pile installation near sensitive sites would reduce injury to or mortality of benthic resources and the potential for stress and behavioral changes to individuals over a greater area.

ft/sec = foot per second; OSW = offshore wind

Table 3.6-7 Additional Proposed Measures (Also Identified in Appendix H, Table H-3): Benthic Resources

Measure	Description	Effect
Cable protection (NYSDOS-proposed)	Avoid the use of concrete mattresses as cable protection (in all areas, but most critically within sand ridge/trough habitat features and the NJ to NY Connector Fairway) to the extent possible.	The effect of this measure would be similar to the effects of the Scour and Cable protection measure analyzed in Table 3.6-6.

3.6.9.1. Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.6-6 and Table H-2 in Appendix H, *Mitigation and Monitoring*, are incorporated in the Preferred Alternative. BOEM has identified the following additional measures in Table 3.6-7 as incorporated in the Preferred Alternative: cable protection (NYSDOS). These measures, if adopted, would have the effect of reducing the potential for interactions with sensitive benthic habitat in nearshore waters and ridge and trough habitats in the Lease Area. While the impact determination for benthic resources, described in

Section 3.6.2, would not change, the combination of these measures (Table 3.6-6 and Table 3.6-7) would ensure the effectiveness of, and compliance with, APMs already analyzed as part of the Proposed Action.

3.7. Birds (see Appendix G)

The reader is referred to Appendix G for a discussion of current conditions and potential impacts on birds from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.8. Coastal Habitat and Fauna (see Appendix G)

The reader is referred to Appendix G for a discussion of current conditions and potential impacts on coastal habitat and fauna from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.9. Commercial Fisheries and For-Hire Recreational Fishing

This section discusses potential impacts on commercial fisheries and for-hire recreational fishing from the proposed Project, alternatives, and ongoing and planned activities in the commercial fisheries and for-hire recreational fishing geographic analysis area. The commercial fisheries and for-hire recreational fishing geographic analysis area, as shown on Figure 3.9-1, includes the waters managed by the New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC) for federal fisheries within the U.S. Exclusive Economic Zone (from 3 to 200 nm [5.6 to 370.4 kilometers] from the coastline, plus the state waters (out to 3 nm [5.6 kilometers] from the coastline) from Maine to North Carolina. The boundaries for the geographic analysis area were developed to consider impacts on federally permitted vessels operating in all fisheries in state and U.S. Exclusive Economic Zone waters surrounding the proposed Project.

Due to size of the geographic analysis area, the analysis for this EIS focuses on the commercial fisheries and for-hire recreational fishing that would likely occur in the Project area or be affected by Project-related activities, while providing context within the larger geographic analysis area.

A description of the affected environment and potential impacts related to private recreational anglers is included within Section 3.18, *Recreation and Tourism*. This section specifically discusses commercial fisheries and for-hire recreational fishing.

3.9.1 Description of the Affected Environment for Commercial Fisheries and For-Hire Recreational Fishing

Commercial Fisheries

This section provides an overview of commercial fisheries management and the economic value of fisheries in the geographic analysis area and Project area.

The primary source for regional fisheries data (Mid-Atlantic and New England regions) was Vessel Trip Report data provided by NMFS. The summary Vessel Trip Report data included catch estimates by fishing location combined with NMFS estimates of revenue using ex-vessel price data drawn from commercial fisheries data dealer reports. The primary source of fisheries data within the Lease Area was NMFS's *Socioeconomic Impacts of Atlantic Offshore Wind Development* website (https://www.fisheries.noaa.gov/resource/data/socioeconomic-impacts-atlantic-offshore-wind-development), which summarizes commercial fisheries data for each proposed WEA along the U.S. Atlantic coast. In addition, figures developed by BOEM based on NMFS Vessel Monitoring System (VMS) data provided by NMFS (2019) are included and provide additional information about fishing activities in the Lease Area.

To the extent that data are available, the commercial fishing described here includes fishing activity in both state and federal waters for those vessels issued federal fishing permits from the NMFS Greater Atlantic Region. Data on the average annual revenue of federally permitted vessels by Fishery Management Plan (FMP) fishery, gear type, and port of landing are summarized. In general, the data presented focus on those FMP fisheries, species, gear types, and ports that are relevant to commercial fishing activity in the Project area.

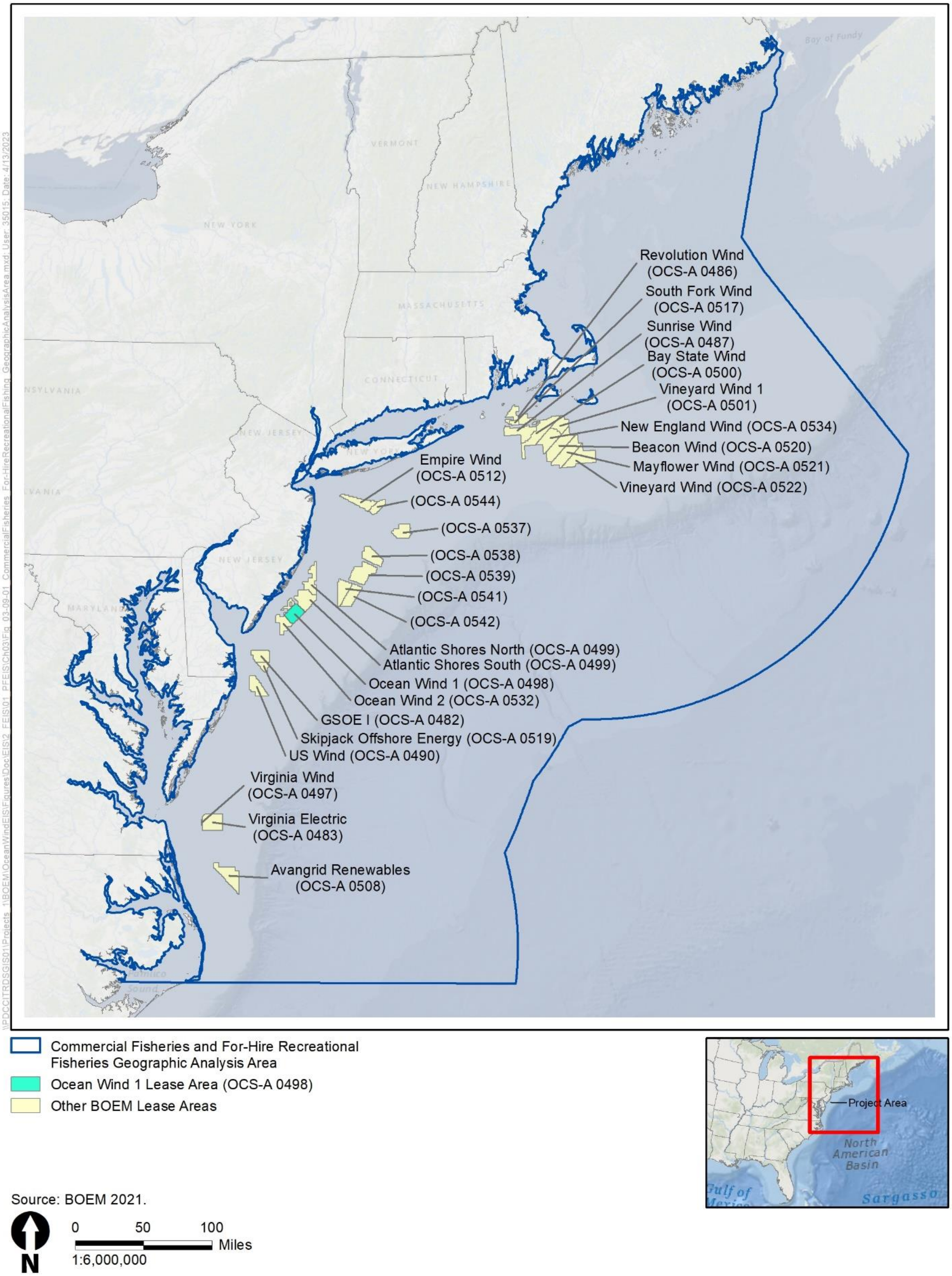


Figure 3.9-1 Commercial Fisheries and For-Hire Recreational Fishing Geographic Analysis Area

Regional Setting

Commercial fisheries operating in federal waters off the Mid-Atlantic and New England regions are known for large catches of a variety of species, including Atlantic herring (*Clupea harengus*), clams (Atlantic surfclam [*Spisula solidissima*] and ocean quahog [*Arctica islandica*]), squid (Decapodiformes), Atlantic sea scallops (*Placopecten magellanicus*), skates (Rajidae), summer flounder (*Paralichthys dentatus*), groundfish, monkfish (*Lophius americanus*), American lobster (*Homarus americanus*), and Jonah crab (*Cancer borealis*). These fishery resources are harvested with a broad assortment of fishing gear, specifically mobile gear (e.g., bottom trawl, dredge, midwater trawl) and fixed gear (e.g., gillnet, pot, bottom longline, seine, hand line). For example, dredging gear targets seafloor organisms such as surfclam, ocean quahog, and scallops; bottom trawl for monkfish and summer flounder; trawlers and purse seines for herring; and traps and pots for lobster and Jonah crab. The fishery resources are managed under several FMPs: the Northeast Multispecies (large-mesh and small-mesh) FMP,[1] Sea Scallop FMP, Monkfish FMP, Atlantic Herring FMP, Skate FMP, and Red Crab FMP under NEFMC (NEFMC 2021); the Summer Flounder/Scup/Black Sea Bass FMP, Spiny Dogfish FMP, Mackerel/Squid/Butterfish FMP, Bluefish FMP, Surfclam/Ocean Quahog FMP, and Golden and Blueline Tilefish FMP under MAFMC (MAFMC 2021); the Highly Migratory Species FMP under NMFS (NMFS 2006); and the Shad and River Herring FMP, Lobster FMP, and Jonah Crab FMP under the Atlantic States Marine Fisheries Commission (ASMFC) (ASMFC 2021). These FMP fisheries are referred to throughout this section; therefore, the author-date citations are provided only here. Commercial fisheries species managed in state waters include the American eel (*Anguilla rostrate*), Atlantic croaker (*Micropogonias undulatus*), Atlantic menhaden (*Brevoortia tyrannus*), American shad (*Alosa sapidissima*) and river herring (*Alosa*), red drum (*Sciaenops ocellatus*), horseshoe crab (*Limulus polyphemus*), and northern shrimp (*Pandalus borealis*). The American lobster, as well as Jonah crab, is managed under the authority of the Atlantic Coastal Fisheries Cooperative Management Act and is cooperatively managed by the states under the framework of ASMFC and NMFS in federal waters. American lobster is managed under Amendment 3 of the Interstate FMP and its Addenda (I–XXVI). There are three coastal migratory stocks for lobster: Gulf of Maine, Georges Bank, and Southern New England. The stocks are further divided into seven management areas. The Project area falls within the Inshore and Offshore Mid-Atlantic (Area 5) lobster area.

Within the New Jersey state waters of the Lease Area, commercial and recreational fisheries are further managed by state regulatory agencies under various ocean management plans developed at the state level or at the regional level (MAFMC). Each coastal state has its own structure of agencies and plans that govern fisheries resources. In New Jersey, NJDEP's Bureau of Marine Fisheries administers all laws relating to marine fisheries (Part 7:25, Subchapter 18 – Marine Fisheries) and is responsible for the development and enforcement of state and federal regulations pertaining to marine fish and fisheries in New Jersey state waters, including the management of diadromous species (e.g., American eel, striped bass, river herring, sturgeon).

Regional Fisheries Economic Value and Landings

This section describes federally permitted fishing activity in both federal and state waters of the Mid-Atlantic and New England fisheries. It summarizes regional data on the average annual revenue of federally permitted vessels by FMP fishery and port of landing.

[1] The Northeast Multispecies large-mesh fishery is composed of the following species: Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, windowpane flounder, American plaice, Atlantic halibut, Acadian redfish, Atlantic wolffish, ocean pout, and white hake. The Northeast Multispecies small-mesh fishery is composed of five stocks of three species of hakes: northern silver hake and southern silver hake, northern red hake and southern red hake, and offshore hake. Southern silver hake and offshore hake are often grouped together and collectively referred to as "southern whiting."

Commercial fishing contributes to the overall regional economy through direct employment, income, and gross revenues; products and services to maintain and operate fishing vessels; and seafood processors, wholesalers/distributors, and retailers. Table 3.9-1 shows the average annual revenue by FMP fishery for the Mid-Atlantic and New England fisheries from 2008 through 2021, the most recent period for which the data are available. Table 3.9-2 shows the average annual landings in pounds by species for the same period. During this period, the species with the highest average annual landed weight included Atlantic menhaden, which represented 34 percent of the average landed weight, Atlantic herring, American lobster, blue crab, sea scallop, and surfclam (Table 3.9-2). The most valuable species over this period were American lobster and sea scallop, which together represented 58 percent of the average annual revenue, followed by blue crab, eastern oyster, Atlantic menhaden, and northern quahog (Table 3.9-1).

Table 3.9-1 Commercial Fishing Revenue of the Top 20 Most Valuable Species within the Geographic Analysis Area (2008–2021)

Species[1]	FMP Fishery	Peak Annual Revenue (millions of dollars)	Average Annual Revenue (millions of dollars)	Percentage of Revenue in Geographic Analysis Area
American Lobster	American Lobster (ASMFC)	$924.7	$535.8	30.4%
Atlantic Sea Scallop	Sea Scallop	$670.6	$493.7	28.0%
Blue Crab	No federal FMP	$127.5	$94.0	5.3%
Eastern Oyster[2]	No federal FMP	$102.6	$64.8	3.7%
Atlantic Menhaden	Atlantic Menhaden	$140.5	$49.0	2.8%
Northern Quahog[2]	No federal FMP	$75.8	$44.7	2.5%
Loligo Squid	Mackerel/Squid/Butterfish	$50.1	$29.5	1.7%
Atlantic Surfclam	Surfclam/Ocean Quahog	$32.3	$27.6	1.6%
Soft-shell Clam	No federal FMP	$34.2	$24.2	1.4%
Summer Flounder	Summer Flounder/Scup/Black Sea Bass	$27.4	$22.2	1.3%
Atlantic Herring	Atlantic Herring	$31.8	$21.9	1.2%
Monkfish	Monkfish	$27.1	$18.8	1.1%
Striped Bass	No federal FMP	$22.0	$17.1	1.0%
Haddock	Northeast Multispecies (large-mesh)	$22.4	$14.7	0.8%
Atlantic Cod	Northeast Multispecies (large-mesh)	$32.6	$13.7	0.8%
American Eel	No federal FMP	$39.7	$13.6	0.8%
Ocean Quahog	Surfclam/Ocean Quahog	$22.8	$12.4	0.7%
Illex Squid	Mackerel/Squid/Butterfish	$27.3	$12.3	0.7%
Jonah Crab	Jonah Crab	$18.6	$10.8	0.6%
Silver Hake	Northeast Multispecies (small-mesh)	$11.2	$9.8	0.6%
All species[3]		**$2,476.4**	**$1,763.4**	**--**

Source: NMFS 2022a.
[1] Species are sorted by average annual revenue in descending order.
[2] Farmed.
[3] Includes 252 species and taxonomic groups (e.g., drums, skates) for which there were recorded landings.

Table 3.9-2 Commercial Fishing Landings (pounds) of the Top 20 Species by Landed Weight within the Geographic Analysis Area (2008–2021)

Species[1]	FMP Fishery	Peak Annual Landings (millions of lbs.)	Average Annual Landings (millions of lbs.)	Percentage of Landings in Geographic Analysis Area
Atlantic Menhaden	Atlantic Menhaden	504.8	423.8	33.8%
Atlantic Herring	Atlantic Herring	224.5	135.5	10.8%
American Lobster	American Lobster	159.4	132.5	10.6%
Blue Crab	No federal FMP	119.0	69.6	5.5%
Atlantic Sea Scallop	Sea Scallop	60.6	49.7	4.0%
Atlantic Surfclam	Surfclam/Ocean Quahog	50.4	36.7	2.9%
Skates	Skate	40.1	32.9	2.6%
Illex Squid	Mackerel/Squid/Butterfish	61.4	28.9	2.3%
Loligo Squid	Mackerel/Squid/Butterfish	40.1	24.4	1.9%
Monkfish	Monkfish	24.5	20.0	1.6%
Atlantic Mackerel	Mackerel/Squid/Butterfish	49.9	18.2	1.5%
Ocean Quahog	Surfclam/Ocean Quahog	31.7	16.7	1.3%
Spiny Dogfish	Spiny Dogfish	24.1	15.2	1.2%
Jonah Crab	Jonah Crab	20.2	13.9	1.1%
Silver Hake	Northeast Multispecies (small-mesh)	17.8	13.9	1.1%
Scup	Summer Flounder/Scup/Black Sea Bass	17.8	13.4	1.1%
Haddock	Northeast Multispecies (large-mesh)	22.4	13.4	1.1%
Pollock	Northeast Multispecies (large-mesh)	22.0	10.7	0.9%
Acadian Redfish	Northeast Multispecies (large-mesh)	12.9	8.4	0.7%
Summer Flounder	Summer Flounder/Scup/Black Sea Bass	13.0	8.1	0.6%
All species[2]		**1,454.0**	**1,255.4**	**--**

Source: NMFS 2022a.
[1] Species are sorted by average annual landings in descending order.
[2] Includes 252 species and taxonomic groups (e.g., drums, skates) for which there were recorded landings.

Commercial fishing fleets provide economic benefits to coastal communities in the Mid-Atlantic and New England regions. These fleets not only generate direct employment and income for vessel owners and crew, but also contribute indirectly to the employment and revenue generated through products and services necessary to maintain and operate fishing vessels, seafood processors, wholesalers/distributors, and retailers. On average, commercial fishing activity in New England and the Mid-Atlantic generated approximately $1.2 billion in annual ex-vessel revenue from 2010 through 2021. Table 3.9-3 summarizes the average annual revenue by port of landing from 2010 through 2021 for ports in the geographic analysis area. Landings in New Bedford, Massachusetts represented approximately 32 percent of the average annual commercial fishing revenue in the geographic analysis area. The ports with the next highest revenues—Cape May, New Jersey; Reedville, Virginia; and Hampton Roads area, Virginia—represented 7 percent, 6 percent, and 5 percent, respectively.

Table 3.9-3 Commercial Fishing Landings and Revenue for the Top 20 Highest Revenue Ports in the Geographic Analysis Area, 2010–2021

Port and State[1]	Peak Annual Landings (millions lbs.)	Average Annual Landings (millions lbs.)	Peak Annual Revenue (millions dollars)	Average Annual Revenue (millions dollars)	Percentage of Revenue in Geographic Analysis Area
New Bedford, Massachusetts	170.0	126.4	$569.7	$367.9	31.7%
Cape May, New Jersey	113.5	69.0	$147.7	$80.8	7.0%
Reedville, Virginia	426.1	349.0	$466.5	$65.4	5.6%
Hampton Roads Area, Virginia	19.3	15.1	$88.3	$60.8	5.2%
Gloucester, Massachusetts	122.3	72.5	$80.3	$54.1	4.7%
Stonington, Maine	25.4	17.7	$73.2	$50.4	4.3%
Point Judith, Rhode Island	57.3	45.6	$72.1	$49.2	4.2%
Vinalhaven, Maine	13.4	9.7	$55.8	$36.0	3.1%
Point Pleasant, New Jersey	43.3	25.2	$35.7	$28.7	2.5%
Portland, Maine	62.4	42.9	$38.1	$28.5	2.5%
Provincetown-Chatham, Massachusetts	26.5	18.7	$35.5	$28.3	2.4%
Barnegat Light, New Jersey	8.9	7.2	$33.8	$25.7	2.2%
Wanchese-Stumpy Point, North Carolina	25.6	18.7	$26.6	$22.4	1.9%
Friendship, Maine	9.1	6.2	$40.7	$22.0	1.9%
Beals Island, Maine	8.1	6.6	$35.6	$21.4	1.8%
Newington, New Hampshire	4.7	3.9	$30.0	$20.3	1.7%
Atlantic City, New Jersey	35.3	25.6	$24.1	$18.9	1.6%
Montauk, New York	14.8	11.7	$21.2	$16.8	1.4%
Boston, Massachusetts	20.2	14.8	$19.3	$16.3	1.4%
Spruce Head, Maine	6.3	4.4	$31.5	$16.1	1.4%
All Ports[2]	**1,073.7**	**998.1**	**$2,196.3**	**$1,160.1**	**--**

Source: NMFS 2022a.
[1] Ports are sorted by average annual revenue in descending order.
[2] Includes 58 ports within the New England and Mid-Atlantic region, which encompasses the geographic analysis area.

Commercial Fisheries in the Lease Area

The commercial fisheries active in the Lease Area encompass a wide range of FMP fisheries, gears, and landing ports, although NMFS VMS data[2] indicate that most FMP fisheries within the Lease Area do not have a high level of fishing effort compared to surrounding areas (see Figure 2.3.4-1 to Figure 2.3.4-7 in COP Volume II, Section 2.3.4.1.3; Ocean Wind 2023). Table 3.9-4 and Table 3.9-5 provide data on revenue and landings for 2008 through 2021 for commercial fisheries in the Lease Area for vessels that were issued federal fishing permits by the NMFS Greater Atlantic Region.

[2] VMS coverage is not universal for all fisheries. Non-VMS data have declared as out of fishery, meaning they have declared out of a fishery managed by days-at-sea effort controls (i.e., scallops, Northeast multispecies, and monkfish).

Table 3.9-4 Commercial Fishing Revenue of Federally Permitted Vessels in the Lease Area by FMP Fishery (2008–2021)

FMP Fishery	Average Annual Revenue	Total Annual Revenue	Average Annual Revenue as Percentage of Total Revenue from the Geographic Analysis Area	Average Annual Number of Vessels in the Lease Area	Average Annual Number of Vessel Trips in the Lease Area
Top Five FMPs					
Sea Scallop	$131,714	$1,844,000	0.03%	74	121
Surfclam, Ocean Quahog	$128,357	$1,797,000	0.15%	14	118
ASMFC FMP	$44,786	$627,000	<0.01%	29	182
No Federal FMP	$28,286	$396,000	0.01%	42	254
Summer Flounder, Scup, Black Sea Bass	$14,714	$206,000	0.04%	66	249
Total Top Five FMPs	**$347,857**	**$4,870,000**	**--**	**225**	**924**
Other FMP Fisheries					
Mackerel, Squid, and Butterfish	$11,857	$166,000	0.02%	43	112
Monkfish	$4,214	$59,000	0.02%	65	132
Skates	$1,786	$25,000	0.03%	11	74
Atlantic Herring	$500	$7,000	<0.01%	2	3
All Others[2]	$286	$4,000	<0.01%	NA	NA
Highly Migratory Species	$286	$4,000	<0.01%	12	22
Bluefish	$71	$1,000	<0.01%	28	46
Small-Mesh Multispecies	$71	$1,000	<0.01%	18	38
Northeast Multispecies	$71	$1,000	<0.01%	4	9
Southeast Regional Office FMP	$71	$1,000	0.02%	9	13
Spiny Dogfish	<$36	<$500	<0.01%	3	7
Tilefish	<$36	<$500	<0.01%	12	18
Total Other FMP Fisheries	**$19,214**	**$269,000**	--	**207**	**474**
All FMP Fisheries	**$367,071**	**$5,139,000**	**0.02%**	**432**	**1,398**

Source: Developed using data from NMFS 2022b.
Notes: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region. Numbers are in 2021 dollars and Total Revenue is rounded to nearest $1,000. NA indicates data not available to perform calculations. Differences in totals are due to rounding. Averages were calculated based upon total counts across years 2008–2021 then divided by 14 years.
[1] Regional comparison is relative to the individual species noted, not all species combined.
[2] All Others refers to FMP fisheries with fewer than three permits or dealers affected to protect data confidentially.

Table 3.9-5 Commercial Fishing Landings (pounds) of Federally Permitted Vessels in the Lease Area (2008–2021)

FMP Fishery	Average Annual Landings (Pounds)	Total Landings (Pounds)
Top Five Fisheries		
ASMFC FMP	339,214	4,749,000
Surfclam, Ocean Quahog	176,214	2,467,000
Sea Scallop	12,786	179,000
Summer Flounder, Scup, Black Sea Bass	5,571	78,000
No Federal FMP	4,929	69,000
Total	**5,571**	**7,542,000**
Other FMP Fisheries		
Mackerel, Squid, and Butterfish	17,929	251,000
Atlantic Herring	4,357	61,000
Skates	3,786	53,000
Monkfish	2,429	34,000
All Others	1,571	22,000
Highly Migratory Species	214	3,000
Spiny Dogfish	143	2,000
Bluefish	143	2,000
Small-Mesh Multispecies	143	2,000
Southeast Regional Office FMP	<36	<500
Northeast Multispecies	<36	<500
Tilefish	30,714	<500
Total	**569,429**	**430,000**
All FMP Fisheries	**17,929**	**7,972,000**

Source: NMFS 2022b.
Notes: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region. Total landings rounded to nearest 1,000. Differences in totals are due to rounding. Averages were calculated based upon total counts across years 2008–2021 then divided by 14 years.

The top fisheries by revenue in the Lease Area were Sea Scallop, Surfclam/Ocean Quahog, ASMFC FMP, the No Federal FMP,[3] and Summer Flounder/Scup/Black Sea Bass. The top FMP fisheries accounted for approximately 97 percent of total revenue generated commercially within the Lease Area from 2008 through 2021 and approximately 95 percent of all landings. While the Sea Scallop FMP fishery only accounted for roughly 2 percent of the total landings, it was the top revenue producer, accounting for approximately 36 percent of the total revenue produced within the Lease Area. Sea Scallop and Surfclam/Ocean Quahog together accounted for approximately 71 percent of the total revenue and 33 percent of the total landings within the Lease Area. In total, the Lease Area accounted for

[3] The No Federal FMP contains a variety of species that are managed under an FMP but are not federally regulated, such as the smooth and chain dogfish (*Mustelus canis* and *Scyliorhinus retifer*, respectively), whelk (Buccinidae), and menhaden. In total, there are approximately 88 species caught within the Lease Area that are not regulated under a federal FMP (NMFS 2022b).

approximately 0.02 percent of the total revenue across all FMP fisheries in the Mid-Atlantic and New England regions.

As noted, the No Federal FMP includes a variety of species that are managed under an FMP but are not federally regulated, including the menhaden, which is an important species to commercial fisheries operating in and around New Jersey. The Atlantic menhaden fishery is managed by ASMFC. The Atlantic menhaden commercial fishery consists of a reduction fishery (named because it "reduces" the whole fish into fish meal, fish oil, and fish solubles) and a bait fishery. Commercial landings overall in 2021 including reduction, bait, bycatch, and episodic event landings were 195,092 metric tons, which was a 6-percent increase from 2020 landings (ASMFC 2023). The current management quota allocations for Atlantic menhaden include 11 percent for New Jersey, which is second only to Virginia at 75 percent. Recent assessments indicate the stock is not overfished or experiencing overfishing and the total allowable catch for 2023 through 2025 includes an increase of approximately 20 percent from the total allowable catch from 2021–2022 (ASMFC 2023).

Table 3.9-6 and Table 3.9-7 provide the revenue (average annual and total) and landings in pounds (average annual and total) in the Lease Area by gear type for the 2008–2021 period. Together, dredge-scallop and dredge-clam accounted for approximately 71 percent of the total revenue generated by commercial fishing activity in the Lease Area, followed by pot-other and all others. When compared to the entire geographic analysis area, this only equated to 0.01 percent of average annual revenue. From an average annual landings perspective, the all others category generated the highest percentage of landings at over 59 percent, followed by dredge-clam at approximately 31 percent, and when compared to the geographic analysis area were 0.03 percent and 0.01 percent, respectively.

Table 3.9-6 Commercial Fishing Revenue of Federally Permitted Vessels in the Lease Area by Gear Type (2008–2021)

Gear Type	Average Annual Revenue	Total Revenue	Percentage of Annual Average Revenue in the Geographic Analysis Area [1]
Dredge-Scallop	$130,857	$1,832,000	0.01%
Dredge-Clam	$128,500	$1,799,000	0.01%
Pot-Other[1]	$42,357	$593,000	0.00%
All Others[3]	$38,857	$544,000	0.00%
Trawl-Bottom	$19,571	$274,000	0.00%
Gillnet-Sink	$4,857	$68,000	0.00%
Pot-Lobster	$1,143	$16,000	0.00%
Trawl-Midwater	$786	$11,000	0.00%
All Gear Types	**$367,000**	**$5,138,000**	**0.02%**

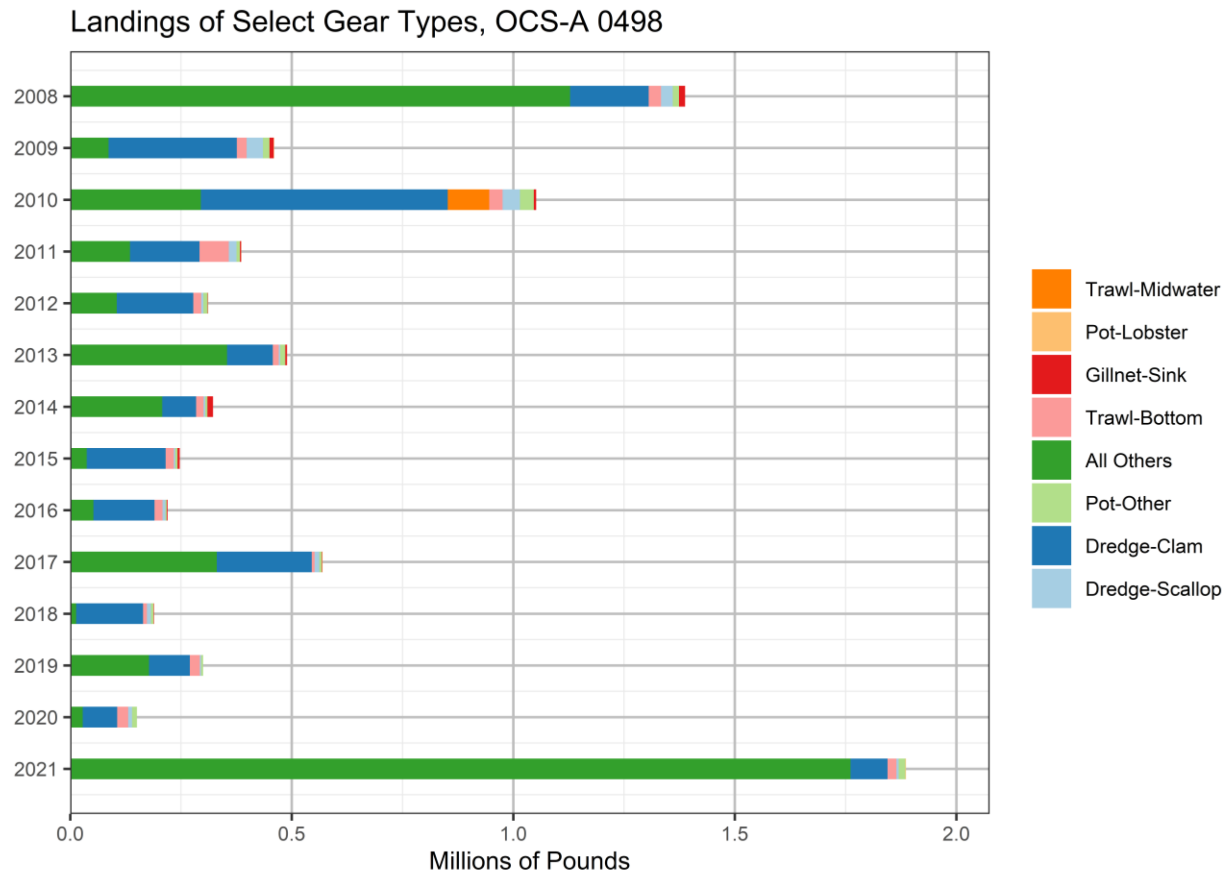
Source: Developed using data from NMFS 2022b.
Notes: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region. Revenue is in 2021 dollars, with total revenue rounded to nearest thousand. Differences in totals are due to rounding. Averages were calculated based upon total counts across years 2008–2021 then divided by 14 years.
[1] Calculated as the average annual revenue generated by gear type in the Lease Area divided by the total average revenue generated by all gear types in the geographic analysis area. A value of 0.00% means there is a value below 0.01%, but not zero.
[2] Pot-Other includes pot gear used in the Lobster FMP fishery.
[3] All Others includes Seine-Purse.

Table 3.9-7 Commercial Fishing Landings (pounds) of Federally Permitted Vessels in the Lease Area by Gear Type (2008–2021)

Gear Type	Average Annual Landings (Pounds)	Total Landings (Pounds)	Percentage of Annual Average Landings in the Geographic Analysis Area [1]
All Others[2]	336,643	4,713,000	0.03%
Dredge-Clam	176,286	2,468,000	0.01%
Trawl-Bottom	22,429	314,000	0.00%
Dredge-Scallop	12,786	179,000	0.00%
Pot-Other[3]	10,143	142,000	0.00%
Trawl-Midwater	6,714	94,000	0.00%
Gillnet-Sink	4,143	58,000	0.00%
Pot-Lobster	286	4,000	0.00%
All Gear Types	**569,429**	**7,972,000**	**0.05%**

Source: NMFS 2022b.
Note: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region. Differences in totals are due to rounding. Averages were calculated based upon total counts across years 2008–2021 then divided by 14 years.
[1] Calculated as the annual average landings by gear type in the Lease Area divided by the total average landings generated by all gear types in the geographic analysis area. A value of 0.00% means there is a value below 0.01%, but not zero.
[2] All Others includes Seine-Purse.
[3] Pot-Other includes pot gear used in the Lobster FMP fishery.

From 2008 through 2020, landings within the Lease Area had generally decreased across all gear types; however, in 2021 there was a substantial increase specifically for the All Others category (see Figure 3.9-2).



Source: NMFS 2022b

Figure 3.9-2 Summary of Landings (pounds) by Gear Type in Lease Area

It is widely acknowledged that there are a number of attributes and variables that are important data points to incorporate into the development of social indicators. Fisheries are part of social-ecological systems that take into account inter-relationships between ecological functions and human communities that depend on ecosystem services for their well-being. Research and resources are available that attempt to capture this relationship and potential impact. For example, the Social Wellbeing in Fisheries Tool can be used to understand social aspects of fisheries performance, including security, flexibility, and viability at the individual, community, and system levels. Well-being objectives to consider according to the article include impacts on income and employment, infrastructure investment, equitable distribution of fisheries benefits, maintaining fishing opportunities for small-scale operators, promoting food security, and maintaining cultural importance of fishing to the community (Van Holt et al. 2016).

Incorporation of social sciences, including social indicators that can be scaled to various geographic study areas and provide a mechanism to track progress toward sustainability goals, is important (Clay and Colburn 2020; Hicks et al. 2016). Social vulnerability indicators and gentrification pressure indicators are important data sources and information to consider, including the impact on traditional values and historical significance of fishing areas in the region. In addition, consideration of the demographics, well-being indicators, and job satisfaction of those working in the commercial fisheries and for-hire recreational fishing industries is important.

As found in the literature, established fishing communities are oftentimes forced to adapt to new social, economic, and environmental conditions and as a result many fishing communities in the Northeast have been supplemented with technology-based industries and tourism or are heavily affected by coastal development, gentrification, and the emergence of retirement communities (Claesson et al. 2006). Increased tourism and recreational boating and fishing infrastructure as a result of gentrification has also resulted in space-use conflicts both onshore and offshore between commercial and recreational fishing (Jepson and Colburn 2013; Thompson et al. 2016; Hall-Arber et al. 2001) that could be exacerbated by offshore wind development.

As such, social vulnerability indicators (i.e., personal disruption, population consumption, and poverty) and gentrification pressure indicators (i.e., retiree migration and urban sprawl) along with other selected socioeconomic characteristics of communities with fishing ports that could be affected by the Project are also presented in Section 3.11 (*Demographics, Employment, and Economics*) and Section 3.12 (*Environmental Justice*).

Table 3.9-8 shows the average number of vessel trips and average number of vessels fishing in the Lease Area by port for 2008 through 2021. The Lease Area is predominantly utilized by vessels whose home ports are in the Mid-Atlantic. Of the 676 average annual trips, the Mid-Atlantic has taken 604 trips. Of the 150 average annual vessels, the Mid-Atlantic region effort consists of 109 vessels. Table 3.9-9 provides a ranking of ports by revenue of fishing vessels in the Lease Area from 2008 through 2021, as well as the level of commercial fishing engagement and reliance of the community in which the port is located. As noted earlier, these rankings portray the level of dependence of the community on commercial fishing and are compiled by NMFS (NOAA Fisheries Office of Science and Technology 2021). Seventy-five percent of the trips of fishing vessels that operate within the Lease Area originate from the Atlantic City, Cape May, and Sea Isle City ports in New Jersey. Atlantic City and Cape May receive the highest value of landings of any ports, with respective totals of $1.665 million and $1.150 million for 2008 through 2021. These ports contribute just over 64 percent of the total revenue for the Lease Area. As shown in the table, the commercial fishing engagement and reliance differ across communities that engage in commercial fishing within the Lease Area. For example, while Cape May ranks high in both commercial fishing engagement and reliance, Atlantic City, which generates the most revenue from the Lease Area, ranks high in fishing engagement but low in the community’s reliance on commercial fishing. Information regarding the ranking determinations for each community is provided in the community profiles available from NMFS (NMFS 2021d). These profiles present the most recent data available for these key indicators of New England and Mid-Atlantic fishing communities related to dependence on fisheries and other economic and demographic characteristics.

Table 3.9-8 Commercial Fishing Trips and Vessels in the Lease Area by Port (2008–2021)

Port and State	Average Annual Trips[1,2]	Average Annual Vessels[2]
Atlantic City, New Jersey	247	18
Barnegat, New Jersey	34	7
Beaufort, North Carolina	5	4
Cape May, New Jersey	143	46
Chincoteague, Virginia	1	1
Davisville, Rhode Island	3	1
Fairhaven, Massachusetts	0	0
Hampton, Virginia	14	8
Montauk, New York	1	0
Long Beach, New Jersey	5	1
New Bedford, Massachusetts	34	23

Port and State	Average Annual Trips[1,2]	Average Annual Vessels[2]
New London, Connecticut	1	1
Newport News, Virginia	22	15
North Kingstown, Rhode Island	8	1
Ocean City, Maryland	12	6
Oriental, North Carolina	1	1
Point Judith, Rhode Island	17	8
Point Pleasant, New Jersey	2	2
Sea Isle City, New Jersey	120	5
Shinnecock, New York	0	0
Wanchese, North Carolina	4	3
Wildwood, New Jersey	2	0
Total	**676**	**150**

Source: Developed using data from NMFS 2022b.
Note: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region. Differences in totals are due to rounding. Averages were calculated based upon total counts across years 2008–2021 then divided by 14 years.
[1] Trips were not necessarily made in every year, but all ports had at least one or more years where trips were made. Ports with only one year where trips to the Lease Area were made include Fairhaven, Massachusetts (2010); Montauk, New York (2009); Long Beach, New Jersey (2008); and Shinnecock, New York (2009).
[2] Zeros are due to rounding.

Table 3.9-9 Commercial Fishing Revenue of Federally Permitted Vessels in the Lease Area by Port (2008–2021)

Port and State	Average Annual Revenue	Total Revenue for the 12-Year Period	Commercial Fishing Engagement Categorical Ranking[1]	Commercial Fishing Reliance Categorical Ranking[2]
Atlantic City, New Jersey	$118,946	$1,665,000	High	Low
Cape May, New Jersey	$82,156	$1,150,000	High	High
New Bedford, Massachusetts	$26,005	$364,000	High	Medium
Newport News, Virginia	$19,658	$275,000	High	Low
Sea Isle City, New Jersey	$16,503	$231,000	Medium	Medium
Barnegat, New Jersey	$6,483	$91,000	Low	Low
Wildwood, New Jersey	$3,786	$53,000	Medium	Low
Hampton, Virginia	$3,104	$43,000	High	Low
Ocean City, Maryland	$2,537	$36,000	High	Medium
Long Beach, New Jersey	$1,112	$16,000	Low	Low
Beaufort, North Carolina	$1,088	$15,000	High	Medium
Point Judith, Rhode Island	$637	$9,000	High	Medium
North Kingstown, Rhode Island	$445	$6,000	High	Low
Point Pleasant, New Jersey	$433	$6,000	High	Medium
Wanchese, North Carolina	$260	$4,000	High	Medium
New London, Connecticut	$215	$3,000	Medium-High	Low

Port and State	Average Annual Revenue	Total Revenue for the 12-Year Period	Commercial Fishing Engagement Categorical Ranking[1]	Commercial Fishing Reliance Categorical Ranking[2]
Davisville, Rhode Island	$206	$3,000	High	Low
Chincoteague, Virginia	$57	$1,000	Medium	Medium
Oriental, North Carolina	$43	$1,000	Medium	Medium
Montauk, New York	$21	<$1,000	High	Medium
Shinnecock, New York	$8	<$1,000	High	Low
All Others	$28,905	$405,000	NA	NA

Source: Developed using data from NMFS 2022b; NOAA Fisheries Office of Science and Technology 2021.
Notes: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region. Revenue is in 2021 dollars with total revenue rounded to nearest thousand. Averages were calculated based upon total counts across years 2008–2021 then divided by 14 years.
[1] Commercial fishing engagement measures the presence of commercial fishing through fishing activity as shown through permits, fish dealers, and vessel landings. A high rank indicates more engagement. Rankings are for 2019, the latest year data are available.
[2] Commercial fishing reliance measures the presence of commercial fishing in relation to the population size of a community through fishing activity. A high rank indicates more reliance. Rankings are for 2019, the latest year data are available.
NA = not applicable

Annual average commercial fishing landings and revenue within the Lease Area from 2008–2021 are summarized by fishing port in Table 3.9-10 and by state in Table 3.9-11. The fishing ports with the highest landed weight were Atlantic City, New Jersey and Cape May, New Jersey, which combined for over 83 percent of the total annual average landings from the Lease Area, and 0.01 percent and 0.02 percent of the geographic analysis area, respectively. No other fishing port landed more than an average of 10,000 pounds per year, except the all others category. From an average annual revenue perspective, Atlantic City, New Jersey and Cape May, New Jersey accounted for over 64 percent of the average annual revenue generated within the Lease Area, and 0.01 percent of the geographic analysis area, each. No other fishing ports had above 0.01 percent of the geographic analysis area average annual revenue.

When looking at average annual landings and revenue generated by state, Table 3.9-11 shows that ports in New Jersey generated over 86 percent of the average landings and, compared to the geographic analysis area, this equated to 0.04 percent. No other states reached 0.01 percent of the geographic analysis area in average annual landings from the Lease Area.

In general, fishing ports and states that derive higher percentages of landings and revenue from the Lease Area are expected to experience greater impacts from the Proposed Action. However, this should also be considered relative to the overall commercial fishing engagement and reliance of ports, as outlined in Table 3.9-9. For instance, the two ports with the highest percentage of annual average revenue generated within the Lease Area are the New Jersey ports of Atlantic City and Cape May. Both have a “high” commercial fishing engagement ranking, but Atlantic City has a “low” commercial fishing reliance rank and Cape May has a “high” commercial fishing reliance rank.

Table 3.9-10 Annual Average Commercial Fishing Landings and Revenue Exposed to the Wind Farm Area by Port Based on Annual Average Revenue 2008–2021

Port	Lease Area Landings (pounds)	Percentage of Landings in the Geographic Analysis Area[1]	Lease Area Average Annual Revenue (2020 dollars)	Percentage of Revenue in the Geographic Analysis Area[2]
Atlantic City, New Jersey	173,674	0.01%	$134,370	0.01%
Cape May, New Jersey	304,731	0.02%	$89,625	0.01%
New Bedford, Massachusetts	5,001	0.00%	$28,865	0.00%
Newport News, Virginia	2,932	0.00%	$22,982	0.00%
Sea Isle City, New Jersey	5,523	0.00%	$17,960	0.00%
Barnegat, New Jersey	2,840	0.00%	$7,089	0.00%
Hampton, Virginia	774	0.00%	$3,587	0.00%
Wildwood, New Jersey	3,582	0.00%	$3,584	0.00%
Ocean City, Maryland	1,971	0.00%	$2,780	0.00%
Long Beach, New Jersey	993	0.00%	$1,343	0.00%
Beaufort, North Carolina	182	0.00%	$1,071	0.00%
Point Judith, Rhode Island	601	0.00%	$691	0.00%
North Kingstown, Rhode Island	1,166	0.00%	$527	0.00%
Point Pleasant, New Jersey	185	0.00%	$500	0.00%
Wanchese, North Carolina	179	0.00%	$305	0.00%
New London, Connecticut	32	0.00%	$258	0.00%
Davisville, Rhode Island	413	0.00%	$229	0.00%
Chincoteague, Virginia	35	0.00%	$65	0.00%
Oriental, North Carolina	35	0.00%	$52	0.00%
Montauk, New York	27	0.00%	$25	0.00%
Shinnecock, New York	9	0.00%	$10	0.00%
All Others[3]	67,136	0.01%	$32,466	0.00%
All Ports	**572,021**	**0.05%**	**$348,384**	**0.02%**

Sources: Developed using data from NMFS (2022b).
Notes: Revenue values have been adjusted to real 2020 dollars and are estimated based on the annual average revenue by port from 2008 through 2021. Ports were then sorted by revenue in descending order, with All Others listed last, as it is not attributable to a specific port.
[1] Calculated as the landed weight at a port from the Lease Area divided by the total landed weight across all ports from the geographic analysis area. A value of 0.00% means there is a value below 0.01%, but not zero.
[2] Calculated as the revenue at a port from the Lease Area divided by the total revenue across all ports from the geographic analysis area. A value of 0.00% means there is a value below 0.01%, but not zero.
[3] “All Others” is for data that have been aggregated for confidentiality purposes.

Table 3.9-11 Annual Average Commercial Fishing Revenue Exposed to the Wind Farm Area by State Based on Annual Average Revenue 2008–2021

State	Lease Area Landings (pounds)	Percentage of Landings in the Geographic Analysis Area[1]	Lease Area Average Annual Revenue (2020 dollars)	Percentage of Revenue in the Geographic Analysis Area[2]
New Jersey	493,329	0.04%	$261,367	0.01%
Virginia	5,199	0.00%	$38,600	0.00%
Massachusetts	60,883	0.00%	$35,911	0.00%
Rhode Island	9,015	0.00%	$6,387	0.00%
Maryland	1,895	0.00%	$2,583	0.00%
North Carolina	668	0.00%	$2,064	0.00%
Connecticut	71	0.00%	$550	0.00%
New York	50	0.00%	$53	0.00%
Delaware	3	0.00%	$9	0.00%
All Others[3]	910	0.00%	$862	0.00%
All States	**572,023**	0.05%	**$348,386**	0.02%

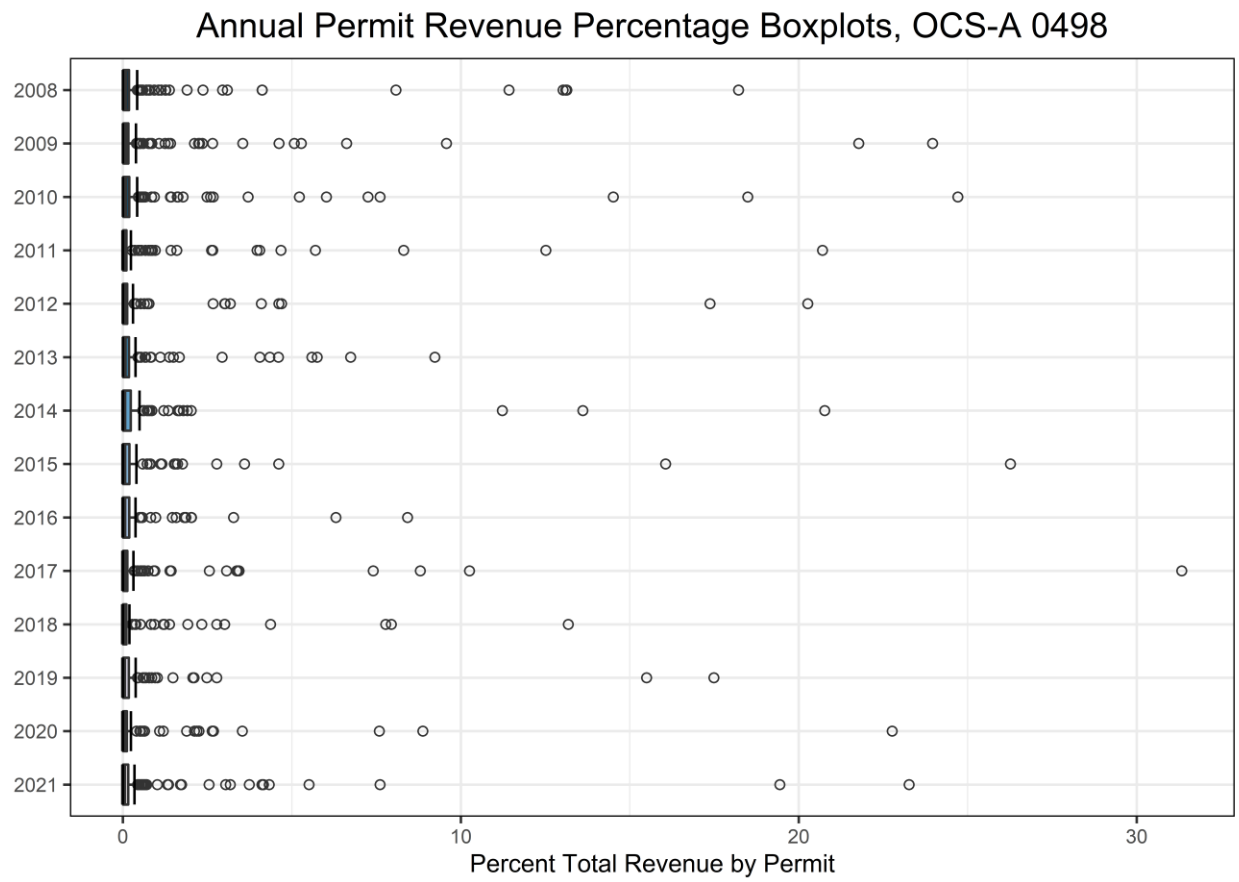
Sources: Developed using data from NMFS (2022b).
Notes: Revenue values have been adjusted to real 2020 dollars and are estimated based on the annual average revenue by state from 2008 through 2021. They were then sorted by highest average annual revenue, with All Others listed last, as it is not attributable to a specific state.
[1] Calculated as the landed weight at a port from the Lease Area divided by the total landed weight across all ports from the geographic analysis area. A value of 0.00% means there is a value below 0.01%, but not zero.
[2] Calculated as the revenue at a port from the Lease Area divided by the total revenue across all ports from the geographic analysis area. A value of 0.00% means there is a value below 0.01%, but not zero.
[3] "All Others" is for data that have been aggregated for confidentiality purposes.

To analyze differences in the economic importance of fishing grounds in the Lease Area across the commercial fishing fleet, NMFS analyzed the percentage of each permit's total commercial fishing revenue attributed to catch within the Lease Area during 2008 through 2021 (NMFS 2022b).

The vessel-level annual revenue percentages were divided into quartiles, which were created by ordering the data from lowest to highest percentage value and then dividing the data into four groups of equal size. The first quartile represents the lowest 25 percent of ranked percentages, while the fourth quartile represents the highest 25 percent.

The distribution of the vessel-level annual revenue percentages for the Lease Area is provided in the boxplot on Figure 3.9-3. The boxplot begins at the first quartile, or the value beneath which 25 percent of all vessel-level revenue percentages fall. A thick line within the box identifies the median, the observation that 50 percent of vessel-level revenue percentages are above or beneath. The box ends at the third quartile, or the vessel-level revenue percentage beneath which 75 percent of observations fall. Nonparametric estimates of the minimum and maximum values are also indicated by the "whiskers" (dashed line terminating in a vertical line) that jut out from each side of the box. Any points outside of these whiskers are vessel-level revenue percentages that are considered outliers. In the context of this analysis, an outlier is a vessel that derived an exceptionally high proportion of its annual revenue from the Lease Area in comparison to other vessels that fished in the area.[4]

[4] Technically, an outlier in a boxplot distribution is an observation that is more than 1.5 times the length of the box away from either the first quartile (Q1) or third quartile (Q3). Specifically, if an observation is less than Q1 – (1.5 × IQR) or greater than Q3 + (1.5 × IQR), it is an outlier; where IQR = interquartile range = Q3 – Q1.



Source: NMFS 2022b.

Figure 3.9-3 Percentage of Total Commercial Fishing Revenue of Federally Permitted Vessels Derived from the Lease Area by Vessel (2008–2021)

Table 3.9-12 presents the minimum, first quartile, median, third quartile, and maximum values for the Lease Area from 2008 through 2021. Table 3.9-13 presents the number of outliers by year.

Table 3.9-12 Analysis of 14-Year Permit Revenue Boxplots for the Lease Area (2008–2021)

Minimum Revenue Percentage Value	First Quartile	Median	Third Quartile	Maximum Revenue Percentage Value[1]
0	0	0.04	0.16	31

Source: Developed using data from NMFS 2022b.
Note: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region.
[1] Maximum value is inclusive of outliers.

Table 3.9-13 Number of Federally Permitted Vessels in the Lease Area (2008–2021)

Year	Number of Vessels	Number of Outliers	Number of Outliers as a Percentage of Total Vessels
2021	139	28	20.1%
2020	111	18	16.2%

Year	Number of Vessels	Number of Outliers	Number of Outliers as a Percentage of Total Vessels
2019	115	19	16.5%
2018	131	18	13.7%
2017	139	25	18.0%
2016	123	14	11.4%
2015	108	15	13.9%
2014	126	19	15.1%
2013	132	20	15.2%
2012	139	18	12.9%
2011	180	28	15.6%
2010	268	33	12.3%
2009	282	31	11.0%
2008	260	33	12.7%
Average	**161**	**23**	**14.2%**

Source: Developed using data from NMFS 2022b.
Note: Data are for vessels issued federal fishing permits by the NMFS Greater Atlantic Region.

A total of 75 percent of the permitted vessels that fished in the Lease Area derived less than 0.16 percent of their total annual revenue from the area (NMFS 2022b). The highest percentage of total annual revenue attributed to catch within the Lease Area was 31 percent in 2017, but varied from year to year. Although outliers derived a high proportion of their annual revenue from the Lease Area in comparison to other vessels that fished in the area, Figure 3.9-3 shows that, in any given year, the revenue percentage for the majority of outliers was below 5 percent. As such, while some vessels depended heavily on the Lease Area for their commercial fishing revenue, most derived a small percentage of their total annual revenue from the area.

Another aspect of commercial fishing within the Lease Area is the proportion of small business operations compared to large businesses. To characterize the amount of fishing revenue from the Lease Area that is generated by small businesses, NMFS conducted a small business analysis. The analysis defined a small business as a business that is independently owned and operated, is not dominant in its field of operation (including its affiliates), and has combined annual receipts not in excess of $11 million for all its affiliated operations worldwide. The analysis was conducted upon unique business interests, which can represent multiple vessel permits. Both within the Northeast region as well as the Ocean Wind Lease Area, there are more small businesses operating than large businesses. The number of small and large businesses engaged in federally managed fishing and the revenue of those businesses from 2019 through 2021 are summarized for the geographic analysis area in Table 3.9-14 and for the Lease Area in Table 3.9-15. During this 3-year time period, an annual average of 1,166 businesses fished in the geographic analysis area, of which 1,155 (99 percent) were small businesses and 11 (1 percent) were large businesses. Businesses engaged in fishing in the geographic analysis area generated an annual average revenue of more than $1 billion, of which over $777 million (77 percent) was attributed to small businesses and $232 million (23 percent) was attributed to large businesses. During this same time period, an annual average of 89 businesses fishing in the Lease Area, of which 81 (91 percent) were small businesses and 8 (9 percent) were large businesses. Businesses generated an annual average revenue of $272,000 in the Lease Area, of which $239,000 (88 percent) was attributed to small businesses and $33,000 (12 percent) was attributed to large businesses. Small businesses that fished inside the Lease Area generated 0.118 percent of their total revenue from the Lease Area, while large businesses that fished inside the Lease Area generated 0.020 percent of their total revenue from the Lease Area, demonstrating that small businesses were more reliant on revenue generated from the Lease Area.

Table 3.9-14 Number and Revenue of Small and Large Businesses Engaged in Federally Managed Fishing within the Geographic Analysis Area, 2019–2021

Year	Business Type	Number of Entities	Revenue (thousands of dollars)[1]
2019	Large business	11	$247,928
	Small business	1,130	$799,249
2020	Large business	11	$200,342
	Small business	1,144	$684,526
2021	Large business	11	$248,437
	Small business	1,190	$849,039
Annual Average	**Large business**	**11**	**$232,236**
	Small business	**1,155**	**$777,605**

Source: Developed using data from NMFS 2022b.
[1] Revenue values have been delated to 2021 dollars and rounded to the nearest thousand.

Table 3.9-15 Number and Revenue of Small and Large Businesses Inside the Lease Area Compared to the Total Revenue of those Businesses, 2019–2021

Year	Business Type	Number of Entities	Revenue from Lease Area (thousands of dollars)[1]	Total Revenue (thousands of dollars)[1]	Percentage of Revenue from Lease Area
2019	Large business	8	$40	$181,251	0.022%
	Small business	70	$129	$178,269	0.072%
2020	Large business	9	$32	$167,555	0.019%
	Small business	70	$174	$153,437	0.113%
2021	Large business	7	$27	$158,163	0.017%
	Small business	102	$413	$274,758	0.150%
Annual Average	**Large business**	**8**	**$33**	**$168,990**	**0.020%**
	Small business	**81**	**$239**	**$202,155**	**0.118%**

Source: Developed using data from NMFS 2022b.
[1] Revenue values have been delated to 2021 dollars and rounded to the nearest thousand.

Commercial fishing regulations include requirements for VMS. A VMS is a satellite surveillance system that monitors the location and movement of commercial fishing vessels; therefore, it is a good data source for understanding the spatial distribution of fishing vessels engaged in FMP fisheries in the Northeast region. However, VMS coverage is not universal for all fisheries, with some fisheries (summer flounder, scup, black sea bass, bluefish, American lobster, spiny dogfish, skate, whiting, and tilefish) not covered at all by VMS (for a greater description of the limitations of VMS data see Appendix D, Section D1.6). In 2018 there were 912 VMS-enabled vessels operating in the Northeast across all fisheries. These 912 vessels represented a substantial portion (71–87 percent) of summer flounder, scup, black sea bass, and skate landings, and greater than 90 percent of landings for scallops, squid, monkfish, herring, mackerel, large mesh multispecies, whiting, surfclams, and ocean quahogs. VMS vessels represented less than

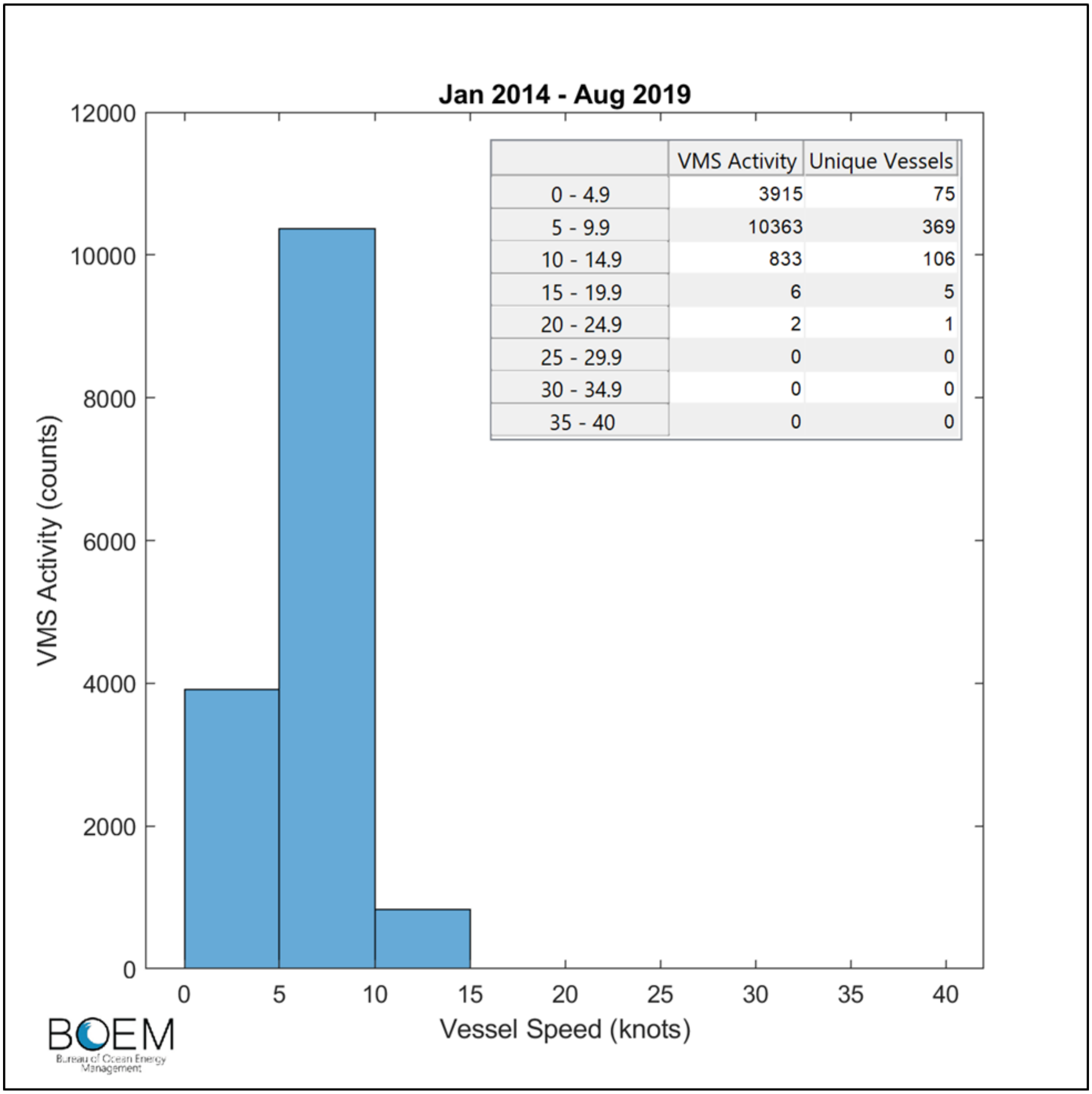
20 percent of highly migratory species and 10 percent of lobster/Jonah crab landings (NMFS pers. comm. 2020).

Using VMS data conveyed in individual position reports (pings) from January 2014 to August 2019, BOEM compiled information about fishing activities within the Lease Area (NMFS 2019). From the VMS data, it is interpreted that vessels with speeds less than 5 knots (2.6 m/s) are actively engaged in fishing, although vessels may also be using slower speeds to transit or be engaged in other activities such as processing at sea. Vessels traveling faster than 5 knots (2.6 m/s) are generally interpreted to be transiting. Figure 3.9-4 indicates that only about 13 percent of the 556 unique vessels identified operating in the Lease Area during the above-referenced period were actively fishing. BOEM also developed polar histograms using the VMS data that show the directionality of VMS-enabled vessels operating in the Project area and the targeted FMP fishery (Figure 3.9-5 through Figure 3.9-9). The larger bars in the polar histograms represent a greater number of position reports showing fishing vessels moving in a certain direction within the Project area. The polar histograms differ with respect to their scales.

Figure 3.9-5 shows that for all activities (transiting and fishing combined), most of the 377 unique vessels participating in a VMS fishery generally operated in a southwest-northeast pattern with a secondary pattern of northwest-southeast, while most of the 201 unique vessels participating in a non-VMS fishery[5] generally operated in a southwest-northeast pattern. Figure 3.9-6 shows that VMS fishery vessels transiting the Lease Area followed primarily a southwest-northeast pattern with a secondary pattern of northwest-southeast and non-VMS fishery vessels generally transited in a southwest-northeast pattern. Figure 3.9-7 show that most of the unique VMS fishery vessels fishing in the Lease Area followed a slightly northeast-southwest fishing pattern while the orientation for those non-VMS fishery vessels actively fishing in the Lease Area varied, but had a slightly southwest pattern.

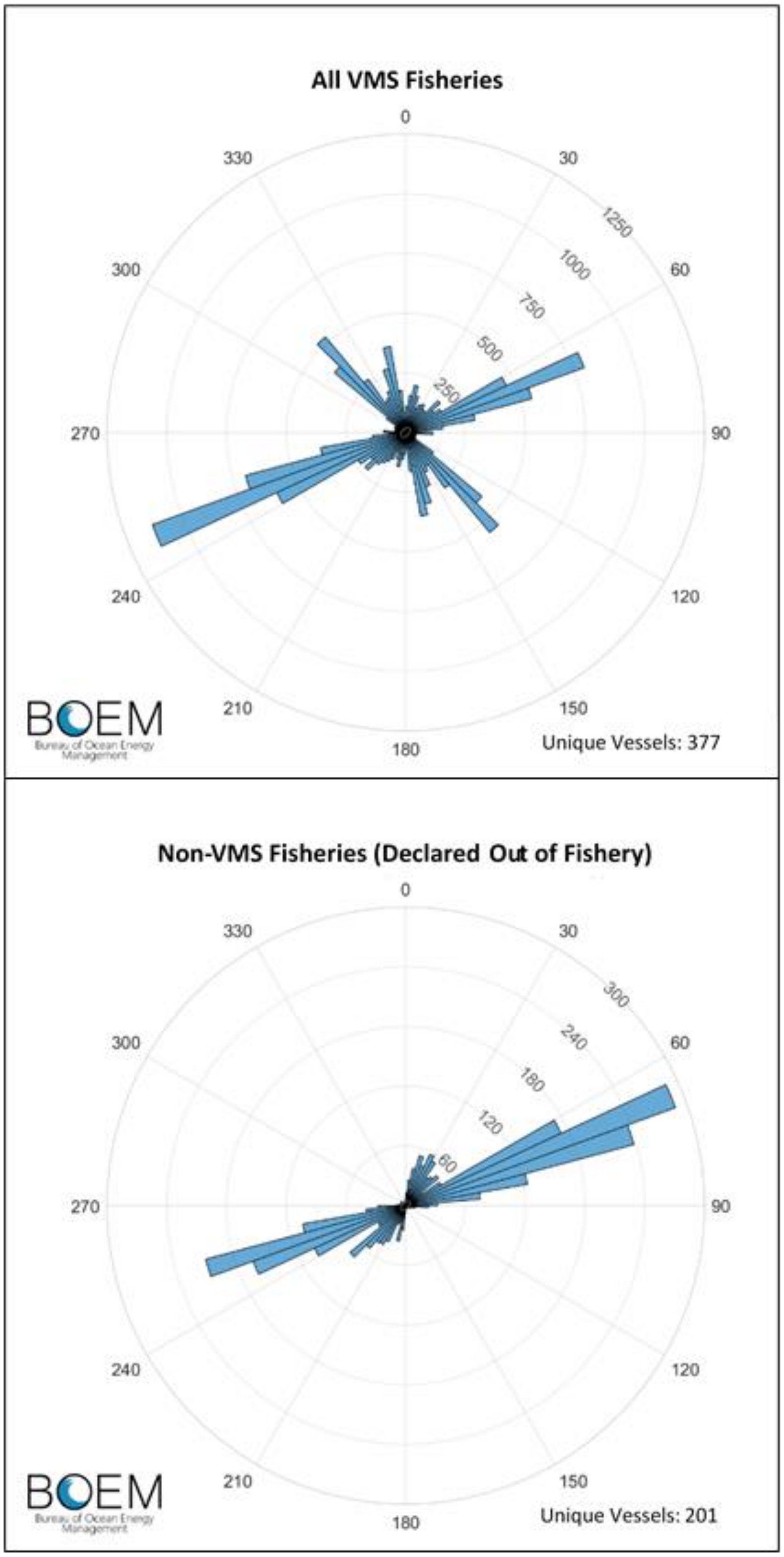
For individual FMP fisheries, Figure 3.9-8 shows that the orientation of vessels transiting the Lease Area generally followed a northeast-southwest pattern except for those in the Surfclam/Ocean Quahog FMP fishery, which followed a northwest-southeast pattern. Figure 3.9-9 shows that the orientation of vessels actively fishing within the Lease Area varied by FMP fishery.

[5] Vessels that are considered non-VMS Fisheries have declared as out of fishery, meaning they have declared out of a fishery managed by days-at-sea effort controls (i.e., scallops, Northeast multispecies, and monkfish).



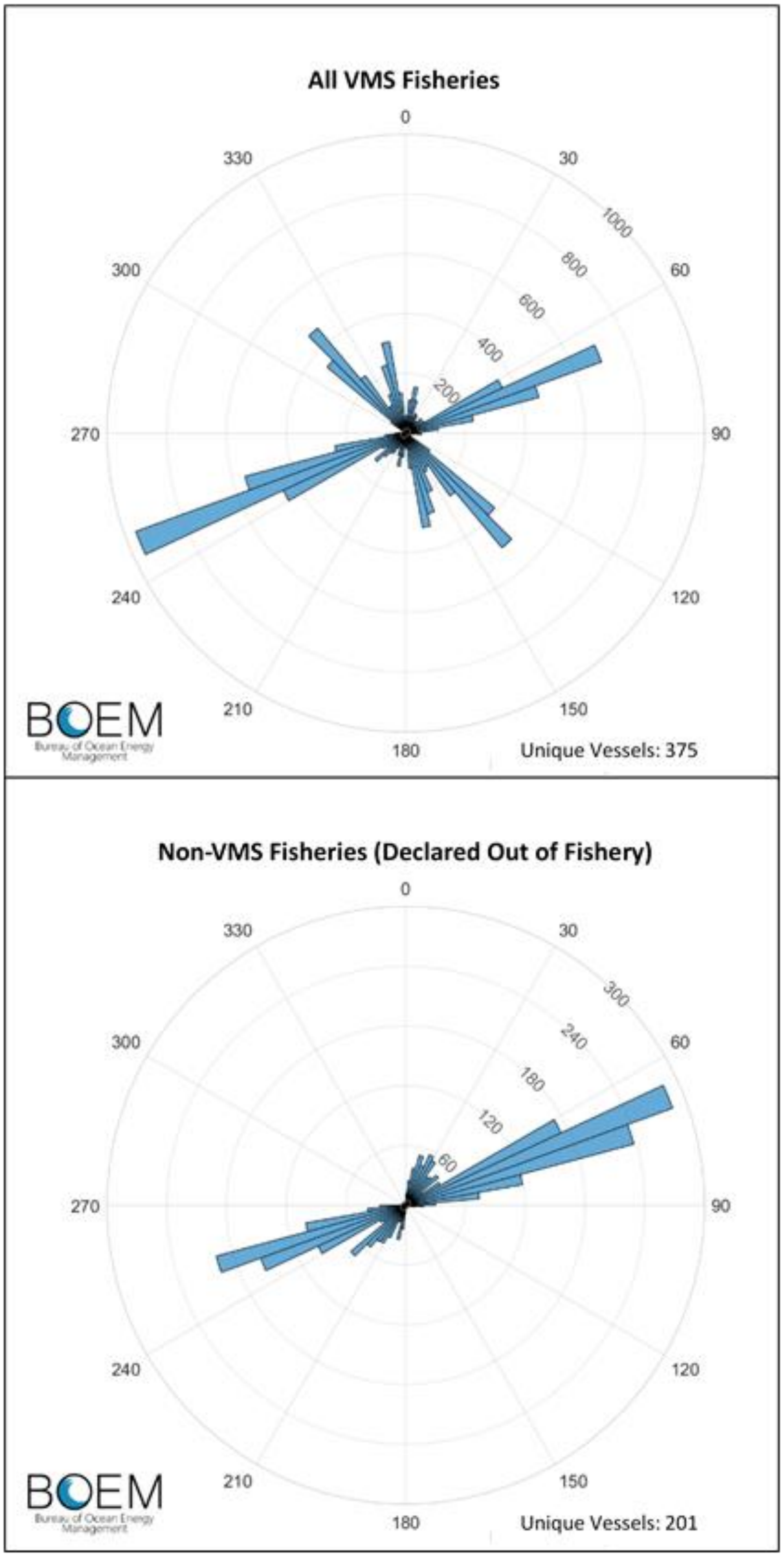
Source: Developed by BOEM using VMS data provided by NMFS (2019).

Figure 3.9-4 VMS Activity and Unique Vessels Operating in the Lease Area, January 2014–August 2019



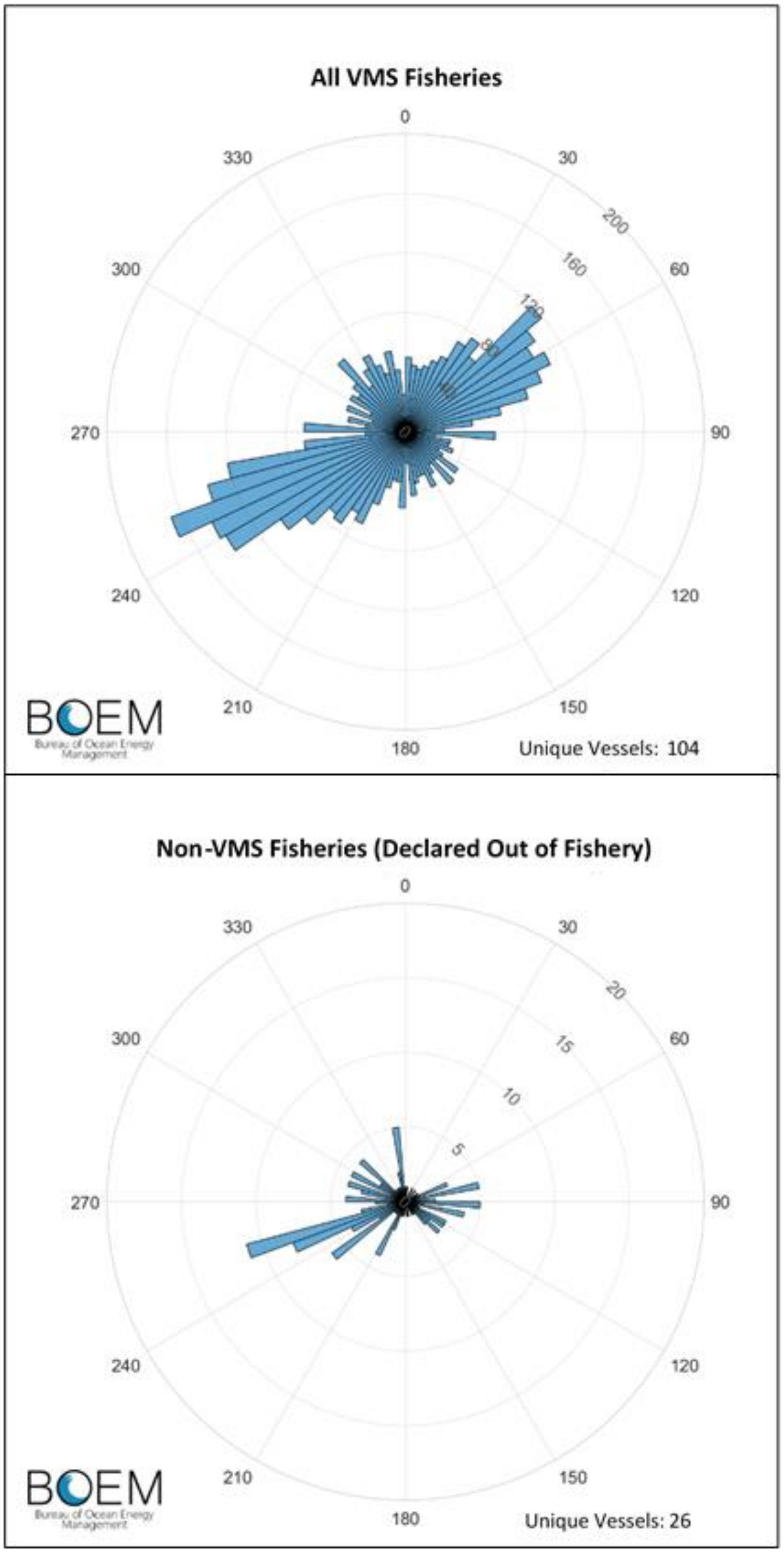
Source: Developed by BOEM using VMS data provided by NMFS (2019).

Figure 3.9-5 VMS Bearings for All Activity of VMS and Non-VMS Fisheries within the Lease Area, January 2014–August 2019



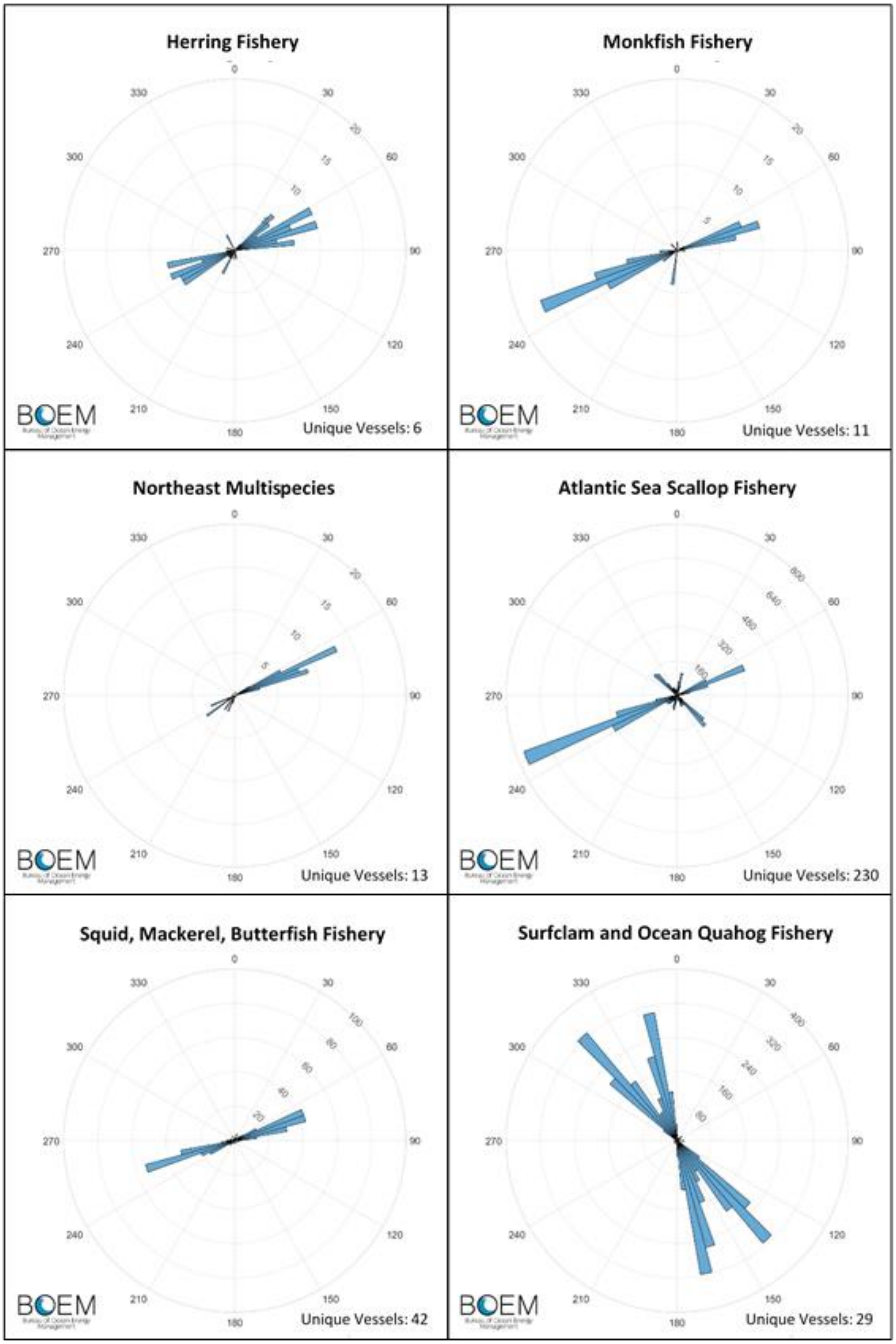
Source: Developed by BOEM using VMS data provided by NMFS (2019).

Figure 3.9-6 VMS Bearings for Transiting VMS and Non-VMS Fishery Vessels within the Lease Area, January 2014–August 2019



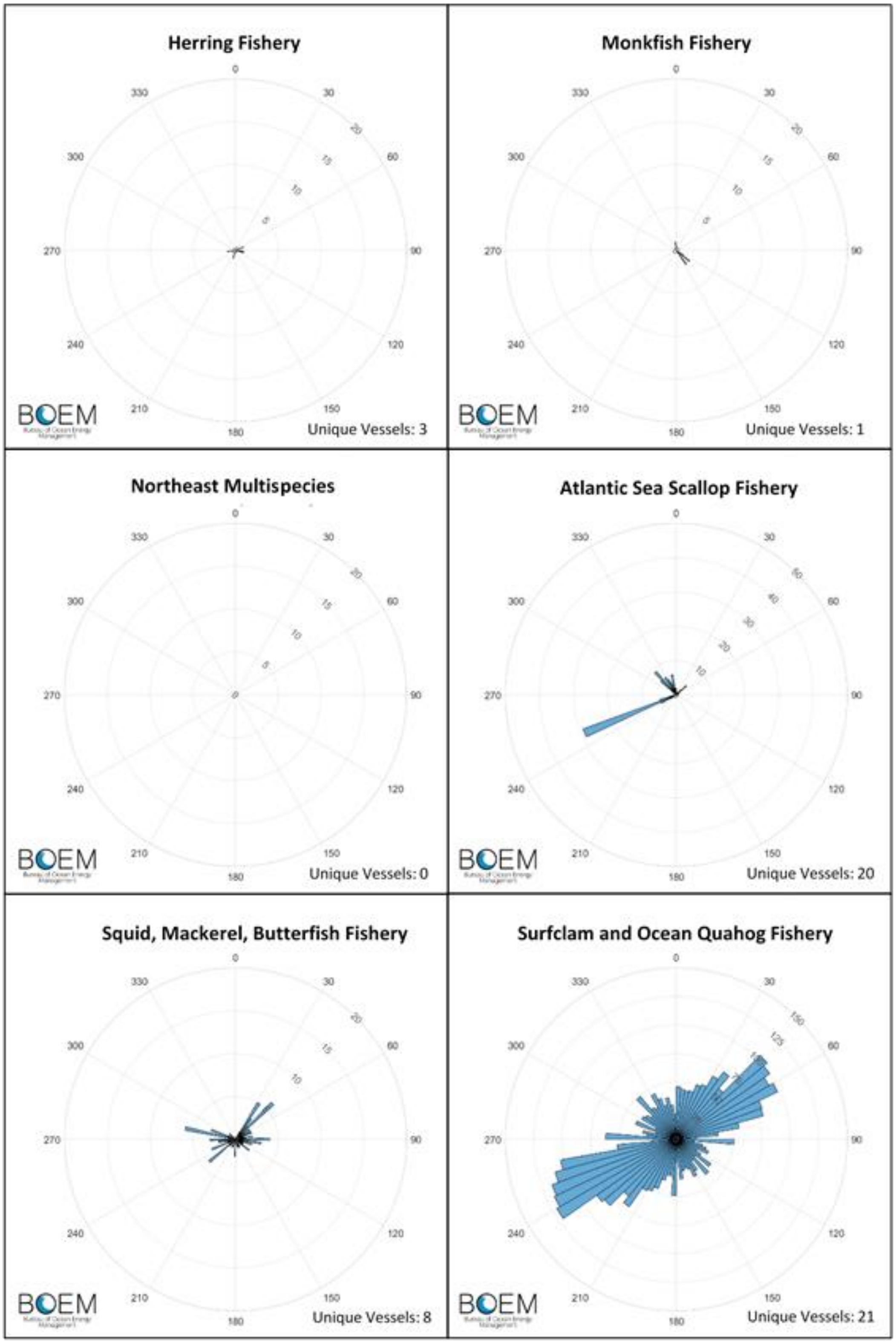
Source: Developed by BOEM using VMS data provided by NMFS (2019).

Figure 3.9-7 VMS Bearings for Fishing Activity by VMS and Non-VMS Fishery Vessels within the Lease Area, January 2014–August 2019



Source: Developed by BOEM using VMS data provided by NMFS (2019).

Figure 3.9-8 VMS Bearings of Vessels Transiting the Lease Area by FMP Fishery, January 2014–August 2019



Source: Developed by BOEM using VMS data provided by NMFS (2019).

Figure 3.9-9 VMS Bearings of Vessels Actively Fishing in the Lease Area by FMP Fishery, January 2014–August 2019

For-Hire Recreational Fishing

As with the commercial fishing industry, the for-hire recreational fishing fleets contribute to the economy through direct employment, income, and gross revenues of the for-hire businesses, as well as through spending on products and services to maintain and operate their vessels, triggering further indirect multiplier effects that are dependent upon the initial demands of the for-hire fleet (Steinback and Brinson 2013). For-hire recreational fishing boats are operated by licensed captains for businesses that sell recreational fishing trips to anglers. These boats include both party (head) boats, defined as boats on which fishing space and privileges are provided for a fee, and charter boats, defined as boats operating under charter for a price, time, etc., whose participants are part of a preformed group of anglers (NMFS 2021c). New Jersey's recreational fleet consists of approximately 100 party and 300 charter boats, which are docked near all major inlets and bays (NJDEP 2010).

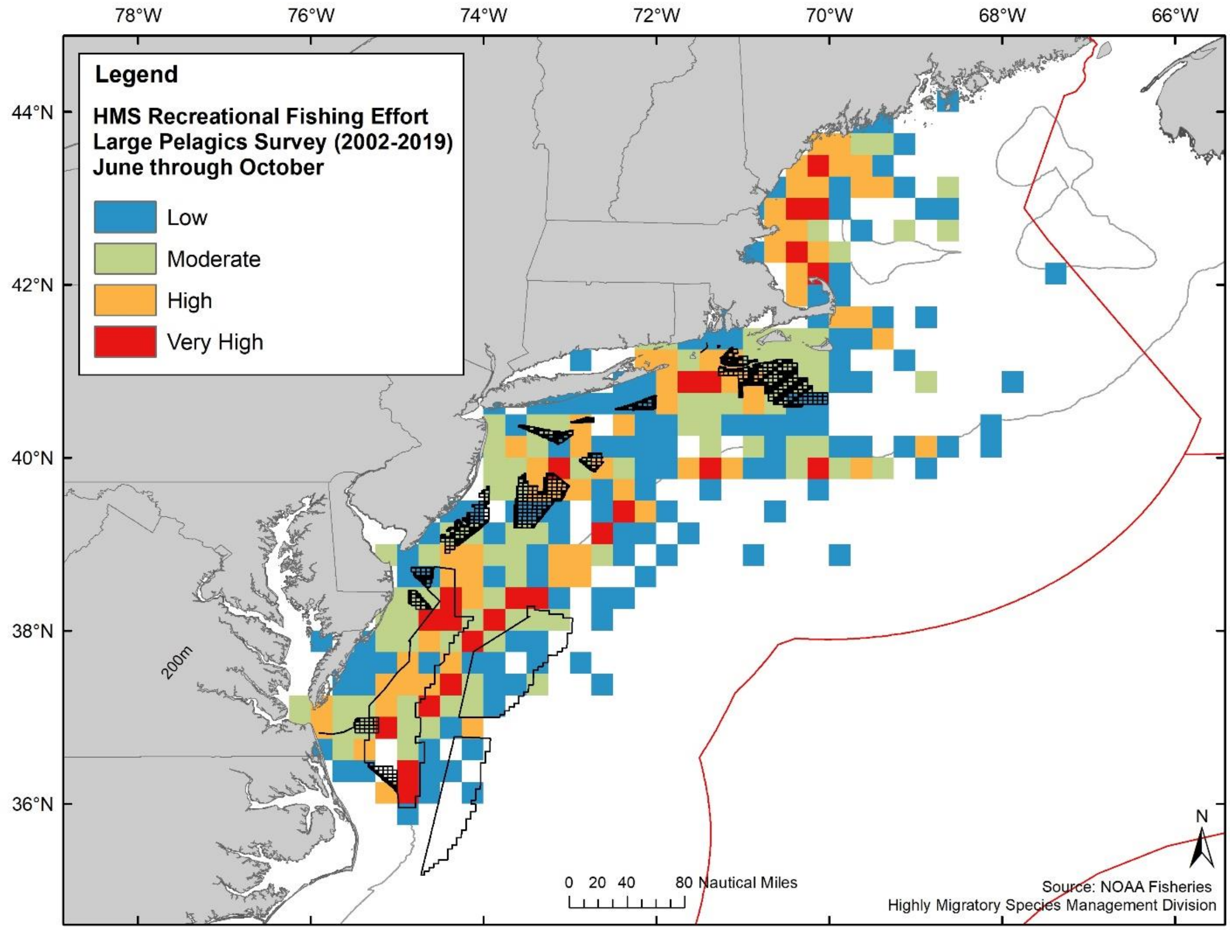
New Jersey has compiled information from charter boat, party boat, and private boat captains to identify the areas they consider recreationally significant fishing areas or prime fishing areas (see Figure 2.3.4-9 in COP Volume II, Section 2.3.4.1.4; Ocean Wind 2023). These specific areas are described as those that consistently produce good catches of fish, most likely because the physical characteristics of those locations provide optimum fish habitat. Historically productive fishing grounds, for example, often occur around rock piles, shallow ridges, artificial and natural reefs, deep sloughs, and bay inlets.

NOAA works with state and local partners to monitor the recreational fishery catch and effort through the Marine Recreational Information Program (COP Volume II, Section 2.3.4.1.4; Ocean Wind 2023 citing NOAA Fisheries n.d.). The for-hire recreational fishing data reported for New Jersey (March to December) include fish discarded, landed, and used as bait. Approximately 1.8 million fish were reported caught in New Jersey in 2017. A wide variety of species/groups were reported, with the highest numbers and diversity of species in offshore areas. Striped bass (*Morone saxatilis*) was the primary species caught in inland waters in March/April and November/December. Summer flounder dominated the inland catch from May to October with sea robins (Triglidae) co-dominating during summer months. The highest catch numbers reported caught in state waters offshore New Jersey occurred from July/August and September/October, with approximately 200,000 fish caught during each interval. The reported catch was dominated primarily by black sea bass, followed by scup (*Stenotomus chrysops*), summer flounder, sea robin, striped bass, and skates/rays. Other species reported in higher numbers consist of cunner (*Tautogolabrus adspersus*), tautog (*Tautoga onitis*), dogfish sharks, Atlantic cod (*Gadus morhua*), and bluefish. The highest reported catch numbers occurred in federal waters, ranging from more than 25,000 reported in March/April to nearly 675,000 for July/August. The species composition for federal waters was similar to that of state waters, with additional species of tunas/mackerels. Large numbers of black sea bass, nearly 300,000, were reported in November/December (COP Volume II, Section 2.3.4.1.4; Ocean Wind 2023 citing NOAA Fisheries n.d.).

The blue crab fishery is not included in the Marine Recreational Information Program. Blue crabs are abundant all along the New Jersey coast, in tidal creeks and rivers, and in shallow, saltwater bays, from the Hudson River to Delaware Bay. Recreational fishing effort in New Jersey is greater for blue crab than any other single species (COP Volume II, Section 2.3.4.1.4; Ocean Wind 2023 citing NJDFW n.d.). Recreational crabbing is done by small boats, shoreline bank, bulkhead, bridge, or pier-bordering tidal waters and not by for-hire party boats or charters. Adult blue crabs may use benthic habitat for spawning; dredging impacts could include increased local total suspended solids, loss of larvae due to suction dredging, or short-term displacement of individual crabs. However, these impacts are either short term, limited in spatial extent, or insignificant to the success of the species.

Recreational fishing for highly migratory species also occurs in and around the Lease Area and along the export cable corridor. Based on the NMFS Large Pelagics Survey, an intercept survey that includes both for-hire and private fishing, the level of recreational fishing effort for highly migratory species from

2002–2019 ranged from low to moderate in the Project area (Figure 3.9-10). The Large Pelagics Survey data metric is intercepts, meaning a fisherman intercepted by a dockside monitor reported fishing for highly migratory species in that block on the intercepted trip (i.e., a positive fishing effort for highly migratory species); therefore, it is not a census of all trips, but a sample of trips based upon dockside coverage in ports (Curtis 2023).



Note: Data are based on intercept surveys and include both for-hire and private fishing for highly migratory species. Leasing and planning areas are as of approximately 2020.

Figure 3.9-10 Fishing Effort for Highly Migratory Species in the Greater Atlantic

As shown in Table 3.9-16, from 2008 to 2021, the annual revenue from the for-hire recreational fishery operating in the Lease Area varied considerably, ranging from a low of $5,000 (rounded to the nearest thousand dollars) in 2008 to a high of $82,000 in 2012, while totaling $293,000 during the entire period and averaging $20,929.

Table 3.9-16 Total For-Hire Recreational Fishing Revenue by Year for Lease Area, 2008–2021

Year	Annual Revenue
2008	$5,000
2009	$11,000
2010	$6,000

Year	Annual Revenue
2011	17,000
2012	$82,000
2013	$5,000
2014	$12,000
2015	$16,000
2016	$19,000
2017	$16,000
2018	$44,000
2019	$22,000
2020	$31,000
2021	$7,000
Total	**$293,000**
Average	**$20,929**

Source: NMFS 2022b.
Notes: Escalated to 2021 dollars and rounded to nearest $1,000.

Table 3.9-17 and Table 3.9-18 show the total number of trips to the Lease Area by year and port for party/charter boats and angler trips, respectively.

Table 3.9-17 Total Number of Party/Charter Boat Trips by Port and Year for Lease Area, 2008–2021

Port	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Other Ports, NJ[1]	9	14	9	11	31	10	10	10	35	36	25	23	13	6
Atlantic City, NJ	0	0	0	4	0	0	8	7	0	0	0	0	0	0
Other Ports, MD	0	0	0	0	0	0	0	3	0	0	0	0	0	0
No Port Data	0	0	0	0	0	0	0	0	0	0	2	1	0	3
Sea Isle City, NJ	0	0	0	0	0	0	0	0	0	0	19	0	0	0

Source: NMFS 2022b.
[1] The “Other Ports” category refers to ports with fewer than three permits to protect data confidentiality.

Table 3.9-18 Total Number of Angler Trips by Port and Year for Lease Area, 2008–2021

Port	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Other Ports, NJ[1]	71	143	78	153	953	57	80	79	204	171	334	231	336	80
Atlantic City, NJ	0	0	0	46	0	0	49	45	0	0	0	0	0	0
Other Ports, MD	0	0	0	0	0	0	0	47	0	0	0	0	0	0
No Port Data	0	0	0	0	0	0	0	0	0	0	20	29	0	14
Sea Isle City, NJ	0	0	0	0	0	0	0	0	0	0	142	0	0	0

Source: NMFS 2022b.
[1] The “Other Ports” category refers to ports with fewer than three permits to protect data confidentiality.

To understand the relative importance of the Lease Area to the regional for-hire recreational fishing industry, Table 3.9-19 compares the landings reported in the Lease Area for the top five species to the entire Northeast region by year during the 2008–2021 period. Table 3.9-20 provides the 14-year fish count and percentage of the total for the Northeast region for the top five species.

Table 3.9-19 Annual Party Vessel Trips, Angler Trips, and Number of Vessels in the Lease Area as a Percentage of the Geographic Analysis Area, 2008–2021

Year	Vessel Trips as % of Total	Angler Trips as % of Total	Number of Vessels as % of Total
2008	0.03%	2.12%	1.08%
2009	0.05%	6.38%	1.08%
2010	0.03%	1.47%	0.74%
2011	0.05%	1.96%	1.64%
2012	0.10%	10.83%	1.21%
2013	0.03%	4.51%	0.55%
2014	0.07%	1.55%	1.54%
2015	0.08%	6.57%	1.61%
2016	0.14%	11.30%	1.37%
2017	0.15%	14.16%	1.20%
2018	0.22%	15.90%	2.24%
2019	0.12%	28.11%	0.74%
2020	0.06%	11.08%	0.73%
2021	0.04%	6.88%	0.66%

Source: NMFS 2022b.

Table 3.9-20 14-Year Fish Count for Top Six Fish Species Landed by For-Hire Recreational Fishing in the Lease Area as a Percentage of the Geographic Analysis Area, 2008–2021

Species	Fish Count as % of Total
Triggerfish	0.08%
Summer Flounder	0.06%
Black Sea Bass	0.05%
Tautog	0.03%
Sea Robins	0.02%
Bluefish	0.01%

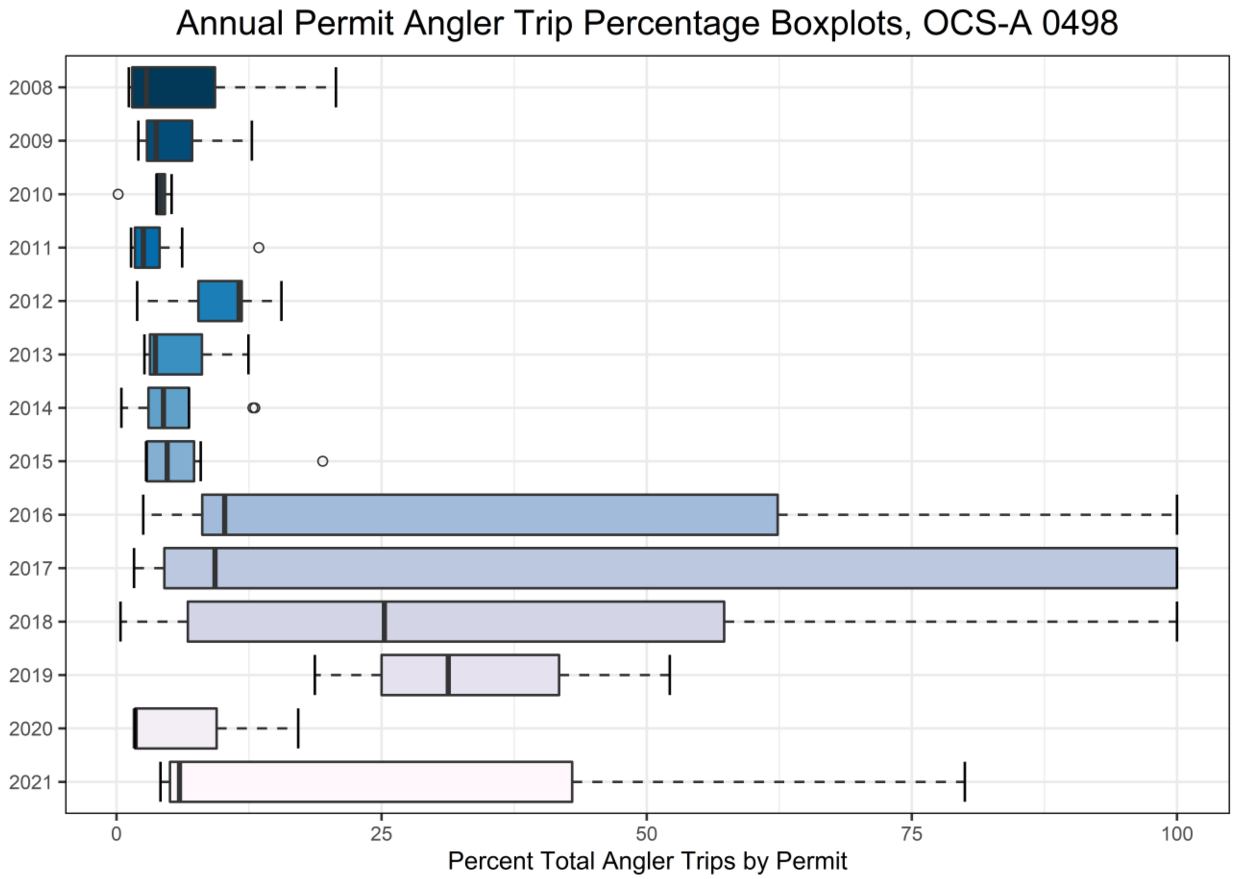
Source: NMFS 2022b.
[1] "All Others" refers to species with fewer than three permits to protect data confidentiality.

To analyze differences in the importance of fishing grounds in the Lease Area for the for-hire recreational fishery, NMFS analyzed the percentage of each permit's total angler trips in the Lease Area from 2008 through 2021 (NMFS 2022b). Results are presented on Figure 3.9-11, which displays the data in a boxplot. A description of the meaning of the quartiles and other information for the boxplot can be found in Section 3.9.1, in the text associated with Figure 3.9-3. Table 3.9-21 presents the minimum, first quartile, median, third quartile, and maximum values for the Lease Area from 2008 through 2021.

Table 3.9-21 Analysis of 14-Year Summary of Permit Angler Trip Percent Boxplots for the Lease Area (2008–2021)

Minimum	1st Quartile	Median	3rd Quartile	Maximum Revenue Percentage Value[1]
0.16%	3%	5%	13%	100%

Source: Developed using data from NMFS 2022b.
[1] Maximum value is inclusive of outliers.



Source: NMFS 2022b.

Figure 3.9-11 Annual Permit Angler Trip Percentage Boxplots for the Lease Area, 2008–2021

A total of 75 percent of the permitted vessels that fished in the Lease Area derived less than 13 percent of their total annual revenue from the area (NMFS 2022b). The highest percentage of total annual angler trips attributed to the Lease Area was 100 percent in 2016, 2017, and 2018, but varied from year to year. There was a change in the percentage of annual angler trips to the Lease Area from 2008 to 2015 compared to after 2016 where there was an increase in the percentage of angler trips to the Lease Area (Figure 3.9-11).

Data show that essentially all for-hire recreation fishing entities both in the Northeast Region as well as within the Ocean Wind Lease Area are considered small businesses. At the regional level, from 2019 to 2021, there were between 289 and 402 entities operating that generated between $1.8 and 4.7 million in the for-hire recreational fishing category. Within the Lease Area, data available for 2021 show three small business entities operating and no large business entities (NMFS 2022b).

3.9.2 Environmental Consequences

3.9.2.1. Impact Level Definitions for Commercial Fisheries and For-Hire Recreational Fishing

Definitions of impact levels are provided in Table 3.9-22.

Table 3.9-22 Impact Level Definitions for Commercial Fisheries and For-Hire Recreational Fishing

Impact Level	Impact Type	Definition
Negligible	Adverse	No impacts would occur, or impacts would be so small as to be unmeasurable.
	Beneficial	No effect or no measurable effect.
Minor	Adverse	Impacts on the affected activity or community would be avoided and would not disrupt the normal or routine functions of the affected activity or community. Once the affecting agent is eliminated, the affected activity or community would return to a condition with no measurable effects.
	Beneficial	Small or measurable effects that would result in an economic improvement.
Moderate	Adverse	Impacts on the affected activity or community are unavoidable. The affected activity or community would have to adjust somewhat to account for disruptions due to impacts of the Project or, once the affecting agent is eliminated, the affected activity or community would return to a condition with no measurable effects if appropriate remedial action is taken.
	Beneficial	Notable and measurable effects that would result in an economic improvement.
Major	Adverse	The affected activity or community would experience substantial disruptions and, once the affecting agent is eliminated, the affected activity or community could retain measurable effects indefinitely, even if remedial action is taken.
	Beneficial	Large local or notable regional effects that would result in an economic improvement.

3.9.3 Impacts of the No Action Alternative on Commercial Fisheries and For-Hire Recreational Fishing

When analyzing the impacts of the No Action Alternative on commercial fisheries and for-hire recreational fishing, BOEM considered the impacts of activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for commercial fisheries and for-hire recreational fishing. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*.

3.9.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for commercial fisheries and for-hire recreational fishing described in Section 3.9.1, *Description of the Affected Environment for Commercial Fisheries and For-Hire Recreational Fishing*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities (see Section F.2 in Appendix F for a description of ongoing and planned activities).

Ongoing non-offshore wind activities within the geographic analysis area that have impacts on commercial and for-hire recreational fisheries are generally associated with climate change and fisheries use and management. Ongoing impacts of climate change include increased magnitude or frequency of storms, shoreline changes, ocean acidification, and water temperature changes. Risks to fisheries associated with these events include the ability to safely conduct fishing operations (e.g., because of storms) and climate-related habitat or distribution shifts in targeted species. Fish and shellfish species are expected to exhibit variation in their responses to climate change, with some species benefiting from climate change and others being adversely affected (Hare et al. 2016). To the extent that impacts of climate change on targeted species result in a decrease in catch or increase in fishing costs, the profitability of businesses engaged in commercial fisheries and for-hire recreational fishing would be adversely affected. Ongoing activities of NMFS and fishery management councils affect commercial and for-hire recreational fisheries through stock assessments, setting quotas, and implementing FMPs to ensure the continued existence of species at levels that will allow commercial and for-hire recreational fisheries to occur. Fishery management measures affect fishing operations differently for each fishery and are intended to achieve long-term, sustainable fisheries populations, which should have long-term benefits to fisheries and fishing communities.

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on commercial fisheries and for-hire recreational fishing include:

- Continued O&M of the Block Island project (five WTGs) installed in state waters;
- Continued O&M of the Coastal Virginia Offshore Wind project (two WTGs) installed in OCS-A 0497; and
- Ongoing construction of two offshore wind projects, the Vineyard Wind 1 project (62 WTGs and 1 OSS) in OCS-A 0501 and the South Fork Wind project (12 WTGs and 1 OSS) in OCS-A 0517.

The effects of approved projects have been evaluated through previous NEPA review and are incorporated by reference. Ongoing O&M of the Block Island and Coastal Virginia Offshore Wind projects and ongoing construction of the Vineyard Wind 1 and South Fork projects would affect commercial fisheries and for-hire recreational fishing through the primary IPFs of anchoring, noise, port utilization, vessel traffic, presence of structures, and cable emplacement and maintenance. Ongoing offshore wind activities would have the same type of impacts from anchoring, noise, port utilization, vessel traffic, presence of structures, and cable emplacement and maintenance that are described in detail in Section 3.9.3.2 for planned offshore wind activities but the impacts would be of lower intensity.

3.9.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities within the geographic analysis area that contribute to cumulative impacts on commercial fisheries and for-hire recreational fishing include new submarine cables and pipelines, oil and gas activities, marine minerals extraction, port expansions, and future marine transportation and fisheries use. Some of these activities may result in disruptions to fishing vessel traffic, bottom disturbance or habitat conversion, and injury or mortality of fish and shellfish that are targeted in fisheries.

Fishery management measures likely to be implemented in the future include measures to reduce the risk of interactions between fishing gear and the North Atlantic right whale (NARW) by 60 percent (McCreary and Brooks 2019). This measure would likely have an adverse impact on fishing effort in the lobster and Jonah crab fisheries in the geographic analysis area. See Table F1-7 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for commercial and for-hire recreational fisheries.

Planned offshore wind activities include offshore wind energy development activities on the Atlantic OCS other than the Proposed Action determined by BOEM to be reasonably foreseeable (see Section F.2 and Attachment 2 in Appendix F for a complete description of planned offshore wind activities). BOEM expects planned offshore wind activities to affect commercial and for-hire recreational fisheries through the following primary IPFs.

Anchoring: Excluding the Proposed Action, BOEM estimates that approximately 3,058 acres (12.3 km^2) of seabed would be disturbed by anchoring associated with all other offshore wind activities. Anchoring vessels used in the construction of offshore wind energy projects would pose a navigational hazard to fishing vessels. All impacts would be localized (within a few hundred meters of anchored vessel) and temporary (hours to days in duration). Although anchoring impacts would occur primarily during project construction, some impacts could also occur during O&M and conceptual decommissioning. Therefore, the adverse effects of offshore wind energy–related anchoring on commercial fisheries and for-hire recreational fishing are expected to be long term and minor, though periodic in nature.

Noise: Noise impacts caused by offshore construction, including pile driving, trenching for cable placement, O&M activities, G&G investigations, and vessels, could cause indirect impacts on commercial and for-hire recreational fisheries through their direct impacts on species targeted by commercial and for-hire recreational fisheries. Noise impacts would also occur during decommissioning activities.

G&G surveys would be conducted for site assessment and characterization activities associated with offshore wind facilities and are expected to occur intermittently over a 2- to 10-year period at locations throughout the geographic analysis area. Site characterization surveys for offshore wind farms typically use sub-bottom profiler technologies that generate sound waves that are similar to common deep-water echosounders. These survey methods produce less-intense sound waves compared to seismic surveys used in oil and gas exploration. Noise from G&G surveys may cause localized and temporary behavioral changes in some fish species, which could affect the catch efficiency of some fishing gears (e.g., hook and line). However, the noise from G&G surveys is not anticipated to affect reproduction and recruitment of fish stocks. Although schedules for many planned offshore wind activities are still being developed, noise impacts on fish and shellfish might be minimized by sequentially scheduling site assessment and characterization surveys to avoid overlapping noise from different surveys.

Planned offshore wind activities will generate impulsive pile-driving noise during foundation installation. One or more projects may install more than one foundation per day, either concurrently or sequentially over the 6- to 10-year construction period. Noise transmitted through water and the seabed can cause injury to or mortality of fish over a small area around each pile and can cause temporary stress and behavioral changes over a larger area. Because of the relatively small footprint of injurious sound and the ability for most fish to swim away from noise sources, injurious noise from pile driving is not expected to cause stock-level changes that would adversely affect fisheries. High-intensity pile-driving noise may influence fish behavior by causing auditory masking and alteration of foraging patterns, social behavior, and metabolism (McCauley et al. 2000; Wahlberg and Westerberg 2005; Madsen et al. 2006; Slabbekoorn et al. 2010, as cited in Siddagangaiah et al. 2021). It is expected that behavioral responses to noise may cause some displacement of fish, thereby temporarily reducing the quality of fishing in affected areas and causing fishers to seek alternative fishing areas (Skalski et al. 1992). Behavioral responses from pile driving may occur at distances of 11 kilometers or greater, such that construction activities in adjacent projects could affect fish and fisheries beyond the boundaries of an individual project. While most finfish species are expected to avoid the noise-affected areas, invertebrates may exhibit stress and behavioral changes, such as discontinuation of feeding activities (Roberts and Elliott 2017). Behavioral responses to pile-driving noise may cause displacement of fishing activity and resulting increased conflict among fishers, increased operating costs for vessels, and lower revenue. Furthermore, pile-driving noise may cause spawning behavior changes. To the extent that changes in spawning behavior result in reduced reproductive success and subsequent recruitment, this could potentially result in long-term effects on populations and harvest levels. However, the risk of reduced recruitment from pile-driving noise is low because the behavioral impacts would only occur over the duration of noise. Behavioral impacts would be localized to the ensonified area and temporary, as fish behavior is expected to return to pre-construction levels following the completion of pile driving (Jones et al. 2020; Shelledy et al. 2018).

Several activities associated with cable laying would produce noise, including route identification surveys, trenching, jet plowing, backfilling, and installation of cable protection. Modeling based on noise data collected during cable laying for European wind farms has estimated that underwater noise levels would exceed 120 dB in a 98,842-acre area surrounding the source (Bald et al. 2015; Nedwell and Howell 2004; Taormina et al. 2018), which is well below the 150-dB threshold for behavioral responses in fish (Andersson et al. 2007; Mueller-Blenkle et al. 2010; Purser and Radford 2011; Wysocki et al. 2007). As was described for pile-driving noise above, fish that are exposed to cable-laying noise may experience temporary stress and behavioral changes, which could indirectly cause displacement of fishing activity. However, because the cable-laying vessel and equipment would be continually moving and the ensonified area would move with it, a given area would not be ensonified for more than a few hours. Therefore, any behavioral responses to cable-laying noise are expected to be temporary and localized and are not expected to result in fishery-level impacts.

Vessels generate low-frequency, non-impulsive noise that could cause temporary stress or behavioral responses in fish. Vessel activity from planned offshore wind activities is expected to peak in 2024 when up to 379 vessels could be involved in construction of offshore wind facilities (BOEM 2019). This increase in vessel activity could cause repeated, intermittent behavioral responses in fish, which could indirectly cause displacement of fishing activity. Because behavioral responses to vessel noise would be localized and temporary, dissipating once the vessel leaves the area, they are not expected to result in fishery-level impacts.

Operating WTGs generate non-impulsive underwater noise that is audible to some fish. However, operating WTGs are expected to produce noise levels that are below recommended thresholds for fish injury and behavioral effects, and noise levels are expected to reach ambient levels within a short distance of turbine foundations. Therefore, noise from operating WTGs is not expected to result in fishery-level impacts.

Consequently, BOEM expects that underwater noise associated with planned offshore wind activities will cause long-term, moderate impacts on commercial and for-hire recreational fisheries, depending on the timing and overlap of construction activities. Impacts are expected to primarily result from pile-driving noise during the installation of foundations for WTGs and OSS. See Section 3.13.3.2 for a full description of noise impacts on fish and invertebrates.

Port utilization: Construction and decommissioning of offshore wind energy projects would require port facilities for staging and installation/decommissioning vessels, including crew transfer, dredging, cable lay, pile driving, survey vessels, and, potentially, feeder lift barges and heavy lift barges. All of these activities would add vessel traffic to port facilities and would require berthing. The additional vessel volume in construction ports could cause vessel traffic congestion, difficulties with navigating, and an increased risk for collisions, together with reduced access to high-demand port services (e.g., fueling and provisioning) by existing port users, including commercial fishing vessels. The impacts would be spread across the entire geographic analysis area throughout the duration of the construction period for offshore wind projects from 2023 to 2030, as well as beyond 2030 when projects go through decommissioning. These potential adverse impacts could cause some commercial and for-hire recreational vessel operators to change routes or use an alternative port. However, none of the New Jersey ports that may be used for the Project (and for which there is potential for cumulative effects with other offshore wind activities) are in areas with high levels of commercial fishing engagement, reducing the potential for space-use conflicts and competition between fishing vessels and vessels used for offshore wind for berths at ports. Areas adjacent to Charleston Harbor have medium to medium-high levels of commercial fishing engagement, while Norfolk, Virginia, supports a medium level of commercial fishing engagement. Impacts would be expected to be negligible to minor and temporary in nature, lasting the duration of the construction and decommissioning of the projects.

Traffic: The installation and decommissioning of offshore components for offshore wind energy projects and the presence of construction vessels could temporarily restrict fishing vessel movement and thus transit and harvesting activities within offshore wind lease areas and along the cable routing areas. To safeguard mariners from the hazards associated with installation and decommissioning of these offshore components, it is expected that most, if not all, offshore wind energy projects would create safety zones around construction areas. For example, for the Block Island Wind Farm, a 500-yard (457-meter) safety zone around the individual wind turbine locations was implemented during construction (BOEM 2018). When safety zones are in effect, fishing vessels could either forfeit fishing revenue or relocate to other fishing locations and continue to earn revenue. However, vessels that chose to relocate could incur increased operating costs such as increased fuel costs due to longer transit times to and from more distant fishing grounds, increased equipment maintenance/repair, and additional crew compensation due to more days at sea, among other factors. Commercial and for-hire recreational vessel operators could also experience lower revenue due to fishing potentially less-productive fishing grounds, potentially having to switch to less-valuable species, and potentially encountering more competition for a given resource. In addition, the increased steaming time may result in product spoilage for fisheries such as surfclams that must be processed shortly after harvest.

Once offshore wind projects are completed, some commercial fishermen may avoid the offshore wind lease areas if large numbers of recreational fishermen are drawn to the areas by the prospect of higher catches. WTG foundations and associated scour protection may produce an artificial reef effect, potentially increasing fish and invertebrate abundance within a facility's footprint (see Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*). According to ten Brink and Dalton (2018), the influx of recreational fishermen into the Block Island Wind Farm caused some commercial fishermen to cease fishing in the area because of vessel congestion and gear conflict concerns. If these concerns cause commercial fishermen to shift their fishing effort to areas not routinely fished, conflict with existing users could increase as other areas are encroached. In general, the potential for conflict among commercial fishermen due to fishing displacement may be higher for fishermen engaged in fisheries that have regulations that constrain where fishermen can fish, such as the lobster fishery. However, the potential for vessel congestion and gear conflict may also increase if mobile species targeted by commercial fishermen, such as Atlantic herring, Atlantic mackerel, squid, tuna, and groundfish, are attracted to offshore wind energy facilities by the artificial reef effect, and fishermen targeting these species concentrate their fishing effort in offshore wind lease areas as a result. Overall, the adverse impacts from vessel traffic would be long term and moderate.

Presence of structures: The presence of structures can lead to impacts on commercial fisheries and for-hire recreational fishing through allisions, entanglement or gear loss/damage, fish aggregation, and habitat conversion. It can also create navigational hazards (including transmission cable infrastructure) and space-use conflicts, which in turn could lead to vessel collisions. These impacts may arise from buoys, meteorological towers, foundations, scour/cable protection, and transmission cable infrastructure. Using the assumptions in Table F2-1 and Table F2-2 in Appendix F, offshore wind energy projects under the No Action Alternative would include 81 WTGs, 1,145 acres (4.3 km^2) of seabed disturbance due to foundation and scour protection, and 97 acres (0.4 km^2) of new hard protection atop cables. Projects may also install more buoys and meteorological towers. BOEM anticipates that structures would be added intermittently over an assumed 10-year period and that they would remain until conceptual decommissioning of each facility is complete.

The presence of the WTG foundations and associated scour protection would convert existing sand or sand with mobile gravel habitat to hard bottom, which, in turn, would reduce the habitat for target species that prefer soft-bottom habitat (e.g., surfclams, sea scallops, squid, summer flounder) and increase the habitat for target species that prefer hard-bottom habitat (e.g., lobster, striped bass, black sea bass, cod). Where WTG foundations and associated scour protection produce an artificial reef effect and attract finfish and invertebrates, the aggregation of species could increase the catchability of target species (Kirkpatrick et al. 2017). Although species that rely on soft-bottom habitat would experience a reduction in favorable conditions, the impacts from structures are not expected to result in population-level impacts (see Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*). Decommissioning of each wind farm would then have the opposite impact, wherein the species dependent on hard-bottom or reef habitat would experience a reduction in favorable conditions, although some hard-bottom protection measures would remain, while removal of WTGs and their foundations would favor the increase of targeted species that prefer soft-bottom habitat.

USCG has stated that it does not plan to create exclusionary zones around offshore wind facilities during their operation (BOEM 2018). However, because of the height of wind turbines above the ocean surface, they would be visually detectable at a considerable distance during the day and easily detected by vessels equipped with radar regardless of the time of day. To further ensure navigational safety, all structures would have appropriate markings and lighting in accordance with USCG, BOEM, and IALA guidelines, and NOAA would chart wind turbine locations and could include a physical or virtual Automatic Identification System (AIS) at each turbine. Some fishing vessels operating in or near offshore wind facilities may experience radar clutter and shadowing. Most instances of interference can be mitigated through the proper use of radar gain controls (DNV-GL 2021). See also Section 3.16, *Navigation and Vessel Traffic*.

Notwithstanding these safety measures, some fishermen have commented that, because of safety considerations, they would not enter an offshore wind array during inclement weather, especially during low-visibility events (Kirkpatrick et al. 2017); during interviews with commercial fishermen, ten Brink and Dalton (2018) found that fishermen had concerns that low visibility, wind, or crew exhaustion could lead to vessels alliding with WTGs. Moreover, mechanical problems, such as loss of steerage, could result in an allision with a WTG as the vessel drifts during repair (DNV-GL 2021).

In addition, a potential effect of the presence of the offshore cables and wind turbines associated with offshore wind energy development is the entanglement and damage or loss of commercial and recreational fishing gear. Economic impacts on fishing operations associated with gear damage or loss include the costs of gear repair or replacement, together with the fishing revenue lost while gear is being repaired or replaced. In addition, comments from the fishing industry have included concerns that fishing vessel insurance companies may not cover claims for incidents within a WEA resulting in gear damage or loss, or they may increase premiums for vessels that operate within these areas. Given that mobile fishing gear is actively pulled by a vessel over the seafloor, the chance of snagging this gear type on project infrastructure is much greater than if—as in the case of fixed gear—the gear was set on the infrastructure or waves or currents pushed the gear into the infrastructure. The risk of damage or loss of deployed gear as a result of offshore wind development could affect mobile and fixed-gear commercial fisheries and for-hire recreational fishing. While the depth to which offshore power cables are buried is specific to individual projects, standard commercial practice is to bury cables 3 to 10 feet (0.9 to 3.0 meters) deep in waters shallower than 6,562 feet (2,000 meters) to protect them from external hazards such as fishing gear and anchors (BOEM 2018), and fishing gear does not typically penetrate that deep into the sediment and would normally not snag or become entangled in the cable. In a study of seabed depletion and recovery from bottom-trawl disturbance, Hiddink et al. (2017) found that hydraulic dredges, at 6.3 inches (16.1 centimeters), penetrated the ocean floor the deepest of any bottom-trawl gear. Therefore, even with the common practice of dredge vessels fishing the same or similar tow paths on multiple occasions during the same trip, it is unlikely that fishing gear would penetrate deep enough to snag or become tangled in the cable. However, due to underlying geology, cables may not be able to be buried to the minimum target depth along their entire distance. BOEM assumes less than 10 percent of the cables may not achieve the target burial depth and would require cable protection in the form of rock placement, concrete mattresses, or half-shell (BOEM 2021a). While cables are typically marked on nautical charts to aid in avoidance, mobile bottom-tending gear (trawl and dredge gear) could get snagged on these cable protection measures and cause damage or gear loss. Economic impacts on fishing operations associated with gear damage or loss include the costs of gear repair or replacement plus the fishing revenue lost while gear is being repaired or replaced, although the cost of these impacts would vary depending on the extent of damage to the fishing gear. To avoid these economic impacts, some vessel operators may not trawl or dredge over inter-array or export cables, but this could result in increased operating costs (e.g., additional fuel to arrive at more distant locations; additional crew compensation due to more days at sea) or lower revenue (e.g., fishing in a less-productive area or for a less-valuable species).

With respect to fishing vessel maneuverability restrictions (including risk of allisions and collisions with other vessels) within offshore wind lease areas, fishermen have expressed concerns about fishing vessels operating trawl gear that may not be able to safely deploy and operate in an offshore wind lease area given the size of the gear, the spacing between the WTGs, and the space required to safely navigate, especially with other vessels present and during poor weather conditions. Trawl and dredge vessel operators have commented that less than 1-nm (1.9-kilometer) spacing between WTGs may not be enough to operate safely due to maneuverability of fishing gear and gear not directly following in line with vessel orientation. Clam industry representatives (Atlantic surfclam and ocean quahog fisheries) state that their operations require a minimum distance of 2 nm (3.7 kilometers) between WTGs, in alignment with the bottom contours, for safe operations (BOEM 2021b; RODA 2021). Navigating through the offshore wind lease areas would not be as problematic for for-hire recreational fishing vessels, which tend to be smaller than commercial vessels and do not use large external fishing gear (other than hook and line) that makes maneuverability difficult. However, trolling for highly migratory species (e.g., bluefin tuna [*Thunnus thynnus*], swordfish [*Xiphias gladius*]) may involve deploying many feet of lines and hooks behind a vessel and then following large pelagic fish once they are hooked, which poses additional navigational and maneuverability challenges around WTGs (BOEM 2021b).

Some fishers that are displaced from traditional fishing grounds may find suitable alternative fishing grounds and continue to earn revenue, while others may switch the species they target or the gear they use, and others may leave the fishery altogether (O’Farrell et al. 2019). These behaviors are like those of fishers experiencing reduced access to fisheries resulting from fishing regulations and shifting species composition resulting from climate change (Papaioannou et al. 2021). Each of these scenarios requires adaptive behavior and risk tolerance, traits that are not universally shared by all fishers. For example, O’Farrell et al (2019) observed that some fishers have low vessel mobility and less explorative behavior, are risk averse, and take shorter trips, whereas other fishers have high mobility and a greater explorative behavior, are tolerant of risk, and conduct longer trips. Similarly, Papaioannou et al. (2021) observed that smaller trawlers had a higher affinity for their fishing grounds and were less likely to switch fishing grounds than larger trawlers. Fishers willing to seek alternate fishing grounds may experience increased operating costs (e.g., additional fuel to arrive at more distant locations; additional crew compensation due to more days at sea), lower revenue (e.g., fishing in a less-productive area, fishing for a less-valuable species, or increased competition for the same resource), or both. Fishers that switch target species or gear types used may also lose revenue from targeting a less-valuable species and increased costs from switching gear type. Switching species could also cause fishers to land their catch in different ports (Papaioannou et al. 2021), which could result in increased operational costs depending on where the port is located.

It is acknowledged that proposing fishers find alternative fishing grounds to earn revenue is a complex issue with many factors. Fishing communities may have a difficult time with climate adaptation. Historically, warming (and cooling) events have affected the abundance of species targeted, prevalence of invasives, and physical access to target species. Fishing communities historically viewed cooling waters twice as negatively as warming waters, as they were associated with a decrease in fishing opportunity due to storms, while warmer waters were associated with the potential for new fisheries. However, recent warming trends were viewed as strongly negative, associated with disease, reductions in target species, and shifts of fish distributions across jurisdictional lines (McClenachan et al. 2019).

The increased use of ocean space by offshore wind farms will likely result in increased travel time to landing ports, which may cause some fishers to use different landing ports, thereby resulting in economic loss to certain ports and communities, especially in small ports. Many fishing vessels use landing ports that differ from their primary port (i.e., the port where the vessel is docked or moored), and these vessels are likely to be particularly vulnerable to reductions in unobstructed ocean space. Silva et al. (2021) conducted an intercept survey from Maine to North Carolina and observed that 20 percent (n=479) of the fishing industry participants reported different primary and landing ports from the intercept port. Among those reporting differences, the primary and landing ports were generally in different states. The ports where differences were most reported included Newport News, Virginia; Cape May and Point Pleasant, New Jersey; New Bedford, Massachusetts; and Point Judith, Rhode Island. Surfclam vessels often travel between Atlantic City, New Jersey and New Bedford, Massachusetts. The increased travel time would also result in increased fuel costs and potential wear and tear on equipment.

In addition, as also discussed within Section 3.12, *Environmental Justice*, the commercial fisheries industry is experiencing socioeconomic impacts related to gentrification of the ocean environment, including significant pressure from new industries, such as offshore wind power generation, tourism, coastal development, and other elements. As these different industries compete for ocean space, the result could be adverse impacts for communities that are heavily dependent on either commercial fishing or recreational fishing, or both. The development of offshore lease areas for wind power generation creates a space-use conflict that may exacerbate this issue for these potentially vulnerable populations that support either the commercial fishing industry, for-hire recreational fishing services, or shoreside services. In many cases, shoreside support services, such as seafood processing and vessel/equipment repair services, are supported by lower-income workers that may have less capacity to absorb a reduction in pay and it can oftentimes be more challenging to identify alternative or supplemental employment.

An accurate assessment of the extent of the effects of planned offshore wind energy projects on commercial fisheries and for-hire recreational fishing would depend on project-specific information that is unknown at this time, such as the actual location of offshore activities within offshore wind lease areas and the arrangement of WTGs. However, it is possible to estimate the amount of commercial fishing revenue that would be “exposed” as a result of offshore wind energy development. Estimates of revenue exposure quantify the value of fishing that occurs in the footprint areas of individual offshore wind farms. Therefore, these estimates represent the fishing revenue that would be foregone if fishing vessel operators opt to no longer fish in these areas and cannot capture that revenue in a different location. However, there is not enough resolution in the data to allow estimates to be made on a small enough scale to differentiate impacts along wind farm export cable corridors. Therefore, estimates have only been made for individual offshore wind lease areas. Revenue exposure estimates should not be interpreted as measures of actual economic impact. Exposure is based on historical landings and actual economic impact would depend on many factors—foremost, the potential for continued fishing to occur within the footprint of the wind farm, together with the ecological impact on target species residing within the project areas. Economic impacts also depend on a vessel operator's ability to adapt to changing where fishing could occur. For example, if alternative fishing grounds are available nearby and could be fished at no additional cost, the economic impact would be lower. In addition, it is important to note that there may be cultural and traditional values to fishermen related to fishing in certain areas that go beyond expected monetary profit. For example, some fishermen may gain utility from being able to fish in locations that are known to them and also fished by their peers; the presence of other boats in the area can contribute to the fishermen's sense of safety.

Table 3.9-23 depicts the annual commercial fishing revenue exposed[6] to offshore wind energy development in the geographic analysis area by FMP fishery from 2021 through 2030. The amount of revenue at risk increases as proposed offshore wind energy projects are constructed and come online (see Table F-3) and would continue beyond 2030 during the continued operational phases of the offshore wind energy projects. The largest impacts in terms of exposed revenue are expected to be in the Sea Scallop, Surfclam/Ocean Quahog, and Mackerel/Squid/Butterfish FMP fisheries. Vessels from most fisheries remain close to home, such that the exposed revenue is expected to be greatest in fishing ports closest to offshore wind projects. A notable exception to this is the scallop fishery, in which vessels often travel several hundred miles to reach fishing grounds. The total average annual exposed revenue over the 2021–2030 period represents approximately 1.6 percent of the total average annual revenue of the FMP fisheries in the geographic analysis area during the 2008–2019 period (see Table 3.9-1). The maximum exposed revenue—which is projected to occur in year 2030 when construction on the last of the planned activities could begin—represents approximately 3.6 percent of the total regional revenue average; however, it is acknowledged that projects would be in operation beyond 2030 and therefore this revenue exposure would continue. In general, fisheries do not have high relative revenue intensity within the offshore wind lease areas compared with nearby waters because offshore wind lease areas were chosen to reduce potential use conflicts between the wind energy industry and fishers.

[6] Revenue exposure is the amount of revenue that could be potentially affected by WEA development.

Table 3.9-23 Annual Commercial Fishing Revenue Exposed to Offshore Wind Energy Development in the Geographic Analysis Area Under the No Action Alternative by FMP

FMP Fishery	Total Annual Revenue Exposed ($1,000s)									
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030[1]
Atlantic Herring	$0.0	$0.0	$65.3	$97.4	$116.7	$169.1	$210.5	$242.9	$275.3	$275.3
Bluefish	$0.0	$0.0	$5.9	$8.5	$12.7	$16.2	$18.2	$19.7	$21.3	$21.3
Golden Tilefish	$0.0	$0.0	$4.1	$9.6	$55.8	$76.4	$81.5	$86.4	$91.4	$91.4
Highly Migratory Species	$0.0	$0.0	$0.1	$0.3	$0.8	$1.0	$1.2	$1.4	$1.6	$1.6
Mackerel/Squid/Butterfish	$0.1	$0.1	$378.5	$621.5	$824.2	$1,190.3	$1,343.6	$1,477.5	$1,611.3	$1,611.3
Monkfish	$0.0	$0.0	$435.6	$508.8	$615.9	$780.3	$884.1	$966.6	$1,049.2	$1,049.2
Multispecies Large Mesh	$0.0	$0.0	$182.6	$197.2	$214.9	$264.1	$286.5	$300.8	$315.1	$315.1
Multispecies Small Mesh	$0.0	$0.0	$143.5	$185.4	$275.5	$366.4	$394.8	$411.7	$428.5	$428.5
Jonah Crab	$0.0	$0.0	$55.6	$93.2	$283.9	$325.6	$349.9	$370.4	$390.9	$390.9
Sea Scallop	$0.0	$0.0	$343.7	$2,587.9	$2,862.5	$7,805.7	$12,672.9	$17,513.2	$22,353.4	$22,353.4
Skate	$0.0	$0.0	$258.9	$298.1	$358.8	$453.9	$505.1	$537.4	$569.6	$569.6
Spiny Dogfish	$0.0	$0.0	$21.4	$28.7	$33.5	$39.5	$43.6	$45.7	$47.8	$47.8
Summer Flounder/Scup/Black Sea Bass	$0.2	$0.2	$294.7	$464.6	$644.3	$935.6	$1,121.5	$1,286.5	$1,451.4	$1,451.4
Surfclam/Ocean Quahog	$0.0	$0.0	$11.0	$47.8	$671.2	$1,070.4	$1,469.6	$1,868.8	$2,268.1	$2,268.1
American Lobster	$0.0	$0.0	$328.9	$374.5	$447.4	$603.8	$703.4	$758.1	$812.8	$812.8
None: Unmanaged[2]	$0.4	$0.4	$732.5	$895.7	$1,093.0	$1,693.2	$2,106.8	$2,488.7	$2,870.5	$2,870.5
All revenues of federally permitted vessels	**$0.7**	**$0.7**	**$3,262.4**	**$6,419.0**	**$8,486.0**	**$15,791.4**	**$22,193.3**	**$28,375.7**	**$34,558.1**	**$34,558.1**

Source: Developed using FMP Revenue Exposure Analysis – 2020 to 2030 Calculations data provided by BOEM 2022 and based on BOEM's OCS offshore wind schedule as of March 2022 and NMFS landings and revenue data for wind energy areas, 2008–2019, accessed October 2021. The analysis excludes the Proposed Action.

[1] This column represents the total average revenue exposed in 2030 in order to give a value reference for the percentage of revenue exposed in 2030.

[2] Includes revenues from all species not assigned to an FMP including American lobster and Jonah crab fisheries.

Notes: Revenue is in nominal dollars using the monthly, not seasonally, adjusted Producer Price Index by Industry for Fresh and Frozen Seafood Processing provided by the U.S. Bureau of Labor Statistics. The data represent the revenue-intensity raster developed using fishery-dependent landings' data. To produce the data set, Vessel Trip Report information was merged with data collected by at-sea fisheries observers, and a cumulative distribution function was estimated to present the distance between Vessel Trip Report points and observed haul locations. Resolution of the data does allow estimates to be made on a small enough scale to differentiate impacts along wind farm export cable corridors. Therefore, estimates only pertain to individual offshore wind lease areas. This provided a spatial footprint of fishing activities by FMPs. The percentages are expected to continue after 2030 until facilities are decommissioned. Slight differences in totals are due to rounding.

"–" indicates the value is zero; "$0" indicates the value is positive but less than $100.

With respect to impacts on individual fishing operations, long-term, negligible to minor, adverse impacts would occur for vessels that derive a small percentage of their total revenue from areas where offshore wind facilities would be located or are willing to seek and able to find suitable alternative fishing locations. Long-term, moderate adverse impacts would occur for fishing vessels that derive a large percentage of their total revenue from areas where offshore wind facilities would be located, if they choose to avoid these areas once the facilities become operational and either choose not to seek alternative fishing grounds or are unable to find suitable alternative fishing locations. NMFS (NMFS 2021e) determined, for each federally permitted commercial fishing vessel that fished in New England/Mid-Atlantic offshore wind lease areas, the percentage of the vessel's total fishing revenue that was derived from within each area during the 2008–2019 period. It is estimated that over that period, only 0.9 percent of the vessels that fished in one or more of the offshore wind lease areas generated more than 50 percent of their total fishing revenue for the year from one or more of the areas. According to the data presented, in each offshore wind lease area there was one or more vessels that earned a substantial (more than 5 percent) portion of their revenue from fishing in the area. Some vessels derived more than half of their revenue from fishing in a particular offshore wind lease area. However, 75 percent of the vessels fishing in any given offshore wind lease area derived less than 0.9 percent of their total revenue from the area. Given that a majority of fishing vessels derive a small percentage of their total revenue from any one offshore wind lease area and some but not all of those may choose to seek out other suitable fishing locations, or switch their targeted species, the overall adverse impact of offshore wind energy development on fishing access by commercial fishing vessels is expected to be long term and moderate to major, depending on the mitigation measures implemented by offshore wind developers. Impacts are expected to primarily result from reduced access to traditional fishing grounds and increased risk of fishing gear damage or loss.

Cable emplacement and maintenance: Displacement of fishing vessels and disruption of fishing activities would occur in over 183,868 acres (744 km^2) (see Table F2-2 in Appendix F), though this disruption would not occur all at the same time. Installation of offshore cables for each offshore wind energy facility would require temporary rerouting of all vessels, including commercial and for-hire recreational fishing vessels, away from areas of active construction.

Boulder clearance, sand wave clearance, and cable laying disturbs the seabed and can reduce water quality through resuspension of sediment, increase underwater noise, or introduce artificial lighting and can result in a behavioral response from mobile finfish species and injury or death of less-mobile species or benthic infauna such as scallops, surfclams, and ocean quahogs, as well as alter the seabed profile (see Section 3.13.5). In turn, these responses could decrease catchability for a fishery, such as by changing the species composition where seabed profiles are changed or due to disturbances causing fish to not bite at hooks or changing swim height. The relocation of boulders also could increase the risk of gear stags, as uncharged or unknown obstructions could result in damage to equipment, lost revenue, and potential safety impacts.

For any given offshore wind energy project, the impacts of behavioral responses on target species catch in commercial and for-hire recreational fisheries are expected to be confined to a small area, and to end shortly after construction activities end. Benthic species such as sea scallops and ocean quahogs would also be expected to repopulate cable areas once the offshore cables are installed and buried. Cable inspection and repair activities would result in types of impacts similar to those resulting from construction activities, such as temporary displacement or other behavioral responses of target species. The impacts are expected to be minor and temporary in nature, only occurring during cable placement or maintenance activities. Impacts related to gear entanglement from interactions with cables is discussed above under *Presence of structures*. Details regarding potential lighting and noise impacts on finfish and invertebrates are described in Section 3.13.

Climate change: Impacts on commercial fisheries and for-hire recreational fishing are expected to result from climate change events such as increased magnitude or frequency of storms, shoreline changes, ocean acidification, and water temperature changes. Risks to fisheries associated with these events include the ability to safely conduct fishing operations (e.g., due to storms) and habitat or distribution shifts in targeted species, disease incidence, and risk of invasive species. If these risk factors result in a decrease in catch or increase in fishing costs (e.g., transiting time), the profitability of businesses engaged in commercial fisheries and for-hire recreational fishing would be adversely affected. The catch potential for the temperate Northeast Atlantic is projected to decrease between now and the 2050s (Barange et al. 2018). Hare et al. (2016) predict that climate change would affect Northeast fishery species differently. For approximately half of the 82 species assessed, the authors report that overall climate vulnerability is high to very high; diadromous fish and benthic invertebrate species, including surfclam, ocean quahog, and scallops, exhibit the greatest vulnerability. In addition, most species included in the assessment have a high potential for a change in distribution in response to projected changes in climate. Adverse effects of climate change are expected for approximately half of the species assessed, while Hare et al. (2016) anticipate that, for approximately 17 percent of the species, including inshore longfin squid (*Doryteuthis pealeii* [formerly *Loligo pealeii*]), butterfish, and Atlantic croaker, fisheries will see some beneficial impacts. The intensity of the impacts of climate change on commercial fisheries and for-hire recreational fishing is anticipated to qualify as minor to major for fishing operations that target species adversely affected by climate change, and the beneficial impacts are anticipated to qualify as minor to major for fishing operations targeting fishery species that may benefit fishing operations due to climate change effects.

The economies of communities reliant on marine species that are vulnerable to the effects of climate change could be adversely affected. If the distribution of important fish stocks changes, it could affect where commercial and for-hire recreational fisheries are located. Furthermore, coastal communities with fishing businesses that have infrastructure near the shore could be adversely affected by sea level rise (Colburn et al. 2016; Rogers at al. 2019). Because offshore wind facilities would produce lower GHG emissions than fossil fuel–powered generating facilities with similar capacities, the reduction in GHG emissions per kilowatt of electricity produced from other offshore wind projects, as opposed to equivalent energy production powered by fossil fuels, would result in long-term, beneficial impacts on fishing operations that target species adversely affected by climate change. However, the benefits would be negligible. Section 3.4, *Air Quality*, describes the expected contribution of offshore wind development to climate change.

3.9.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action alternative, ongoing activities would have continuing impacts on commercial fisheries and for-hire recreational fishing, primarily through port use, vessel activity, other offshore development, climate change, and fisheries use and management. BOEM anticipates that the impacts of ongoing activities on commercial fisheries would be **minor** to **major**, and on for-hire recreational fishing would be **minor** to **moderate**, depending on the fishery or fishing operation. The major impact rating for some fisheries and fishing operations is primarily driven by regulated fishing effort and climate change associated with ongoing activities. The impacts could also include **minor** to **moderate** long-term, beneficial impacts for certain commercial fisheries and some for-hire recreational fishing operations, due to the artificial reef effect.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and planned non-offshore wind activities, including port expansions, new cable emplacement and maintenance, and future marine transportation and fisheries use, would contribute to impacts on commercial fisheries and for-hire recreational fishing. Planned offshore wind activities would affect commercial fisheries and for-hire recreational fishing through the primary IPFs of anchoring, cable emplacement and maintenance, noise, port utilization, presence of structures, and traffic.

BOEM anticipates that the cumulative impact of the No Action Alternative would result in **minor** to **major** adverse impacts on commercial fisheries and **minor** to **moderate** adverse impacts on for-hire recreational fishing, depending on the fishery or fishing operation. This impact rating would primarily result from regulated fishing effort, climate change, and the increased presence of offshore structures (cable protection measures and foundations), primarily those associated with planned offshore wind projects. The extent of adverse impacts would vary by fishery and fishing operation because of differences in target species, gear type, and predominant location of fishing activity. The impacts could also include **minor** to **moderate** long-term, beneficial impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect.

3.9.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (see Appendix E) would influence the magnitude of the impacts on commercial and for-hire recreational fisheries:

- The number, size, and location/orientation of WTGs, which are factors that could affect access to fishing grounds, allisions and vessel collisions, and availability of targeted species;
- Total length and route of inter-array and offshore export cables, including ability to reach target burial depths, which could affect the ability of fishing vessels to operate in or transit the area and cause entanglements and gear loss, as well as changes in benthic habitat type if armoring of cables with concrete mattresses is required in order to protect cables;
- Total length and location of offshore export cables, which could affect the ability for fishing vessels to operate in or transit the area and cause entanglements and gear loss;
- Number of simultaneous vessels, number of trips, and size of vessels, which could affect potential risk for vessel collisions and use of port facilities; and
- Time of year during which construction occurs, which could affect access to fishing areas and availability of targeted fish in the area, thereby reducing catch and fishing revenue.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- Number, size, location, and amount of scour protection for WTGs, as the level of hazard related to WTGs is proportional to the number of WTGs installed.
- Cable routes: The route chosen (including variants within the general route) would determine targeted fishing areas affected.
- Season of construction: Certain fisheries have peak times during the year. For-hire recreational fisheries are most active when the weather is more favorable, while commercial fishing is active year-round, with many species harvested throughout the year. However, construction activities can affect access to fishing areas and availability of fish in the area, thereby reducing catch and fishing revenue.

Ocean Wind has committed to measures to minimize impacts on commercial fisheries and for-hire recreational fishing such as developing and implementing a Fisheries Communication and Outreach Plan (CFHFISH-02), working with commercial and recreational fishing entities to ensure the Project will minimize potential conflicts (CFHFISH-01), implementing Ørsted's corporate policy and procedure to compensate commercial/recreational fishing entities for gear loss as a result of Project activities (CFHFISH-03), and developing a Navigational Safety Fund by providing eligible commercial, charter, and for-hire fishing vessels operating in and near the Wind Farm Area with reimbursement for new radar equipment and training courses (CFHFISH-04) (COP Volume II, Table 1.1-2; Ocean Wind 2023). COP Volume III, Appendix AE, *Fisheries Mitigation Efforts* (Ocean Wind 2023), describes Ocean Wind's gear claim procedure, Direct Compensation Program, and Navigational Safety Fund. Ørsted administers a portfolio-wide gear claim procedure if Ørsted activities damage or destroy commercial fishing gear. The gear claim process requires a fisherman to file a claim within 30 days upon discovery of lost or damaged gear. They may request reimbursement for lost/damaged gear, economic loss (lost catch and business interruption), and reasonable claim preparation costs. After they submit a complete claim, the claim is reviewed and either accepted or rejected in whole or in part. If rejected in whole or in part, the fisher may appeal the decision to an independent third party. The independent third party's review is final. The full details of the gear claim process can be found at https://us.orsted.com/renewable-energy-solutions/offshore-wind/mariners.

If a regional fund has not been established, Ørsted would create a Direct Compensation Program for affected fisherman that will be in place 30 days after the receipt of all final federal, state, and local permits; authorizations; concurrences; and approvals necessary to construct and operate the Ocean Wind 1 Project as described in the approved COP. The Direct Compensation Fund would exist for the life of the Project. Ocean Wind would use the annual average commercial landings values and for-hire revenue stated in the Final EIS as a baseline for commercial and for-hire fishing. Ocean Wind would hold in reserve an amount determined by the formula set out in the draft BOEM guidance using the baseline amounts. This reserve amount would be used to pay claims brought by both commercial and for-hire fishermen in accordance with the draft guidance. Ocean Wind's compensation program would be open to any eligible commercial or for-hire fisherman regardless of homeport. The program itself would be managed by a third party. The third party would determine eligibility. Eligibility would be based on demonstrated fishing history in the Project area. The third party would also approve and deny claims and there would be an appeals process for those seeking to review a denied claim. Fishermen may make a claim during the construction and deconstruction phases of the Project. They may also make claims under certain circumstances during the operations phase of the Project. If the nine Atlantic states have established a regional compensation fund prior to the start of offshore construction, Ocean Wind would utilize the regional fund for management of funds held in reserve and processing of claims rather than establishing its own third-party managed program.

Ørsted would create a Navigational Safety Fund that will be in place 30 days after the receipt of all final federal, state, and local permits; authorizations; concurrences; and approvals necessary to construct and operate the Ocean Wind 1 Project as described in the approved COP and will exist until funds run out. The Navigational Safety Fund would enable eligible commercial fishermen and for-hire vessels to acquire navigation equipment through a voucher system. The Navigational Safety Fund would provide training and experiential learning opportunities to those navigating within Ørsted's Lease Area off the coast of New Jersey. Fishermen eligible for the Direct Compensation Program described above and who do not already possess AIS transceivers or pulse compression radar systems may receive one-time grants for up to $10,000 in order to upgrade or purchase pulse compression radar or AIS. Commercial fishing vessels and inspected for-hire/party vessels would be eligible for $10,000 in upgrades, and uninspected for-hire vessels would be eligible for $5,000 in upgrades. Eligible fishermen would be issued vouchers to spend at approved vendors for approved products. The process of issuing vouchers, approving vendors, and approving equipment would be managed by a third party, which could be the same third party managing the Direct Compensation Program. In addition to vessel upgrades, there would be an educational component to the Navigational Safety Fund. Those eligible for direct compensation may attend a professional training of their choice with support up to $1,000 per person. Eligible trainings include but are not limited to a captain's course, license upgrade, radar course, or rules of the road refresher. Like with vessel upgrades, a third-party manager would issue vouchers for training and be responsible for approving trainings, trainers, educators, and institutions.

Ocean Wind has developed a Fisheries Monitoring Plan that includes six different components to assess fisheries status in the Project area and a nearby control site throughout the pre-construction, construction, and post-construction phases. Survey types include trawl surveys, environmental deoxyribonucleic acid (DNA) surveys, structure-associated fishes surveys, clam surveys, pelagic fish surveys, and acoustic telemetry monitoring.

3.9.5 Impacts of the Proposed Action on Commercial Fisheries and For-Hire Recreational Fishing

3.9.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.9.8, *Impacts of Alternative E on Commercial Fisheries and For-Hire Recreational Fisheries*.

The sections below summarize the potential impacts of the Proposed Action on commercial fisheries and for-hire recreational fishing during the various phases of the proposed Project. Routine activities would include construction and installation, O&M, and conceptual decommissioning of the proposed Project, as described in Chapter 2, *Alternatives*.

Anchoring: Anchoring involves both anchoring of a vessel involved in the Project and the attachment of a structure to the sea bottom by use of an anchor or mooring. Anchoring vessels and other structures used in construction of the Project would pose a navigational hazard to fishing vessels. All impacts would be localized (within a few hundred meters of anchored vessels) and temporary (hours to days in duration). Although anchoring impacts would primarily occur during Project construction, some impacts could also occur during O&M and conceptual decommissioning. Therefore, the adverse effects of offshore wind energy–related anchoring on commercial fisheries and for-hire recreational fishing are expected to be long term, though periodic in nature, and minor.

Noise: Noise impacts associated with offshore construction activities for 98 WTGs, including pile driving, trenching for cable placement, O&M activities, G&G investigations, and vessels, could cause indirect impacts on commercial and for-hire recreational fisheries within the Wind Farm Area through their direct impacts on species targeted by the commercial and for-hire fisheries. See Section 3.13.5 for a full description of noise impacts on fish and invertebrates. Most noise impacts on species would be short term and behavioral in nature, with most finfish species avoiding the noise-affected areas, while invertebrates may exhibit stress and behavioral changes such as discontinuation of feeding activities. For example, noise has been shown to affect bivalves based on reactions where bivalves close their valves and burrow deeper when subjected to noise and vibration stimuli (Roberts and Elliott 2017). Prolonged closure could reduce respiration and growth, prevent expulsion of wastes, and lead to mortality and population-level impacts. Such biological impacts would have resulting moderate impacts on commercial fisheries.

The primary impacts of noise on finfish and invertebrates would occur during offshore construction activities associated with the Proposed Action. Primary noise impacts would occur from pile-driving activities; research has shown that finfish can suffer behavioral and physiological effects based on received sound levels, distance from the noise, and variables related to the noise-producing impact (e.g., materials, size of hammer). Fish response would be highest near impact pile driving (within tens of meters), moderate at intermediate distances (within hundreds of meters), and low at farther distances (within thousands of meters) (Küsel et al. 2022). During active pile-driving activities, highly mobile finfish likely would be displaced from the area, most likely showing a behavioral response; however, fish in the immediate area of pile-driving activities could suffer injury or mortality. To reduce potential impacts from pile driving, Ocean Wind has committed to using ramp-up procedures to allow mobile species to leave the area prior to experiencing the full noise impact of pile driving (GEN-9; COP Volume II, Table 1.1-2; Ocean Wind 2023). A dual noise mitigation system will also be deployed for all impact piling events, which will be a combination of two devices (e.g., bubble curtain, hydro-damper) to achieve 10-dB noise attenuation, to reduce noise propagation during monopile foundation pile driving (COP Appendix AA; Ocean Wind 2023). The soft start mitigation measure would minimize impacts by inducing fish to leave the immediate vicinity of the pile-driving activity, while the noise mitigation system will minimize behavioral and physical impacts resulting from pile driving on any fish that remain in the area.

Noise impacts related to pile driving are discussed extensively in Section 3.13 of the Final EIS and in Section 5.1.1.2 of the *Ocean Wind 1 Offshore Wind Farm Essential Fish Habitat Assessment.* Although other aspects of noise, such as vessel activity, are discussed, noise from pile driving during installation of the WTGs and OSS foundations would be the most direct acoustic effects on EFH-designated species, and in the context of this section, also fisheries that would be revenue-generating species for commercial fisheries and for-hire recreational fishing industries. As noted in Table 5-3 of the *Ocean Wind 1 Offshore Wind Farm Essential Fish Habitat Assessment,* behavioral impacts from monopile installation could occur up to 7.54 kilometers from the sound source for all fish sizes and up to 5.32 kilometers from pin pile installation. Within those areas, it is likely that some level of behavioral reaction is expected and could include startle responses or migration out of areas exposed to underwater noise (Hastings and Popper 2005). At these distances, there is also potential for secondary impacts on the periphery of the Lease Area, from adjacent offshore wind developments.

Noise from trenching of inter-array and export cables would occur during construction and would likely be limited to dispersal of species, including commercially targeted species, from the area. These disturbances would be temporary and localized and extend only a short distance beyond the emplacement corridor. While noise associated with operational WTGs may be audible to some finfish and invertebrates, this would only occur at relatively short distances from the WTG foundations, and there is no information to suggest that such noise would negatively affect this resource (English et al. 2017). Therefore, impacts on commercial and for-hire recreational fisheries would be unlikely.

Ocean Wind would conduct G&G surveys to inspect or monitor cable routes during the construction and O&M phases of the Project, or both. Noise from G&G surveys of the cable route could disturb finfish and invertebrates in the immediate vicinity of the investigation and could cause temporary behavioral changes; however, the noise is not anticipated to affect reproduction and recruitment of commercial fish stocks into the fishery. Noise impacts from surveys could have temporary, localized impacts during the short-term survey period. Impacts on commercial fisheries and for-hire recreational fishing are anticipated to be temporary and moderate given the small impact area and temporary nature of the impact.

Throughout the construction and O&M phases, vessel traffic associated with the Project would likely result in behavior responses from several species, including species targeted by fisheries. However, noise from vessels would be considered low intensity and would not be expected to affect species on a fisheries level; therefore, impacts on commercial and for-hire recreational fisheries would be minor.

Operating WTGs generate non-impulsive underwater noise that is audible to some fish species. The response of fishes to sustained anthropogenic noise is species-specific and may include disruption in social interactions, hearing loss, and a rise in noise-induced stress (Barton 2002; Popper and Hastings

2009; Debusschere et al. 2016, as cited in Siddagangaiah et al. 2021). Noise levels generated by operating WTGs are expected to reach ambient levels within a short distance of 10-MW turbines (Stöber and Thomsen 2021). Elliot et al. (2019) compared observed particle motion effects at 164 feet (50 meters) from an operational WTG at the Block Island Wind Farm to current research on particle motion sensitivity in fish. They concluded that particle motion effects could occasionally exceed the lower limit of observed behavioral responses in Atlantic cod and flatfish within these limits. Because behavioral impacts would be localized to the immediate area of WTGs, noise from operating WTGs is not expected to result in fishery-level impacts.

BOEM expects that underwater noise associated with the Proposed Action would cause short-term to long-term, localized, minor to moderate impacts on commercial and for-hire recreational fisheries. Moderate impacts are expected to result primarily from pile-driving noise during installation of foundations for WTGs and OSS and would be short term and localized, whereas minor impacts are expected to result from other noise sources. Noise impacts during decommissioning of the Project would be similar to those during the construction and O&M phases, although there would be no pile-driving activities.

Port utilization: Construction of the proposed Project would require a range of both construction and support vessels, including vessels for transferring crew, transporting heavy cargo, and conducting heavy lifts, as well as multipurpose vessels and barges. All of these vessels would add traffic to port facilities and would require berthing. For the proposed Project, construction vessels would travel between the Wind Farm Area and the following ports that are expected to be used during construction: Atlantic City, New Jersey, as a construction management base; Paulsboro, New Jersey, or from Europe directly for foundation fabrication and load out; Norfolk, Virginia, or Hope Creek, New Jersey, for WTG pre-assembly and load out; and Port Elizabeth, New Jersey, or Charleston, South Carolina, or directly from Europe for cable staging. Based on information provided by Ocean Wind, construction activities (including offshore installation of WTGs, substations, array cables, interconnection cable, and export cable) would require up to 20 to 65 simultaneous construction vessels (COP Volume I Tables 6.1.2-1 to 6.1.2-4; Ocean Wind 2023). In total, the Proposed Action would generate approximately 3,847 vessel trips during the construction and installation phase (COP Volume I, Section 6.1, Tables 6.1.2-1 through 6.1.2-5; Ocean Wind 2023). The construction vessels to be used for Project construction are described in Section 6.1.2.4.2 and Tables 6.1.2-1 to 6.1.2-4 in the COP (Ocean Wind 2023). Typical large construction vessels used in this type of project range from 325 to 350 feet (99 to 107 meters) in length, from 60 to 100 feet (18 to 30 meters) in beam, and draft from 16 to 20 feet (5 to 6 meters) (Denes et al. 2021). While there is no port expansion included as part of the Project, for the O&M phase, Ocean Wind would operate out of a new onshore O&M facility in Atlantic City, New Jersey, sited on a retired marine terminal. To accommodate the Project, the City of Atlantic City intends to secure authorization for marina upgrades—namely, dredging in the marina and at Absecon Inlet. The Project would use a variety of vessels to support O&M, including crew transfer vessels, service operation vessels, jack-up vessels, and supply vessels. In a year, the Proposed Action would generate a maximum of 908 crew vessel trips, 102 jack-up vessel trips, and 104 supply vessel trips (COP Volume I, Section 6.1.3.5, Table 6.1.2-11; Ocean Wind 2023).

The ports that would be used by Ocean Wind are also used by commercial fishing vessels and for-hire recreational fishing vessels. For example, Atlantic City ranks in the top ten for commercial fishing revenue attributed to catch from the Lease Area in the years 2008–2021. It ranked number one in average revenue ($118,846) and total revenue ($1,665,000)[7]; see Table 3.9-9 in Section 3.9.1. The additional vessel volume in the ports associated with Project operations could cause vessel traffic congestion, difficulties with navigating, and an increased risk for collisions, together with reduced access to high-

[7] Revenue in 2021 dollars with total revenue rounded to nearest $1,000.

demand port services (e.g., fueling and provisioning) by existing port users, including commercial and for-hire recreational fishing vessels. However, Ocean Wind proposes to employ a Fishing Liaison to communicate Project-related vessel movements with non-Project-related vessels and implement communication protocols to minimize adverse impacts on other users. In Atlantic City, New Jersey, the upgrades to the port undertaken to accommodate the Project vessels—namely, dredging at Absecon Inlet—would also potentially benefit larger commercial and for-hire recreational fishing vessels. In addition, the New Jersey Wind Port and the Port of Paulsboro are specifically being improved for the purpose of supporting offshore wind farm development, which would be an overall benefit for employment and the local economy. As a result, the adverse impact on commercial fisheries and for-hire recreational fishing would be both temporary during construction and long term and negligible to minor during O&M. These same impacts would occur during decommissioning of the Project, although no data are available for the number of vessels that would be required.

Traffic: The installation of offshore components for the Project and the presence of construction vessels (up to 65 construction vessels operating at any given time) and O&M vessels (up to 10 vessel trips per day) could temporarily restrict fishing vessel movement and thus transit and harvesting activities within the Project area and along the cable routing areas. It could also lead to traffic congestion and an increased risk for collisions. While Ocean Wind has not committed to creating safety zones around construction and O&M vessels, it would employ a Fishing Liaison to keep the fishing industry aware of Project vessel movements, construction timeline, and other information to help minimize conflicts and potential vessel collisions. Regardless of whether safety zones are in effect, fishing vessels would likely steer clear of construction vessels to avoid potential collisions and damage to their fishing gear. In doing so, fishing vessels could either forfeit fishing revenue or relocate to other fishing locations and continue to earn revenue. However, vessels that choose to relocate could incur increased operating costs such as increased fuel costs due to longer transit times to and from more distant fishing grounds, increased equipment maintenance/repair, and additional crew compensation due to more days at sea, among other factors. They could also experience lower revenue due to fishing potentially less-productive fishing grounds, potentially having to switch to less-valuable species, and potentially encountering more competition for a given resource. In addition, the increased steaming time may result in product spoilage for fisheries such as surfclams that must be processed shortly after harvest.

As noted in Section 3.9.4, Ocean Wind has committed to developing a Navigational Safety and Training program, which will further mitigate navigation and radar concerns. While this would not eliminate or address whether fishing vessels would transit through or around the Lease Area, it would provide the equipment and training to support the vessels and their captains to maintain safety in relation to the wind farm.

After construction is complete, WTG foundations and associated scour protection may produce an artificial reef effect, potentially increasing fish and invertebrate abundance within a facility’s footprint (see Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*), as well as recreational fishing use. Some commercial fishermen may avoid the Wind Farm Area if large numbers of recreational fishermen are drawn to the area by the prospect of higher catches (ten Brink and Dalton 2018). If these congestion concerns cause commercial fishermen to shift their fishing effort to areas outside of the Wind Farm Area to areas not routinely fished, conflict with existing users could increase as other areas are encroached upon. In general, the potential for conflict among commercial fishermen due to fishing displacement may be higher for fishermen engaged in fisheries that have regulations that constrain where fishermen can fish, such as the lobster fishery. However, the potential for vessel congestion and gear conflict may also increase if mobile species targeted by commercial fishermen, such as Atlantic herring, Atlantic mackerel, squid, tuna, and groundfish, are attracted to offshore wind energy facilities by the artificial reef effect, and fishermen targeting these species concentrate their fishing effort in the Wind Farm Area as a result. Overall, the adverse effects of vessel traffic on commercial and for-hire fishing vessels are expected to be moderate and long term. Similar impacts would also occur during decommissioning of the Project. Once the Project is fully decommissioned, navigational and fishing hazards (e.g., WTG foundations and inter-array cables) would be removed, minimizing space-use conflicts and vessel traffic impacts previously caused by the wind farm.

Presence of structures: The presence of structures can lead to impacts on commercial fisheries and for-hire recreational fishing through navigation hazards (including transmission cable infrastructure) and allisions (collisions with stationary objects), entanglement or gear loss/damage, fish aggregation, habitat conversion, and space-use conflicts, including potential vessel collisions (see Section 3.16, *Navigation and Vessel Traffic*).

Under current regulations, USCG is responsible for determining any type of safety or exclusionary zone around any structure placed in the open ocean. USCG has stated that it does not plan to create exclusionary zones around offshore wind facilities, with the exception of possibly implementing safety zones during construction and conceptual decommissioning, to be determined on a project-by-project basis (BOEM 2018). However, the presence of the Project's WTGs could result in the area essentially becoming an exclusion area for fishing if fishing vessel operators are not—or perceive that they are not—able to safely navigate the area around the WTGs.

Under the Proposed Action, Ocean Wind proposes to install 98 WTGs extending up to 906 feet (276 meters) above MLLW with spacing of 1 nm by 0.8 nm (1.9 by 1.5 kilometers) between WTGs in a southeast-northwest orientation. The Project design orients the WTG arrays in the southeast-northwest direction to support the predominant commercial fishing transit routes originating from Atlantic City (COP Volume I, Executive Summary; Ocean Wind 2023), the port with the highest average number of annual commercial fishing vessel trips to the Wind Farm Area from 2008 to 2021 (Table 3.9-8), as well as the highest average annual revenue and total revenue for the same timeframe (Table 3.9-9).

The presence of WTG arrays may restrict fishing vessel maneuverability (including risk of allisions) within the Wind Farm Area. Fishermen have expressed specific concerns about fishing vessels operating trawl gear that may not be able to safely deploy and operate in an offshore wind lease area given the size of the gear, the spacing between the WTGs, and the space required to safely navigate, especially with other vessels present and during poor weather conditions. Trawl and dredge vessel operators have commented that spacing less than 1 nm (1.9 kilometers) between WTGs may not be enough to operate safely due to maneuverability of fishing gear and gear not directly following in line with vessel orientation. Clam industry representatives (Atlantic Surfclam and Ocean Quahog fisheries) state that their operations require a minimum distance of 2 nm (3.7 kilometers) between WTGs, in alignment with the bottom contours, for safe operations (BOEM 2021a; RODA 2021). While there are a number of areas within the Lease Area designated as Prime Fishing Grounds of New Jersey, Atlantic City Bluefish Lump in the northeastern region, and Lobster Pots, Hambone, Teardrop, Triple Lumps, and The Ham in the northwestern region, navigating through the Wind Farm Area would not be as problematic for for-hire recreational fishing vessels, which tend to be smaller than commercial vessels and do not use large external fishing gear (other than hook and line) that makes maneuverability difficult. However, trolling for highly migratory species (e.g., bluefin tuna, swordfish) may involve deploying many feet of lines and hooks behind the vessel and then following large pelagic fish once they are hooked, which poses additional navigational and maneuverability challenges around WTGs (BOEM 2021a).

Ocean Wind's *Navigation Safety Risk Assessment* (NSRA) (COP Volume III, Appendix M; Ocean Wind 2023) concluded that it is technically possible to fish and transit through the Wind Farm Area with the proposed WTG spacing. Based on pertinent literature, the study concluded that the turning radius of a fishing vessel such as a medium-length (148-foot [80-meter]) hydraulic dredge would be smaller than 0.83 nm (1.5 kilometers) at a typical fishing speed of 4 knots (2 m/s) or less. However, the study does recognize that, depending on the exact type and length of gear being used, the distances between the

WTGs may limit safe fishing patterns within the Project area. While Ocean Wind's NSRA shows that it is technically feasible to navigate and maneuver fishing vessels and mobile gear through the Wind Farm Area, BOEM is cognizant that maneuverability within the Wind Farm Area may vary depending on many factors, including vessel size, fishing gear or method used, and environmental conditions such as wind, sea state, current, and visibility. In addition, BOEM recognizes that even when it is feasible to fish within the Wind Farm Area, some fishermen might still not consider it safe to do so. Furthermore, operating within the Wind Farm Area with other vessels and gear types present may restrict vessel maneuverability.

Because of the height of WTGs above the ocean surface, they would be visually detectable at a considerable distance during the day and easily detected by vessels equipped with radar regardless of the time of day. To further ensure navigational safety, all WTGs and OSS would be lit and marked in accordance with USCG, BOEM, and IALA guidelines, and WTG locations would be charted by NOAA and could include protocols for sound signals, radar beacons, and AIS, which would be finalized with consideration for other such private aids to navigation (PATON) in the area (i.e., foghorns) in coordination with USCG.

O&M of the Proposed Action would likely affect marine vessel radar performance near or within the Wind Farm Area. The National Academies of Sciences, Engineering, and Medicine report titled *Wind Turbine Generator Impacts to Marine Vessel Radar* notes that WTG interference decreases the effectiveness of marine vessel radar mounted on all vessel classes (National Academies of Sciences, Engineering, and Medicine 2022:5). Larger vessels may have more experienced bridge personnel; however, there is no requirement, domestic or international, for training to include specifics on WTGs and there is currently no standard system of active radar tailored to a WTG environment (National Academies of Sciences, Engineering, and Medicine 2022:21–25, 66). Smaller vessels operating in the vicinity of the Project may experience the same challenges as larger vessels if equipped with marine vessel radar, such as clutter due to the WTGs or ambiguous detections, and may also be harder to identify as distinct targets or become lost contacts by larger vessels while in the proximity of WTGs (National Academies of Sciences, Engineering, and Medicine 2022:38–48). While radar is one of several navigational tools available to vessel captains, including navigational charts, global positioning system, and navigation lights mounted on the WTGs (COP Volume III, Appendix M, NSRA, Section 11.3; Ocean Wind 2023), radar is the main tool used to help locate other nearby vessels that are not otherwise visible, particularly in adverse weather when visibility is limited. The navigational complexity of transiting through the Wind Farm Area, including the potential effects of WTGs and OSS on marine radars, would increase risk of collision with other vessels (including non-Project vessels and Proposed Action vessels). See also Section 3.16, *Navigation and Vessel Traffic*.

Development and implementation of Ocean Wind's Fisheries and Communication and Outreach Plan (COP Volume III, Appendix O; Ocean Wind 2023) will cover all phases of the proposed Project and provide a mechanism for coordination and communication related to commercial fishing vessels. In addition, as noted in Section 3.9.4, Ocean Wind has committed to developing a Navigational Safety Fund, which will further mitigate navigation and radar concerns. While this would not eliminate or address whether fishing vessels would transit through or around the Lease Area, it would enable eligible commercial fishermen and for-hire recreational vessels to acquire the navigation equipment and training to support the vessels and their captains to maintain safety in relation to the wind farm. The equipment and training would be managed by a third party, which could be the same third party managing the Direct Compensation Program.

Notwithstanding these safety measures, some fishermen have commented that, because of safety considerations, they would not enter an offshore wind array during inclement weather, especially during low-visibility events (Kirkpatrick et al. 2017). During interviews with commercial fishermen, ten Brink and Dalton (2018) found that fishermen had concerns that low visibility, wind, or crew exhaustion could lead to vessels hitting WTGs. Moreover, mechanical problems, such as loss of steerage, could result in an allision with a WTG as the vessel drifts during repair (DNV-GL 2021). Aside from these potential navigational issues, some commercial fishermen may avoid the Wind Farm Area if large numbers of recreational fishermen are drawn to the area by the prospect of higher catches. According to ten Brink and Dalton (2018), the influx of recreational fishermen into the Block Island Wind Farm in Rhode Island caused some commercial fishermen to cease fishing in the area because of vessel congestion and gear conflict concerns. In addition, if these concerns cause commercial fishermen to shift their fishing effort to areas not routinely fished, conflict with existing users could increase as other areas are encroached. In general, the potential for conflict among commercial fishermen due to fishing displacement may be higher for fishermen engaged in fisheries that have regulations that constrain where fishermen can fish, such as the lobster fishery. However, the potential for vessel congestion and gear conflict may also increase if mobile species targeted by commercial fishermen, such as Atlantic herring, Atlantic mackerel, squid, tuna, and groundfish, are attracted to the Wind Farm Area, and fishermen targeting these species concentrate their fishing effort in the Lease Area as a result.

Whether fishermen continue to fish in the Wind Farm Area is also determined by cultural and traditional values that go beyond expected profit. For example, it is advantageous for fishermen to be able to fish in locations that are known to them and also fished by their peers. In addition, the presence of other boats in the area can contribute to the fishermen’s sense of safety. Some fishermen may choose to not fish in the area due to their perception of risk. Impacts on commercial fisheries may affect the economic health, the cultural identity, and values, and therefore the wellbeing, of individuals and communities that identify as “fishing” communities. Impacts on cultural and traditional values are not quantifiable but are qualitatively considered when assessing the impacts of the Proposed Action. In addition, there could be a psychological effect on commercial fishermen, as studies have shown there are occasionally far-reaching impacts related to fisheries disasters, where an economic fisheries disaster was declared for the Atlantic cod. It was determined that overfishing was occurring largely due to uncertainties in stock estimates and noted that fishing pressure should be reduced by upwards of 90 percent (Scyphers et al. 2019). This resulted in low levels of trust in fisheries management and was a predictor of both initial and chronic psychological distress. Distress was most severe for individuals without income diversity and those with dependents in the household. Some fishing vessel operators unwilling or unable to travel through or deploy fishing gear in the Wind Farm Area may be able to find suitable alternative fishing locations and continue to earn revenue, although it is difficult to predict the ability of fishing operations displaced by the Project to locate alternative fishing grounds that would allow them to maintain revenue targets while continuing to minimize costs, and some vessel operators may choose not to seek alternate fishing grounds. If a vessel operator chooses to seek alternate fishing locations, the available data suggest the presence of alternative productive fishing grounds in proximity to the Wind Farm Area, especially for the two highest revenue-producing FMP species within the Wind Farm Area: sea scallop and surfclam/ocean quahog (COP Volume II, Section 2.3.4.1.3 Figures 2.3.4-12.3.4-2; Ocean Wind 2023). The figures in the COP indicate that the fishing level efforts in large expanses of ocean within 30 nm (55.6 kilometers) of the Lease Area are comparable to or higher than those within the Lease Area. While comparable fishing grounds may exist in proximity to the Wind Farm Area, shifting locations could result in increased operating costs (e.g., additional fuel to arrive at more distant locations; additional crew compensation due to more days at sea), lower revenue (e.g., fishing in a less-productive area, fishing for a less-valuable species, or increased competition for the same resource), or both. In addition, due to other offshore wind development in adjacent offshore wind lease areas, it would be expected that commercial fishing vessels would also be displaced and actively looking for alternative fishing grounds, which could increase competition for ocean space use. However, if, at times, a fishery resource is only available within the Wind Farm Area, some fishermen, primarily those using mobile gear, may lose the revenue from that resource for the time the resource is inaccessible. Not all fishermen would seek alternative fishing grounds and, while some may switch the species they target, some may also leave the fishery altogether (Murray et al. 2010; O’Farrell et al. 2019). Those vessel operators switching species targeted may also lose revenue from targeting a less valuable species and increased costs from switching gear type. They may also look to land their catch at a different port (Papaioannou et al. 2021). All of these impacts could remain until decommissioning of the Project is complete, although the magnitude of the impacts would diminish over time if fishing practices adapt to the presence of structures.

To evaluate the potential costs associated with reduced fishing revenues that may result from construction and O&M activities in the Wind Farm Area, BOEM obtained information from NMFS on fisheries revenue sourced from within the Lease Area. From these data, it is possible to estimate the amount of commercial fishing revenue that would be exposed as a result of the Proposed Action, although the data are only for those vessels issued federal fishing permits by the NMFS Greater Atlantic Region and therefore do not include all sources of commercial fishing revenue within the Lease Area. The estimate of revenue exposure quantifies the value of fishing that occurs in the Lease Area. Therefore, these estimates represent the fishing revenue that would be foregone if fishing vessel operators opt to no longer fish in these areas and cannot capture that revenue in a different location. Revenue exposure estimates should not be interpreted as measures of actual economic impact, as they are based on historic landings. Actual economic impact would depend on many factors—foremost, the loss of the potential for continued fishing to occur within the Wind Farm Area, together with the ecological impact on target species residing within the Project area. Economic impacts of these factors are lessened with a vessel's ability to adapt to changing where it fishes. For example, if alternative fishing grounds are available nearby and could be fished at no additional cost, the economic impact would be lower. There is also the potential to fish the boundary of the Wind Farm Area. If fish stocks increase within the Wind Farm Area due to reduced fishing efforts, stocks may also increase in areas immediately adjacent to the Wind Farm Area and, if fished, these adjacent areas may generate revenue similar to that of the Wind Farm Area.

Based on average annual revenue data from 2008 through 2021, Table 3.9-24 shows the annual revenue at risk in the Lease Area by FMP fishery. The average amount of commercial fishing revenue that would be exposed annually for the life of the Project is estimated to be $312,601 across all FMP and non-FMP fisheries, with any given year potentially above or below this value, and represents about 0.02 percent of the total average annual revenue of the FMP and non-FMP fisheries in the Mid-Atlantic and New England regions. The largest impacts in terms of exposed revenue as a percentage of total revenue in the Mid-Atlantic and New England regions would be in the Surfclam/Ocean Quahog FMP fishery (0.27 percent). In addition, as noted in Section 3.9.4, Ørsted would create a Direct Compensation Program for affected fisherman as described in the COP. The Direct Compensation Fund would serve to mitigate potential revenue at risk in the Lease Area related to claims from both commercial fishing and for-hire recreational fishing operations, regardless of their homeport. The program would be managed by a third party and eligibility would be based upon a demonstrated fishing history in the Project area.

As shown in Table 3.9-9, the ports most affected by revenue sourced from within the Lease Area in the years 2008 through 2021 were Atlantic City, New Jersey, followed distantly by Cape May, New Jersey; New Bedford, Massachusetts; and Newport News, Virginia.

As described above, the amount of fishing activity that could be affected within the Lease Area is a small fraction of the amount of fishing activity in the New England and Mid-Atlantic regions as a whole. However, for fishing vessels that choose to avoid the Wind Farm Area, have historically derived a large percentage of their total revenue from the area, and are unable to find suitable alternative fishing locations, the adverse impacts would be long term and moderate. While a small number of commercial fishing vessels fish heavily in the Lease Area, the highest percentage of total annual revenue attributed to catch within the Lease Area was 31 percent in 2017. However, three quarters of the vessels fishing in the area derived less than 0.16 percent of their total revenue from the area in 2008 through 2021 (see Section 3.9.1). In short, some vessels depended heavily on the Lease Area, but most vessels derived a small percentage of their total annual revenue from the area. In both cases, the impacts could be long term if the respective vessels choose to avoid the Lease Area, but the level of impact for vessels deriving only a small percentage of their revenue from the area would be substantially less than for vessels that derive a large portion of their revenue from the Lease Area. Considering the low revenue risk across ports, together with the small number of vessels and fishing activity that would be affected by the Project, the impacts on other fishing industry sectors, including seafood processors and distributors and shoreside support services, would be long term and negligible to moderate, depending on the fishery in question.

As noted above, there are a number of areas within the Lease Area designated as Prime Fishing Grounds of New Jersey; however, annual exposure of revenue for for-hire recreational fishing specific to the Lease Area is not available. However, BOEM conducted an economic analysis of recreational for-hire boats, as well as for-hire and private-boat angler trips that might be affected by the overall New Jersey WEA, which encompasses all of the New Jersey lease areas (Kirkpatrick et al. 2017). Recreational fishing was considered “exposed” to potential impact if at least part of the trip occurred within 1 nm (1.9 kilometer) of a WEA during the study period (2007–2012). Only the recreational fisheries in New Jersey and Maryland indicate trips to the New Jersey WEA, with a negligible amount from Delaware and New York for which approximately 0 percent of the revenue was exposed (Kirkpatrick et al. 2017). On average, approximately 8,177 for-hire boat trips and 153,989 for-hire angler trips were made from a home port in New Jersey annually during this period. Of these annual estimates, approximately 4.6 percent of boat trips and 3.8 percent of for-hire angler trips were estimated to be exposed to the New Jersey WEA (Kirkpatrick et al. 2017). Based on the information shown in Table 3.9-17 and Table 3.9-18, the vast majority of for-hire recreational fishing in the Wind Farm Area originates from New Jersey ports—namely, Atlantic City and Sea Isle, with other New Jersey ports having fewer than three permits. For Atlantic City and Sea Isle, the exposed revenue for all New Jersey WEAs was 20.8 percent and 9.8 percent, respectively (Kirkpatrick et al. 2017). As shown in Table 3.9-16, the average annual for-hire recreational fishing revenue for the Wind Farm Area from 2008 through 2021 was approximately $21,000; therefore, the exposed revenue as it relates to the Wind Farm Area would be smaller than the noted percentages.

Table 3.9-24 Annual Average Commercial Fishing Revenue Exposed to the Wind Farm Area by FMP Fishery Based on Annual Average Revenue 2008–2021

FMP Fishery	Peak Annual Revenue	Average Annual Revenue	Average Annual Exposed Revenue as a Percentage of Total Revenue from the Geographic Analysis Area
Atlantic Herring	$5,059	$405	0.00%
ASMFC	$102,285	$20,517	0.00%
Bluefish	$144	$67	0.00%
Highly Migratory Species	$746	$199	0.00%
Mackerel/Squid/Butterfish	$33,668	$10,527	0.02%
Monkfish	$14,557	$3,473	0.02%
Multispecies Small Mesh	$301	$64	0.00%
Northeast Multispecies	$162	$15	0.00%
Sea Scallop	$304,741	$110,567	0.02%
Southeast Regional Office FMP	$336	$29	0.01%
Skate	$5,380	$1,335	0.02%
Spiny Dogfish	$100	$24	0.00%
Summer Flounder/Scup/Black Sea Bass	$24,464	$12,730	0.03%
Surfclam/Ocean Quahog	$341,567	$107,850	0.13%
Tilefish	$42	$9	0.00%
None: Unmanaged[1]	$86,322	$22,903	0.01%

FMP Fishery	Peak Annual Revenue	Average Annual Revenue	Average Annual Exposed Revenue as a Percentage of Total Revenue from the Geographic Analysis Area
All Others[2]	$190,070	$21,905	0.02%
All FMP and non-FMP Fisheries	**$804,578**	**$312,601**	0.02%

Sources: Developed using data from NMFS 2022b).
Notes: Revenue is in nominal dollars and is estimated based on the annual average revenue by FMP from 2008 through 2021. Resolution of the data does allow estimates to be made on a small enough scale to differentiate impacts along wind farm export cable corridors. Therefore, estimates only pertain to the Lease Area itself. Peak annual revenue and average annual revenue are calculated independently for all rows, including the All FMP and non-FMP Fisheries row.
[1] Includes revenues from all species not assigned to an FMP (No Federal FMP).
[2] "All Others" is for data that have been aggregated for confidentiality purposes.

A potential effect of the offshore cables and WTGs is the entanglement and damage or loss of commercial and recreational fishing gear. Economic impacts on fishing operations associated with gear damage or loss include the costs of gear repair or replacement, together with the fishing revenue lost while gear is being repaired or replaced.

The Proposed Action would install approximately 384 miles (618 kilometers) of new submarine cable, including 190 miles (305.8 kilometers) of inter-array cables, 175 miles (281.6 kilometers) of offshore export cables, and 19 miles (30.1 kilometers) of OSS interconnector cables. As described in the COP (COP Volume I, Sections 6.1.1.5 and 6.1.1.6; Ocean Wind 2023) and summarized in Appendix E, Ocean Wind proposes to bury all cables to a target depth of 4 to 6 feet (1.2 to 1.8 meters). Four to six feet is well below the typical depth to which bottom trawls penetrate the ocean floor. In a study of seabed depletion and recovery from bottom trawl disturbance, Hiddink et al. (2017) found that hydraulic dredges penetrated the ocean floor the deepest at 6.3 inches (16.1 centimeters). Even with the common practice of dredge vessels fishing the same or similar tow paths on multiple occasions during the same trip, it is unlikely that fishing gear would penetrate deep enough to snag or become tangled in the cable. While it is possible that cables could become uncovered during extreme storm events due to mobile seabed conditions or other natural processes, burying and maintaining cables to the target depth would minimize the risk of exposure and potential damage to fishing gear.

In areas where seabed conditions might not allow for cable burial, other methods of cable protection would be employed, such as rock placement, concrete mattress placement, frond mattress placement, rock bags, or seabed spacers. It is anticipated that up to 10 percent of the offshore cable may require additional cable protection where burial depth may be less than 4 feet (1.3 meters). In addition to cable armoring, the Project would install approximately 84 acres (0.34 km^2) of scour protection for the 101 installed foundations (WTGs and OSS). The scour protection would extend out 72 yards (65.8 meters) from the foundations and have a layered thickness of 8.2 feet (2.5 meters) and, similar to cable armoring, would pose a risk to entanglement and gear loss for commercial fishers, as well as gear loss for for-hire recreational fishers because trolling, bait fishing, and shark fishing could be more challenging, as the fish could use foundations and the scour protection to break free.

Cable, WTG, and OSS locations would be indicated on nautical charts, helping to reduce the potential for fishing gear interactions. Additionally, while Ocean Wind does not currently plan to establish formal exclusion/safety zones around construction vessels during the laying of cables, USCG may implement safety zones, as described in Ocean Wind's Fisheries and Communication and Outreach Plan (COP Volume III, Appendix O; Ocean Wind 2023). However, Ocean Wind employs a Fisheries Liaison to coordinate outreach to the fishing industry and disseminate information regarding Project activities such as Project vessel movements and construction schedule to minimize potential adverse interactions between commercial and for-hire recreational fisheries and Project operations. Additionally, as noted in Section 3.9.4, Ocean Wind has developed a financial compensation policy and procedure to be used when interactions between the fishing industries and Project activities or infrastructure cause gear loss or damage as described in Ocean Wind's Fisheries and Communication and Outreach Plan (COP Volume III, Appendix O; Ocean Wind 2023). The use of this policy for qualifying gear interactions that may occur during construction, as well as during O&M activities, is considered part of the Proposed Action and would help reduce moderate adverse impacts for commercial fisheries to minor impacts. Applicants may request reimbursement for lost/damaged gear, economic loss (lost catch and business interruption), and reasonable claim preparation costs. The full details of the gear claim process can be found at https://us.orsted.com/renewable-energy-solutions/offshore-wind/mariners.

Impacts due to entanglement and gear damage/loss would persist for the duration of Project operations. During decommissioning of the Project, all foundations for WTGs and OSS would be removed to 15 feet below the mudline, and while Ocean Wind proposes to leave any scour protection placed around the base of the monopiles in place (COP Volume I, Section 6.3; Ocean Wind 2023), BOEM would most likely require that the scour protection be removed in accordance with 30 CFR 285.902(a), eliminating the opportunities for entanglement and gear damage/loss. However, if left in place, the scour protection would continue to pose an indefinite threat for entanglement and gear damage/loss. Offshore cables may be either left in place or removed depending on the regulatory requirements at the time of decommissioning, although it is assumed that all inter-array cables would be removed. Any scour protection or materials (e.g., concrete mattresses) that were used to protect exposed cables permitted to be left in-situ would continue to affect bottom trawl fisheries as well as for-hire recreational fishing due to possible entanglement and gear loss.

In addition to posing hazards to fishing gear, the presence of the WTG foundations and associated scour protection, as well as cable protection, would convert existing sand or sand with mobile gravel habitat to hard bottom, which, in turn, would reduce the habitat for target species that prefer soft-bottom habitat (e.g., surfclams, sea scallops, squid, summer flounder) and increase the habitat for target species that prefer hard-bottom habitat (e.g., lobster, striped bass, black sea bass, Atlantic cod). Where WTG foundations, scour, and cable protection produce an artificial reef effect and attract finfish and invertebrates, the aggregation of species could increase the catchability of target species (Kirkpatrick et al. 2017). Although species that rely on soft-bottom habitat would experience a reduction in favorable conditions, the impacts from structures are not expected to result in population-level impacts (see Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*) and changes to species biomass are not expected to be significant enough to affect total quotas.

The habitat changes would likely benefit for-hire recreational fishing due to increased fishing opportunities around the infrastructure, which is what ten Brink and Dalton (2018) found occurred at the Block Island Wind Farm in Rhode Island. Impacts from habitat conversion would last throughout the life span of the Project and, in areas where scour and cable protection are left in place after decommissioning, would last indefinitely, although the scale of impact will not be known until decommissioning and the actual acreage of scour and cable protection to be left in place is known.

The change in habitat from soft bottom to hard bottom could slow the movements of migratory fish species through habitat occupation. However, water temperature is expected to be a bigger driver of habitat occupation and species movement than structure (Fabrizio et al. 2014; Moser and Shepherd 2009; Secor et al. 2018).

The Proposed Action is expected to add up to 101 foundations and 178 acres (0.7 km^2) of scour/cable protection. Foundations and scour/cable protection would remain for the life of the Project. This could tend to slow migration. However, water temperature is expected to be a bigger driver of habitat occupation and species movement (Fabrizio et al. 2014; Moser and Shepherd 2009; Secor et al. 2018).

Migratory animals would likely be able to proceed from structures unimpeded. Therefore, this impact is anticipated to be negligible and would only last for the duration of the Project, as the foundations and scour/cable protection would be removed during decommissioning.

Cable emplacement and maintenance: The Proposed Action would install approximately 384 miles (618 kilometers) of new submarine cable, including 190 miles (305.8 kilometers) of inter-array cables, 175 miles (281.6 kilometers) of offshore export cables, and 19 miles (30.1 kilometers) of OSS interconnector cables. As described in the COP (COP Volume I, Sections 6.1.1.5 and 6.1.1.6; Ocean Wind 2023) and summarized in Appendix E, Ocean Wind proposes to bury all cables to a target depth of 4 to 6 feet (1.2 to 1.8 meters). Cable-laying activities, including preparatory boulder and sand wave clearance activities, would directly disrupt commercial and for-hire recreational fishing activities in areas of active construction, although disruption in any given area would be temporary. Existing aquaculture leases would be avoided to the extent practicable; however, the aquaculture lease near the Oyster Creek marina landfall option may be temporarily affected by cable installation and anchor lines for installation vessels. Boulder clearance would be performed using a combination of displacement plow, subsea grab, or, in shallower waters, a backhoe dredger, while sand wave clearance may be undertaken by traditional dredging methods such as a trailing suction hopper or, alternatively, by a controlled-flow excavator or sand wave removal plow, with the ultimate method chosen based on the results from the site investigation, surveys, and cable design (COP Volume I, Sections 6.1.2.1.3 and 6.1.2.1.5; Ocean Wind 2023).

Boulder clearance, sand wave clearance, and cable laying disturbs the seabed and can reduce water quality through resuspension of sediment, increase underwater noise, or introduce artificial lighting and can result in a behavioral response from mobile finfish species and injury or death of less-mobile species or benthic infauna such as scallops, surfclams, and ocean quahogs, as well as alter the seabed profile (see Section 3.13.5). In turn, these responses could decrease catchability for a fishery, such as by changing the species composition where seabed profiles are changed or due to disturbances causing fish to not bite at hooks or changing swim height. The maximum impacts for boulder and sand wave clearance would be 4,552 acres (18.4 km^2), assuming a 98-foot (30-meter) wide corridor along 100 percent of the cable route within both the Wind Farm Area and the export cable routes (COP Volume I, Section 6.1.1.4; Ocean Wind 2023), even though the actual clearance area is likely to be less than the assumed maximum area. New cable emplacement and maintenance are estimated to affect up to 169 acres (0.7 km^2) of seafloor within the export cable route. The relocation of boulders also could increase the risk of gear stags, as uncharged or unknown obstructions could result in damage to equipment, lost revenue, and potential safety impacts. Behavioral responses of target species in commercial and for-hire recreational fisheries are expected to be confined to a small area at any one time, and to end shortly after construction activities end. Cable inspection and repair activities would result in types of impacts similar to those of construction activities, with temporary disturbance, displacement, injury, or mortality of target species. However, the areas of impact would be expected to be minor and the duration of impacts to be temporary.

Fishing activities for all gear types could be disrupted during periods of active cable site preparation, installation, and maintenance along cable routes in the Wind Farm Area and export cable corridors. Fishing vessels may not have access to affected areas, which could lead to reduced revenue if alternative fishing locations are not available or there is increased conflict over other fishing grounds. Ocean Wind estimates the simultaneous cable lay and burial speed for the offshore export cables would be an average speed of approximately 3 kilometers per day (125 meters per hour) (COP Volume I; Ocean Wind 2023). Cable-laying activities would not restrict large areas, and navigational impacts would likely be on the scale of hours.

Climate change: The types of impacts from global climate change on commercial fisheries and for-hire recreational fisheries described for the No Action Alternative would also occur under the Proposed Action (see Section 3.9.3.2). The Proposed Action could contribute to a long-term net decrease in GHG emissions due to its use of renewable energy. While this decrease may not be measurable, it would be expected to help reduce climate change to some degree, although any negligible benefit would only last until the Project is decommissioned.

3.9.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities.

Anchoring: The Proposed Action would contribute a noticeable increment to the combined anchoring impacts on commercial fisheries and for-hire recreational fishing from ongoing and planned activities including offshore wind. Anchoring activities would result in localized, short-term, minor impacts on commercial fisheries and for-hire recreational fishing, including navigational hazards to fishing vessels, especially if projects are overlapping in the same area as fishing or transiting fishing vessels.

Noise: The incremental contributions of the Proposed Action to the combined noise impacts on commercial fisheries and for-hire recreational fishing associated with ongoing and planned activities would be noticeable. The most significant sources of noise are expected to be from pile driving, followed by vessels. The 101 foundations for the Proposed Action would represent approximately 3 percent of the 3,159 foundations that would be installed on the OCS for planned offshore wind farms, including the Proposed Action. The noise from Project vessels would only represent a small fraction of the large volume of existing traffic in the geographic analysis area.

Traffic: BOEM expects the Proposed Action would contribute a noticeable increment to the combined vessel traffic impacts on commercial fisheries and for-hire recreational fishing from ongoing and planned activities including offshore wind. Increased vessel traffic during the construction timeframe, as well as during O&M activities, would result in moderate impacts.

Port utilization: The incremental contributions of the Proposed Action to the combined port utilization impacts associated with ongoing and planned activities would be noticeable.

Presence of structures: BOEM expects the Proposed Action would contribute a noticeable increment to the combined presence of structure impacts on commercial fisheries and for-hire recreational fishing from ongoing and planned activities including offshore wind. The increased number of structures would increase the risk of highly localized and periodic impacts on commercial fisheries that could be major and impacts on for-hire recreational fishing that could be minor for those trolling for highly migratory species or beneficial due to increased fishing opportunities for other for-hire recreational fisheries.

Cable emplacement and maintenance: The Proposed Action would contribute a noticeable increment to the combined cable emplacement and maintenance impacts on commercial fisheries and for-hire recreational fishing from ongoing and planned activities including offshore wind, which would be localized, short term, and minor due to fishing vessel displacement.

3.9.5.3. Conclusions

Impacts of the Proposed Action. Project construction and installation, O&M, and conceptual decommissioning could affect port and fishing access, as well as transit and harvesting activities, fishing gear interactions, and target species catch. BOEM anticipates that the adverse impacts of the Proposed Action on commercial fisheries and for-hire recreational fishing would vary by fishery and fishing operation due to differences in target species abundance in the Project Area, gear type, and predominant location of fishing activity. It is conceivable that some of the small number of fishing operations that derive a large percentage of their total revenue from areas where Project facilities would be located would choose to avoid these areas once the facilities become operational. In the event that these specific fishing operations are unable to find suitable alternative fishing locations, they could experience long-term, major disruptions. However, it is estimated that the majority of vessels would only have to adjust somewhat to account for disruptions due to impacts and that the Direct Compensation Fund would serve to mitigate potential revenue at risk in the Lease Area. Therefore, BOEM expects the incremental impact of the Proposed Action, when compared with the No Action Alternative, to be minor to moderate for commercial fisheries and for-hire recreational fishing operations, depending on the fishery or fishing operation. In addition, the incremental impacts of the Proposed Action could include long-term, minor to moderate beneficial impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect.

When including the baseline status (No Action Alternative), including regulated fishing effort and climate change, into the impact findings, BOEM expects that the impacts resulting from the Proposed Action would range from **minor** to **major** for commercial fisheries and **minor** to **moderate** for for-hire recreational fishing operations, depending on the fishery or fishing operation. The impacts of the Proposed Action could include long-term, **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect.

Cumulative Impacts of the Proposed Action. The incremental impacts contributed by the Proposed Action to the cumulative impacts on commercial fisheries and for-hire recreational fishing would be appreciable. BOEM anticipates that the cumulative impacts on commercial fisheries and for-hire recreational fishing associated with the Proposed Action when combined with impacts from ongoing and planned activities including offshore wind would be **minor** to **major** for commercial fisheries and **minor** to **moderate** for-hire recreational fishing operations because some fisheries and fishing operations would experience substantial disruptions indefinitely, even with APMs. This impact rating is primarily driven by the presence of offshore structures, climate change, and regulated fishing effort. Cumulative impacts could include long-term, **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect.

The majority of offshore structures in the geographic analysis area would be attributable to the offshore wind industry. However, given the array of measures available to mitigate impacts of offshore wind projects on commercial fisheries and for-hire recreational fishing, this impact rating is driven mostly by reduced stock levels from ongoing fishing mortality because of regulated fishing effort, changes in the abundance and distribution of fish and invertebrates associated with ongoing climate change, and permanent impacts from the presence of structures associated with planned offshore wind projects.

3.9.6 Impacts of Alternatives B and D on Commercial Fisheries and For-Hire Recreational Fishing

Impacts of Alternatives B and D. The relevant change from the Proposed Action to Alternatives B-1 and B-2 would be the removal of up to 19 WTGs from the two most shoreward (northwest) rows within the Wind Farm Area to reduce visual impacts. For Alternative D, the relevant change would be the removal up to 15 WTGs to avoid sand ridge and trough habitat in the northeast corner. Even with removal of these WTGs, implementation of these alternatives would result in most of the same types of impacts from all of the IPFs on commercial fisheries and for-hire recreational fisheries from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action, with some impacts being minimally decreased. The reduction of WTGs in Alternative D may have additional benefits to recreational fisheries in that it can preserve natural fish habitat of the area. Sand ridges and troughs are areas of biological significance for migration and spawning of mid-Atlantic fish species, many of which are recreationally targeted in those specific areas.

Alternatives B-1, B-2, and D would reduce the overall footprint of the Project, providing more area within the Lease Area for commercial fishing vessels to operate and fish without potential impacts from structures, slightly reducing the potential for gear entanglement and loss, as well as allisions. There would likely be fewer construction vessel trips, slightly decreasing congestion and possibly slightly reducing the risk of vessel collisions. With no structures in the northwestern portion of the Lease Area, it would benefit for-hire recreational fishing by removing impacts on some of the Prime Fishing Grounds of New Jersey while also decreasing potential vessel conflicts for the commercial fishery vessels that transit or choose to fish the area. The biological benefits of preserving natural fish habitat may have beneficial impacts on the fish communities and recreational fishing. Additional potential benefits of Alternative D preserving sand ridge and trough habitat would be in the troughs providing migratory pathways for many diadromous fish species. The sand ridges and troughs also influence water and sediment dynamics and provide a complex habitat for multiple life stages of varying species. However, given the small size of the added structure-free area, any additional revenue realized by the commercial fishery would likely be minimal and dependent on the targeted species that may be in that particular area and whether commercial fishermen are willing to fish that part of the Lease Area. According to VMS density mapping available through Northeast Ocean Data (2023), fisheries benefiting the most from removal of the WTGs under Alternatives B and D would be the Surfclam/Quahog and Scallop FMP fisheries, for which hydraulic clam dredges are the primary gear type used, and dredge and pots/traps gear types in general.

Cumulative Impacts of Alternatives B and D. The incremental impacts contributed by these action alternatives to the cumulative impacts on commercial fisheries and for-hire recreational fishing would be similar to or slightly less than those described under the Proposed Action, which would be appreciable.

3.9.6.1. Conclusions

Impacts of Alternatives B and D. The anticipated incremental minor to moderate impacts and minor to moderate beneficial impacts associated with Alternatives B-1, B-2, and D without the baseline (No Action Alternative) scenario would not be substantially different than the incremental impacts of the Proposed Action. While these action alternatives could slightly change the impacts on commercial fisheries and for-hire recreational fishing, ultimately the same or highly similar construction, operation, and decommissioning impacts would still occur. Any additional revenue realized by commercial fisheries would be minimal, and for-hire recreational fishing may see a slight decrease due to fewer structures providing reef habitat for targeted species. When considering all of the IPFs and including the baseline (No Action Alternative), including regulated fishing effort and climate change, the impact on commercial fisheries and for-hire recreational fishing would still be **minor** to **major** for commercial fisheries and **minor** to **moderate** for for-hire recreational fishing operations, depending on the fishery or fishing operations. The impacts of Alternatives B and D could include long-term, **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect.

Cumulative Impacts of Alternatives B and D. The incremental impacts contributed by Alternatives B-1, B-2, and D to the cumulative impacts on commercial fisheries and for-hire recreational fishing would be noticeable. Incremental impacts on commercial fisheries and for-hire recreational fishing would be slightly less, due to fewer WTGs or shorter inter-array cables, but not substantially different from those of the Proposed Action. BOEM anticipates that the cumulative impacts on commercial fisheries and for-hire recreational fishing associated with Alternatives B-1, B-2, and D when combined with the impacts from ongoing and planned activities including offshore wind would be **minor** to **major** for commercial fisheries and **minor** to **moderate** for for-hire recreational fishing operations, the same level as under the Proposed Action, because some commercial and for-hire recreational fisheries and fishing operations would experience substantial disruptions indefinitely even with APMs. Cumulative impacts could include long-term, **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect.

3.9.7 Impacts of Alternative C on Commercial Fisheries and For-Hire Recreational Fishing

Impacts of Alternative C. Alternative C was developed to create an 0.81-nm to 1.08-nm buffer between WTGS in the Lease Area (OCS-A 0498) and WTGs in the Atlantic Shores South Lease Area (OCS-A 0499). Under Alternative C-1, up to eight WTGs (the entirety of the northeastern-most row of WTGs) would be removed and possibly relocated to the northwestern boundary of the Lease Area. Under Alternative C-2, the array of WTGs would be compressed such that inter-row spacing would be reduced to no less than 0.92 nm (1.9 to 1.7 kilometers). This would create the buffer without reducing the number of WTGs within the array. Prior to construction, additional geotechnical or engineering surveys (which may be necessary to determine the new WTG placements) may result in a small, temporary increase in vessel use and bottom disturbance that would not occur under the Proposed Action. BOEM anticipates that this disturbance would be brief and localized, particularly compared to other proposed Project activities, and have negligible to minor impacts. For these alternatives, no changes would be made to the export cable routes; therefore, there would be no changes to impact evaluations outside the Wind Farm Area compared to the Proposed Action. Most other impacts would be similar to those of the Proposed Action as well, except as noted below.

Cumulative Impacts of Alternative C. The removal of WTGs from the boundary with the Atlantic Shores South Lease Area, either through relocation under Alternative C-1 or through compression of the WTG spacing under Alternative C-2, would provide an 0.81-nm- to 1.08-nm-wide buffer, or wider depending on how the alignment is set for the Atlantic Shores South Lease Area, that would be free of structures, making it easier and safer for fishing vessels to transit beyond the Lease Area. Depending on a vessel’s ultimate destination, it may make the trip slightly shorter, reducing overall costs, although any reduction would likely be minor. While the decreased spacing of the WTGs under Alternative C-2 would likely preclude more commercial fishing vessels from being willing to fish the area due to safety concerns related to navigation and gear loss, the impact for potential exposed revenue (for federally permitted fisheries) would not differ from that of the Proposed Action, as it would be within the maximum parameters defined in the PDE. This does not include potential impacts from the compression of WTG spacing on non-federally permitted species, such as menhaden and welk fisheries. For Alternatives C-1 and C-2, the cumulative level of impact and the level of each IPF are anticipated to be the same as under Proposed Action, except for vessel traffic and presence of structures because the 0.81-nm- to 1.08-nm-wide buffer would provide slightly more safety for vessels transiting the area. According to VMS and density mapping available through Northeast Ocean Data (2023), fisheries benefiting the most from removal of the WTGs under Alternative C would be the Surfclam/Quahog and Scallop FMP fisheries. Specifically, those vessels transiting to the Mid-Atlantic Access Scallop Rotational Area from New Jersey ports would not have to circumnavigate the Lease Area (Wilson pers. comm.). The corridor would also benefit those vessels transiting from New Jersey ports to the outer shelf to target squid (Wilson pers. comm.). The incremental impacts contributed by these alternatives on ongoing and planned activities including offshore wind would be similar to those under the Proposed Action, which would be appreciable.

3.9.7.1. Conclusions

Impacts of Alternative C. The anticipated incremental minor to moderate impacts and minor to moderate beneficial impacts associated with Alternatives C-1 and C-2 without the baseline (No Action Alternative) would not be substantially different from the incremental impacts of the Proposed Action. While these action alternatives could slightly change the impacts on commercial fisheries and for-hire recreational fishing, ultimately the same or highly similar construction, O&M, and decommissioning impacts would still occur. The only difference would be a slight increase in safety for vessels using the new structure-free corridor (up to 2.2 nm [4 kilometers]) to transit the area. While Alternative C-2 would likely preclude additional commercial fisheries vessels from fishing within the Wind Farm Area, it is within the maximum parameters defined in the PDE, and therefore the exposed revenue that could be lost would not differ from that under the Proposed Action. When considering all of the IPFs and including the baseline (No Action Alternative), including regulated fishing effort and climate change, the impact on commercial fisheries and for-hire recreational fishing would still be **minor** to **major** for commercial fisheries and **minor** to **moderate** for for-hire recreational fishing operations, depending on the fishery or fishing operation. The impacts of Alternative C could include long-term, **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect.

Cumulative Impacts of Alternative C. The incremental impacts contributed by Alternatives C-1 and C-2 to the cumulative impacts on commercial fisheries and for-hire recreational fisheries would be noticeable. BOEM anticipates that cumulative impacts on commercial fisheries and for-hire recreational fishing associated with Alternatives C-1 and C-2, when combined with the impacts from ongoing and planned activities including offshore wind, would be **minor** to **major** for commercial fisheries and **minor** to **moderate** for for-hire recreation fishing operations, the same level as under the Proposed Action, because some commercial and for-hire recreational fisheries and fishing operations would experience substantial disruptions indefinitely even with APMs. Cumulative impacts could include long-term, **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect.

3.9.8 Impacts of Alternative E on Commercial Fisheries and For-Hire Recreational Fisheries

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. Alternative E would still make landfall on Island Beach State Park; however, the alternative route would continue north before entering Barnegat Bay at a location such that SAV impacts along the eastern shore of the bay could be minimized (see Figure 2-12). Alternative E would then continue west through a historically used remnant channel and then south within Barnegat Bay to connect with the route associated with the Proposed Action. Alternative E would continue to affect SAV at each of the three proposed landing sites on the western shore of Barnegat Bay.

Alternative E would lead to the same types of impacts on commercial fisheries and for-hire recreational fishing from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action, although there may be slightly greater, but temporary, construction impacts related to avoidance of the area for nearshore fisheries and transiting vessels due to the extended length of the export cable. Based on the Mid-Atlantic Ocean Data Portal, scallop fishing could be affected as well as some for-hire recreational fishing, although the relatively minor additional length of the route and the data resolution do not allow estimates to be made on a small enough scale to differentiate impacts among this alternative and the other alternatives. Based on survey data collected by Ocean Wind, the acreage of SAV affected by cable emplacement and maintenance would be reduced by an estimated 14.7 acres (Ocean Wind 2021), which would slightly benefit the fisheries. SAV provides nursery habitat for targeted fishery species, thus possibly enhancing potential recruitment to the fishery, although any enhancement would likely be negligible.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on commercial and for-hire recreational fishing would be noticeable and slightly less than those under the Proposed Action due to avoidance of SAV, which serves as a nursery habitat for species targeted by commercial and for-hire recreational fisheries.

3.9.8.1. Conclusions

Impacts of Alternative E. The anticipated incremental minor to moderate impacts and minor beneficial impacts associated with Alternative E without the baseline (No Action Alternative) would not be substantially different from the incremental impacts of the Proposed Action. While Alternative E could slightly change the impacts on commercial fisheries and for-hire recreational fishing, ultimately the same or highly similar construction, O&M, and decommissioning impacts would still occur. Alternative E would provide a slight benefit to commercial and for-hire recreational fisheries by reducing the impact on SAV, a nursery habitat for targeted species. Alternative E would also result in slightly greater construction impacts related to avoidance of the area for nearshore fisheries due to the extended length of the export cable, but the impact would be temporary, only lasting as long as the construction time frame. When considering all of the IPFs, and including the baseline (No Action Alternative), including regulated fishing effort and climate change, the impact on commercial fisheries and for-hire recreational fishing would still be **minor** to **major** for commercial fisheries and **minor** to **moderate** for for-hire recreational fishing operations, depending on the fishery or fishing operation. The impacts of Alternative E could include long-term, **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on commercial fisheries and for-hire recreational fishing would be noticeable. BOEM anticipates that cumulative impacts on commercial fisheries and for-hire recreational fishing associated with Alternative E when combined with the impacts from ongoing and planned activities including offshore wind would be **major** because impacts would be slightly less, due to reducing the impact on SAV, but not substantially different from those of the Proposed Action. Cumulative impacts could include long-term, **minor** to **moderate beneficial** impacts for certain commercial fisheries and some for-hire recreational fishing operations due to the artificial reef effect.

3.9.9 Proposed Mitigation Measures

In the Draft EIS, BOEM analyzed proposed measures for the compensation of gear loss and damage and compensation for lost fishing income to minimize impacts on commercial fisheries and for-hire recreational fishing. After publication of the Draft EIS, Ocean Wind updated its COP to include APMs for the lost or damaged gear claim procedure and Direct Compensation Program, so these APMs are analyzed in the Final EIS as part of the Proposed Action in Section 3.9.5.1.

Several measures are proposed to minimize impacts on commercial fisheries and for-hire recreational fishing (Appendix H, Table H-3). If the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced.

Table 3.9-25 Additional Proposed Measures (Also Identified in Appendix H, Table H-3): Commercial Fisheries and For-Hire Recreational Fishing

Measure	Description	Effect
Shoreside seafood business compensation	In addition to the Direct Compensation Fund Proposed by the Lessee, BOEM would require the Lessee to ensure that the Direct Compensation Fund includes losses to shoreside businesses. The Lessee shall analyze the impacts to shoreside seafood businesses adjacent to ports listed in Table 3.9-10. The shoreside seafood business analysis would be used to further supplement funds available for settling claims of lost (unrecovered) economic activity as a result of the Ocean Wind 1 project. The Lessee must submit to BOEM (1) a description of the structure of the Fund and its consistency with BOEM's draft Guidance and (2) an analysis of the impacts of the Project on shoreside businesses for review and comment. The Lessee must then submit to BOEM evidence of the implementation of the Fund, including: • A description of any implementation details not covered in the report to BOEM regarding the mechanism established to compensate for losses to commercial and for-hire recreational fishermen and related shoreside businesses resulting from all phases of the project development on the Lease Area (pre-construction, construction, operation, and decommissioning); • The Fund charter, including the governance structure, audit and public reporting procedures, and standards for paying compensatory mitigation for impacts to fishers and related shoreside businesses from lease area development; and • Documentation regarding the funding account, including the dollar amount, establishment date, financial institution, and owner of the account.	If adopted, this measure would reduce negative impacts associated with shoreside economic activity specifically resulting from revenue exposure and potential for reduced catch due to the Ocean Wind 1 Project.
Mobile Gear–Friendly Cable Protection Measures	Cable protection measures should reflect the pre-existing conditions at the site. This mitigation measure chiefly ensures that seafloor cable protection does not introduce new hangs for mobile fishing gear. Thus, the cable protection measures should be trawl-friendly with tapered/sloped edges. If cable protection is necessary in "non-trawlable" habitat, such as rocky habitat, then the lessee should consider using materials that mirror the benthic environment.	If adopted, this measure would reduce negative impacts resulting from mobile gear loss by using materials that would minimize the potential for introducing new hangs associated with cable protection features.

Measure	Description	Effect
Sand Wave Leveling, Boulder Clearance, and Boulder Relocation Plan	Sand wave leveling and boulder relocation clearance should be limited and micrositing should be used to avoid these areas to the extent practicable. The Lessee should develop and implement a boulder relocation plan to ensure potential impacts to essential fish habitat and commercial and recreational fisheries are adequately minimized.	This measure would reduce impacts on habitat of species targeted in fisheries and reduce the risk of gear damage or loss associated with relocated boulders.

3.9.9.1. Measures Incorporated in the Preferred Alternative

BOEM has identified the following additional measures in Table 3.9-25 as incorporated in the Preferred Alternative: shoreside seafood business compensation, mobile gear-friendly cable protection measures, sand wave leveling, boulder clearance, and a boulder relocation plan. These measures, if adopted, would further reduce impacts; however, the impact from the Proposed Action would remain minor to major for commercial fisheries and minor to moderate for for-hire recreational fishing operations, depending on the fishery or fishing operation.

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3.10. Cultural Resources

This section discusses potential impacts on cultural resources from the proposed Project, alternatives, and ongoing and planned activities in the cultural resources geographic analysis area. The cultural resources geographic analysis area, as shown on Figure 3.10-1, is equivalent to the Project's area of potential effects (APE), as defined in the implementing regulations for NHPA Section 106 at 36 CFR Part 800 (Protection of Historic Properties). In 36 CFR 800.16(d), the APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alteration in the character or use of historic properties, if any such properties exist." BOEM (2020) defines the Project APE as the following:

- The depth and breadth of the seabed potentially affected by any bottom-disturbing activities, constituting the marine archaeological resources portion of the APE;
- The depth and breadth of terrestrial areas potentially affected by any ground-disturbing activities, constituting the terrestrial archaeological portion of the APE;
- The viewshed from which renewable energy structures, whether located offshore or onshore, would be visible, constituting the viewshed portion of the APE; and
- Any temporary or permanent construction or staging areas, both onshore and offshore.

The phrase *cultural resources* refers to archaeological sites, buildings, structures, objects, and districts, which may include cultural landscapes and traditional cultural properties (TCP). These resources may be historic properties as defined in 36 CFR 800 and may be listed on national, state, or local historic registers or be identified as being important to a particular group during consultation. Federal, state, and local regulations recognize the public's interest in cultural resources. Many of these regulations, including NEPA and the NHPA, as well as the New Jersey Register of Historic Places Act and New Jersey Public Law 2004, Chapter 170, which protects archaeological sites on state, county, and municipal lands, require a project to consider how it might affect significant cultural resources.

Cultural resources in this section are discussed in terms of three categories: cultural resources landward of the shoreline (hereafter referred to as *onshore*), resources seaward of the shoreline (hereafter referred to as *offshore*), and the viewshed from which Project elements would be visible (hereafter referred to as *visual*).

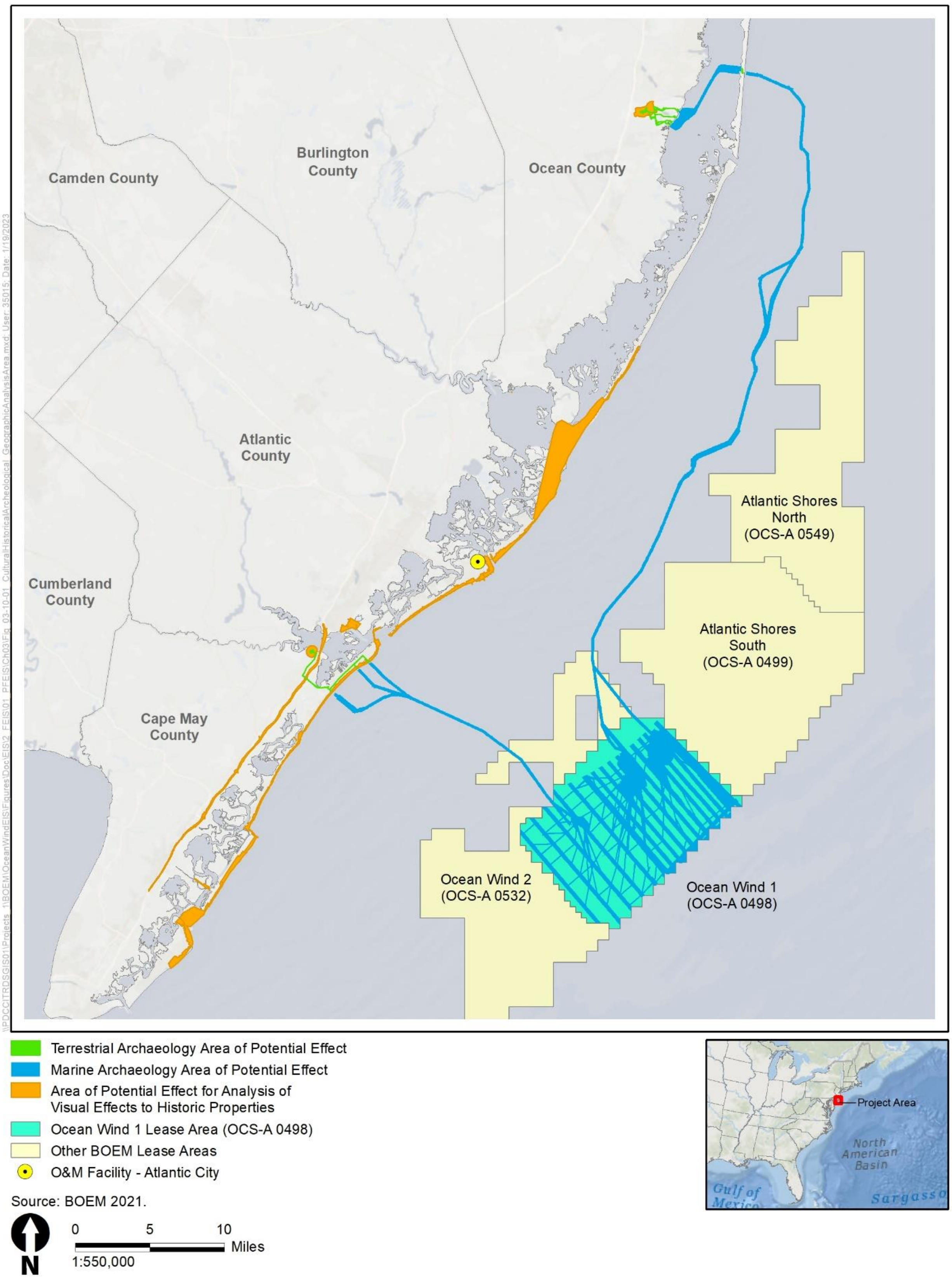

Figure 3.10-1 Cultural, Historical, and Archaeological Geographic Analysis Area

3.10.1 Description of the Affected Environment for Cultural Resources

This section discusses baseline conditions in the geographic analysis area for cultural resources as described in the COP Volume III, Appendix F documents and supplemental cultural resources studies (COP Volume III, Appendix F-1 through Appendix F-5; Ocean Wind 2023). Specifically, this includes terrestrial and offshore areas potentially affected by the proposed Project's land- or bottom-disturbing activities, areas where structures from the Proposed Action would be visible, and the area of intervisibility where structures from both the Proposed Action and offshore wind projects would be visible simultaneously.

Ocean Wind has conducted onshore and offshore cultural resource investigations to identify known and previously undiscovered cultural resources within the marine archaeological, terrestrial archaeological, and viewshed portions of the APE. Table 3.10-1 presents a summary of the pre-Contact period and post-Contact period cultural context of New Jersey based on the Project's Marine Archaeological Resources Assessment (COP Volume III, Appendix F-1; Ocean Wind 2023). COP Volume III, Appendix F documents and supplemental cultural resources studies, including scope, methods, results, and key findings, are further described in Appendix N, *Finding of Effects*.

Table 3.10-1 Summary of New Jersey Prehistoric and Historic Contexts

Period	Description
Paleoindian (>14,500–11,500 BP)	This period was characterized by highly mobile hunter gatherers traversing recently deglaciated landscapes. Paleoindian sites are identified by the presence of Clovis fluted points. This period of development is well represented in New Jersey.
Archaic Period (10,000–3000 BP)	This period is typically divided into two subperiods: Early Archaic (10,000–8000 BP), Middle (8000–6000 BP), and Late (6000–3000 BP). The Early Archaic period was marked by rapid sea level rise and coastal wetland boundary changes. By the Middle Archaic period, stone tool manufacture included grinding and polishing. In the Late Archaic period, both climate and sea level rise began to stabilize. This greater stability fostered increased sedentism. Material culture expanded rapidly, as evidenced by a wide array of new hunting and fishing technologies. Tribal-level societies also emerged during this time.
Woodland Period (3000 BP–European Contact)	This period is typically divided into three subperiods: Early (3000–2000 BP) Middle (2000–1000 BP), and Late (1,000 BP–European Contact). During the Early Woodland Period, pottery became prevalent, as did Oriental Fishtail and Meadowood projectile points. During the Middle Woodland Period, garden farming became common and pottery became more refined. The variability in the distribution of cultural material suggests two distinct cultural groups existed in New Jersey at this time. In the Late Woodland Period, garden farming became more intensive, and occupied settlements became increasingly frequent. People began using food storage pits and pottery became larger and locally distinct. The bow and arrow were introduced.
Contact and Colonization (European Contact–1775)	In 1524, Italian explorer Giovanni de Verrazano and his crew were probably the first European explorers to set eyes on the New Jersey coast. Others soon followed. Trade among European explorers and colonizers and Native American tribes began in about 1604. The colonization of southern New Jersey began with the establishment of the New Sweden (1638–1655) and New Netherlands (1614–1667 and 1673–1674) colonies. New Netherlands was transferred to English rule in 1674. New Jersey became the site of numerous regional trades, including whaling, farming, fishing, hunting, iron ore production, and shipbuilding.

Period	Description
Revolutionary War (1775–1783)	During the Revolutionary War, the coastline of New Jersey was a pivotal geographic feature in the naval efforts. Sandy Hook in northern New Jersey was the site of multiple naval engagements.
Antebellum Period (1783–1861)	Life along the New Jersey coast returned to normal following the Revolutionary War. During the War of 1812 (1812–1815), the bays and tributaries of southern New Jersey became an epicenter for privateering activity, just as they had been during the Revolutionary War. Absecon Island remained largely undeveloped until the 1850s, with the birth of Atlantic City.
Civil War (1861–1865)	New Jersey served as a source of troops, equipment, and resources for the Union Army during the American Civil War. No battles were fought in the state.
Reconstruction and Early 20th Century (1865–1945)	Atlantic City became a major entertainment and commercial hub and experienced explosive population growth. The city was a major site of bootlegging activity during Prohibition (1920–1933); however, it was hit hard during the Great Depression (1929–1939), when the city's reliance on tourism dollars flattened as Americans stopped vacationing.
WW II and Postwar (1945–Present)	During World War II, the New Jersey coast was the scene of numerous German U-Boat attacks. During this time, Absecon Island became a training hub for the U.S. Army. Despite a reinvigorated national economy following the war, Atlantic City continued to suffer economically until the casino boom of the late 1970s and 1980s.

Source: Ocean Wind 2023.
BP = before present

Cultural resources review of the onshore landfall locations of the two export cable corridors identified eight archaeological resources and ten historic structures at these locations. Most of the resources are along the BL England corridor. The archaeological resources include pre-Contact Period Native American sites and 17th through 20th century European-American sites. The historic standing structures date from the 18th through 20th centuries (COP Volume III, Appendix F-2; Ocean Wind 2023).

Offshore cultural resources in the region include pre-Contact and post-Contact period Native American and European-American resources. Offshore archaeological resources include pre-Contact period Native American landscapes on the OCS, which likely contain Native American archaeological sites inundated and buried as sea levels rose at the end of the last Ice Age. Marine geophysical remote sensing studies performed for the Proposed Action identified 16 submerged landform features (hereafter referred to as *ancient submerged landform features*) with the potential to contain Native American archaeological resources. This included 13 within the Lease Area and three within the two export cable corridors. In addition to having archaeological potential, remnant submerged landscape features are considered by Native American tribes in the region to be TCP resources representing places where their ancestors lived. In addition to ancient submerged landform features, 19 potential submerged cultural resources were identified via marine remote-sensing studies. This included 12 within the Lease Area and seven within the two export cable corridors. These resources include both known and potential shipwrecks from the Historic period. Based on known historic and modern maritime activity in the region, the Lease Area and two export cable corridors have a high probability for containing shipwrecks, downed aircraft, and related debris fields (COP Volume III, Appendix F-1; Ocean Wind 2023).

Cultural resources review of the offshore visual area identified nine historic districts and 40 individual historic properties, and review of the onshore visual area identified three historic properties (COP Volume III, Appendix F-3; Ocean Wind 2023).

3.10.2 Environmental Consequences

3.10.2.1. Impact Level Definitions for Cultural Resources

Definitions of impact levels are provided in Table 3.10-2.

Table 3.10-2 Impact Level Definitions for Cultural Resources

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable (i.e., finding of “no historic properties affected” or “no historic properties adversely affected” pursuant to 36 CFR 800).
	Beneficial	Impacts that benefit cultural resources would be so small as to be unmeasurable.
Minor	Adverse	Cultural resources (historic properties that include archaeological sites, buildings, structures, objects, and districts that are listed or eligible for listing in the NRHP) would be affected; however, conditions would be imposed to ensure consistency with the Secretary’s Standards for the Treatment of Historic Properties (36 CFR 68) to avoid adverse impacts. (i.e., finding of “no historic properties adversely affected” pursuant to 36 CFR 800).
	Beneficial	Impacts that benefit cultural resources (historic properties that include archaeological sites, buildings, structures, objects, and districts that are listed or eligible for listing in the NRHP) would passively preserve historic properties consistent with the Secretary’s Standards for the Treatment of Historic Properties or passively create conditions to protect archaeological sites.
Moderate	Adverse	Characteristics of cultural resources would be altered in a way that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association (i.e., finding of “historic properties adversely affected” pursuant to 36 CFR 800). Measures to resolve adverse effects would minimize impacts and the adversely affected property would remain NRHP eligible. However, compensatory mitigation may still be required.
	Beneficial	Impacts that benefit cultural resources would actively preserve historic properties (historic properties that include archaeological sites, buildings, structures, objects, and districts that are listed or eligible for listing in the NRHP) consistent with the Secretary’s Standards for the Treatment of Historic Properties.
Major	Adverse	Characteristics of cultural resources would be affected in a way that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association (i.e., finding of “historic properties adversely affected” pursuant to 36 CFR 800). Measures to resolve adverse effects would mitigate impacts; however, important characteristics would be altered to the extent that the adversely affected property would no longer be listed or eligible for listing on the NRHP.
	Beneficial	Impacts that benefit cultural resources would rehabilitate, restore, or reconstruct historic properties consistent with the Secretary’s Standards for the Treatment of Historic Properties, including cultural landscapes and traditional cultural properties.

NRHP = National Register of Historic Places

3.10.3 Impacts of the No Action Alternative on Cultural Resources

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on cultural resources, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for cultural resources. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.10.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for cultural resources described in Section 3.10.1, *Description of the Affected Environment for Cultural Resources*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind activities. There are no ongoing offshore wind activities within the geographic analysis area for cultural resources.

Under the No Action Alternative, cultural resources would continue to be affected by regional commercial, industrial, and recreational activities. Ongoing activities within the geographic analysis area that contribute to onshore impacts on cultural resources include ground-disturbing activities and the introduction of intrusive visual elements. These activities have the potential to disturb or destroy terrestrial archaeological resources or to damage, destroy, or diminish the integrity that conveys the historic significance of buildings, structures, objects, and historic districts onshore. The primary sources of ongoing offshore impacts include dredging, cable emplacement, and activities that disturb the seafloor. Onshore and offshore construction activities and associated impacts are expected to continue at current trends, range in severity from minor to major, and have the potential to affect cultural resources.

Sea level rise, ocean acidification, increased storm severity/frequency, and increased sedimentation and erosion, have the potential to result in long-term, permanent impacts on cultural resources. Sea level rise will lead to the inundation of terrestrial archaeological sites and historic standing structures. Increased storm severity and frequency will likely increase the severity and frequency of damage to coastal historic standing structures. Increased erosion along coastlines could lead to the complete destruction of coastal archaeological sites and the collapse of historic structures as erosion undermines their foundations. Ocean acidification could accelerate the rate of decomposition and corrosion of shipwrecks, downed aircraft (another common submerged archaeological resource type), and other marine archaeological resources on the seafloor. The incremental contribution of offshore wind development projects on slowing or arresting impacts related to global warming and climate change would result in beneficial impacts on cultural resources that range from negligible to minorly beneficial.

3.10.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned activities (without the Proposed Action). Planned non-offshore wind activities that may affect cultural resources include new submarine cables and pipelines, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS (see Section F.2 in Appendix F for a description of ongoing and planned activities). These activities may result in ground disturbance, which has the potential to disturb or destroy terrestrial archaeological resources; seafloor disturbance, which has the potential to damage or destroy marine archaeological resources or ancient submerged landform features; construction, which could damage, destroy, or diminish the integrity of buildings, structures, objects, and historic districts onshore; or introduction of intrusive visual elements, which could diminish integrity of setting, feeling, or association for cultural resources. See Table F1-8 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for cultural resources.

The No Action Alternative assumes the full build-out of all reasonably foreseeable wind projects. BOEM assumes that each of the reasonably foreseeable offshore wind projects will be subject to NEPA and NHPA reviews and, as a result, will require the identification of cultural resources within their NEPA geographic analysis areas and NHPA APEs. The results of these project-specific studies to identify cultural resources are not yet available. Therefore, the No Action Alternative assumes that the same types of cultural resources identified within the geographic analysis area of the Proposed Action (i.e., historic structures, terrestrial archaeological sites, marine archaeological sites, and TCPs) are present within the geographic scopes of the reasonably foreseeable wind projects, and will be subject to the same IPFs as the Proposed Action. The following discussion assesses the potential impacts on these types of cultural resources from proposed wind facility developments, excluding the Proposed Action. BOEM assumes that if project-specific cultural resource investigations identify historic properties within a project's APE and determines that the project would adversely affect said historic properties, BOEM will require the project to develop treatment plans to avoid, minimize, or mitigate effects to comply with the NHPA.

BOEM expects planned offshore wind activities to affect cultural resources through the following primary IPFs.

Accidental releases: Accidental release of hazmat and trash or debris, if any, may pose long-term, infrequent risks to cultural resources. The majority of impacts associated with accidental releases would be incidental due to cleanup activities that require the removal of contaminated soils. In the planned activities scenario, there would be a low risk of a leak of fuel, fluids, or hazardous materials from any of the WTGs offshore New Jersey. The number of accidental releases from the No Action Alternative, volume of released material, and associated need for cleanup activities would be limited due to the low probability of occurrence, low volumes of material released in individual incidents, low persistence time, standard BMPs to prevent releases, and localized nature of such events. As such, the majority of individual accidental releases from offshore wind development would not be expected to result in measurable impacts on cultural resources and would be considered negligible impacts.

Although the majority of anticipated accidental releases would be small, resulting in small-scale impacts on cultural resources, a single, large-scale accidental release such as an oil spill could have significant impacts. A large-scale release would require extensive cleanup activities to remove contaminated materials, resulting in damage to or complete removal of coastal and marine cultural resources during the removal of contaminated terrestrial soil or marine sediment; temporary or permanent impacts on the setting of coastal historic buildings, structures, objects, and districts, which could include significant landscapes and TCPs; and damage to or removal of nearshore shipwreck or debris field resources during contaminated soil/sediment removal. In addition, the accidentally released materials in deep-water settings could settle on seafloor cultural resources such as shipwreck sites and ancient submerged landform features. In the case of shipwreck sites, this may accelerate their decomposition or cover them and make them inaccessible or unrecognizable to researchers, resulting in a significant loss of historic information. As a result, although considered unlikely, a large-scale accidental release and associated cleanup could result in permanent, geographically extensive, and large-scale major impacts on cultural resources.

Anchoring and gear utilization: Anchoring and gear utilization associated with ongoing commercial and recreational activities and the development of offshore wind projects have the potential to cause permanent, adverse impacts on marine cultural resources. These activities would increase during the construction, maintenance, and eventual decommissioning of offshore wind energy facilities. Construction of offshore wind projects could result in impacts on cultural resources on the seafloor caused by anchoring in the geographic analysis area. The placement and relocation of anchors and other seafloor gear such as wire ropes, cables, and anchor chains that affect or sweep the seafloor could potentially disturb marine cultural resources and ancient submerged landform features on or just below the seafloor surface. The damage or destruction of submerged archaeological sites or other underwater cultural resources from these activities would result in the permanent and irreversible loss of scientific or cultural value and would be considered major impacts.

The scale of impacts on shipwreck and debris field cultural resources would depend on the number of wreck and debris field sites within the offshore wind lease areas. The potential for impacts would be mitigated, however, by existing federal and state requirements to identify and avoid marine cultural resources. Specifically, as part of its compliance with the NHPA, BOEM requires offshore wind developers to conduct geophysical remote sensing surveys of proposed development areas to identify cultural resources and implement plans to avoid, minimize, or mitigate impacts on these resources. As a result, impacts on marine cultural resources from anchoring and gear utilization are considered unlikely and would only affect a small number of individual marine cultural resources if they were to occur, resulting in long-term, localized, adverse impacts. The scale of any impacts on individual resources (the proportion of the resource damaged or removed) would vary on a case-by-case basis and could range from minor to major.

Lighting: Development of offshore wind projects would increase the amount of offshore anthropogenic light from vessels, area lighting during construction and decommissioning of projects (to the degree that construction occurs at night), and use of aircraft and vessel hazard/warning lighting on WTGs and OSS during operation. Up to 574 WTGs with a maximum blade tip height of 1,049 feet (320 meters) above mean sea level (AMSL) would be added within the analysis area for cumulative visual effects on historic properties.

Construction and decommissioning lighting would be most noticeable if construction activities occur at night. Up to five planned offshore wind projects (Atlantic Shores South, Atlantic Shores North, Ocean Wind 2, Garden State, and Skipjack) could contribute to cumulative visual effects on historic properties. These could be constructed from 2024 through 2030 (with up to four projects simultaneously under construction in 2026–2027; Table F-3). Some of the offshore wind projects could require nighttime construction lighting, and all would require nighttime hazard lighting during operations. Construction lighting from any project would be temporary, lasting only during nighttime construction, and could be visible from shorelines and elevated locations, although such light sources would be limited to individual WTG or OSS sites rather than the entirety of the lease areas in the geographic analysis area. Aircraft and vessel hazard lighting systems would be in use for the entire operational phase of each offshore wind project, resulting in long-duration impacts. The intensity of these impacts would be relatively low, as the lighting would consist of small, intermittently flashing lights at a significant distance from the resources.

The impacts of construction and operational lighting would be limited to cultural resources on the coast of New Jersey for which a dark nighttime sky is a contributing element to historical integrity. The National Park Service has indicated that a dark nighttime sky should be assumed to be a character-defining feature of certain resource types such as lighthouses or resources associated with historic events that may have occurred at night, such as battlefields. The intensity of lighting impacts would be limited by the distance between resources and the nearest lighting sources, as the majority of the proposed WTGs would be over 15 miles (24.1 kilometers) from the nearest shoreline (see Section 3.18, *Recreation and Tourism*). The intensity of lighting impacts would be further reduced by atmospheric and environmental conditions such as clouds, fog, and waves that could partially or completely obscure or diffuse sources of light. As a result, nighttime construction and decommissioning lighting would have temporary, intermittent, and localized adverse impacts on a limited number of cultural resources. Operational lighting would have longer-term, continuous, and localized adverse impacts on a limited number of cultural resources.

Lighting impacts would be reduced if ADLS is used to meet FAA aircraft hazard lighting requirements. ADLS would activate the aviation lighting on WTGs and OSS only when an aircraft is within a predefined distance of the structures (for a detailed explanation, see Section 3.20, *Scenic and Visual Resources*). For the Proposed Action, it is anticipated that the reduced time of FAA hazard lighting resulting from an implemented ADLS would reduce the duration of the potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS. The use of ADLS on offshore wind projects other than the Proposed Action would likely result in similar limits on the frequency of WTG and OSS aviation warning lighting use. This technology, if used, would reduce the already low-level impacts of lighting on cultural resources. As such, lighting impacts on cultural resources would be negligible.

Port utilization—expansion: Expected increases in port activity associated with the development of offshore wind projects would likely require modifications and expansions at ports along the East Coast. These port modification and expansion projects could affect historic structures and archaeological sites within or near port facilities. Future channel deepening by dredging that may be required to accommodate larger vessels necessary to carry WTG and OSS components and increased vessel traffic associated with offshore wind projects could affect marine cultural resources in or near ports. Due to state and federal requirements to identify and assess impacts on cultural resources as part of NEPA and the NHPA and the requirements to avoid, minimize, or mitigate adverse impacts on cultural resources, these impacts would be long term, adverse, and isolated to a limited number of cultural resources that cannot be avoided or that were previously undocumented. As such, impacts from port utilization would range from minor to major.

Presence of structures: The development of other offshore wind projects would introduce new, modern, and intrusive visual elements to the viewsheds of cultural resources along the coast of New Jersey. Up to 574 WTGs would be added within the analysis area for cumulative visual effects on historic properties, assuming WTGs with a maximum blade tip height of 1,049 feet (320 meters) AMSL.

Impacts on cultural resources from the presence of structures would be limited to those cultural resources from which offshore wind projects would be visible, which would typically be limited to historic buildings, structures, objects, and districts and could include significant landscapes and TCPs relatively close to shorelines and on elevated landforms near the coast. The magnitude of impacts from the presence of structures would be greatest for cultural resources for which a maritime view, free of modern visual elements, is an integral part of their historic integrity and contributes to their eligibility for listing on the National Register of Historic Places (NRHP). Due to the distance between the reasonably foreseeable wind development projects and the nearest cultural resources, in most instances exceeding 15 miles (24.1 kilometers), WTGs of individual projects would appear relatively small on the horizon, and the visibility of individual structures would be further affected by environmental and atmospheric conditions such as vegetation, clouds, fog, sea spray, haze, and wave action (for a detailed explanation, see Section 3.20). While these factors would limit the intensity of impacts, the presence of visible WTGs from offshore wind activities would have long-term, continuous, moderate to major impacts on cultural resources.

Cable emplacement and maintenance: Construction of offshore wind infrastructure would have permanent, geographically extensive, adverse impacts on cultural resources. Offshore wind projects would result in seabed disturbance from foundation construction and installation of inter-array and offshore export cables. The only other offshore wind development project (other than the Proposed Action) that is expected to lay cable in the geographic analysis area is Atlantic Shores South (Lease Area OCS-A 0499), which would lay cable that crosses the same offshore export cable corridor as the Proposed Action. The 2012 BOEM study and the Proposed Action studies (BOEM 2012; COP Volume III, Appendix F; Ocean Wind 2023) suggest that the offshore wind lease areas and offshore export cable corridors of the offshore wind projects would likely contain a number of archaeological sites and submerged landform features, which could be affected by offshore construction activities.

As part of compliance with the NHPA, BOEM and state historic preservation officers (SHPO) will require offshore wind project applicants to conduct geophysical surveys of offshore wind lease areas and offshore export cable corridors to identify shipwreck and debris field resources and avoid, minimize, or mitigate these resources when identified. Due to these federal and state requirements, the adverse impacts of offshore construction on shipwreck and debris field resources would be infrequent and isolated and, in cases where conditions are imposed to avoid submerged cultural resources, impacts would be minor. However, if submerged cultural resources cannot be avoided, the magnitude of these impacts would remain moderate to major, due to the permanent, irreversible nature of the impacts. As such, across potential circumstances, the magnitude of impacts would range from minor to major.

If present within a project area, the number, extent, and dispersed character of ancient submerged landform features makes avoidance impossible in many situations, and makes extensive archaeological investigations of formerly terrestrial archaeological sites within these features logistically challenging and prohibitively expensive. As a result, offshore construction would result in geographically widespread and permanent adverse impacts on portions of these resources. For those ancient submerged landform features that are contributing elements to an NRHP-eligible TCP but cannot be avoided, mitigations would likely be considered under the NHPA Section 106 review process, including studies to document the nature of the paleontological environment during the time these now-submerged landscapes were occupied and provide Native American tribes with the opportunity to include their history in these studies. However, the magnitude of these impacts would remain moderate to major, due to the permanent, irreversible nature.

Land disturbance: The construction of onshore components associated with offshore wind projects, such as electrical export cables and onshore substations, could result in adverse physical impacts on known and undiscovered cultural resources. Such ground-disturbing construction activities could disturb or destroy undiscovered archaeological sites and TCPs, if present. The number of cultural resources affected, scale and extent of impacts, and severity of impacts would depend on the location of specific project components relative to recorded and undiscovered cultural resources and the proportion of the resource affected. State and federal requirements to identify cultural resources, assess project impacts, and develop treatment plans to avoid, minimize, or mitigate adverse impacts would limit the extent, scale, and magnitude of impacts on individual cultural resources; as a result, if adverse impacts from this IPF occur, they would likely be permanent but localized, and range from negligible to major.

3.10.3.3. Conclusions

Impacts of the No Action Alternative. BOEM expects ongoing activities to have continuing short- and long-term impacts on baseline conditions for cultural resources. The primary source of onshore impacts from ongoing activities includes ground-disturbing activities and the introduction of intrusive visual elements, while the primary source of offshore impacts includes dredging, cable emplacement, and activities that disturb the seafloor. These ongoing activities would have minor to major impacts on individual onshore and offshore cultural resources. Examples of individual resources are ancient submerged landform features, terrestrial archaeological sites, historic standing structures, and TCPs. Impacts would vary widely because the impacts would be dependent on the unique characteristics of the individual resources. The construction and installation of onshore components and port expansions, as well as their O&M, would have negligible to major impacts on individual cultural resources. BOEM anticipates that implementation of existing state and federal cultural resource laws and regulations would include requirements to avoid, minimize, or mitigate project-specific impacts on cultural resources. These state and federal requirements may not be able to reduce the severity of impacts on some cultural resources due to the unique character of specific resources but would reduce the severity of potential impacts in a majority of cases, resulting in overall moderate impacts on cultural resources. As such, the No Action Alternative would result in **moderate** impacts on cultural resources.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and activities would continue, and cultural resources would continue to be affected by natural and human-caused IPFs. Planned non-offshore wind activities could include the same types of onshore and offshore actions listed for ongoing activities, and in different locations than ongoing activities. These planned activities would also have minor to major impacts on individual onshore and offshore cultural resources depending on the scale and extent of impacts and the unique characteristics of the resource. The construction and installation and O&M of offshore wind projects would have minor to major effects as well as negligible to minor beneficial impacts on individual offshore cultural resources. The primary sources of impacts would be physical disturbance from onshore and offshore construction, as well as changes in views from cultural resources. The impacts would be geographically limited to marine and terrestrial archaeological resources within onshore and offshore construction areas and historic structures and TCPs for which an uninterrupted sea view, free of intrusive visual elements, is a contributing element to NRHP eligibility with views of offshore and onshore wind components. The duration of impacts would range from temporary to permanent, while the extent and frequency of impacts would be largely dependent on the unique characteristics of individual cultural resources, resulting in a range of potential impacts from minor to major. BOEM anticipates that implementation of existing state and federal cultural resource laws and regulations would include requirements to avoid, minimize, or mitigate project-specific impacts on cultural resources. These state and federal requirements may not be able to reduce the severity of impacts on some cultural resources due to the unique character of specific resources, but would reduce the severity of potential impacts in a majority of cases. As such, cumulative impacts of the No Action Alternative would result in overall **moderate** impacts on cultural resources.

3.10.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on cultural resources:

- Physical impacts on terrestrial cultural resources (e.g., archaeological sites), depending on the location of onshore ground-disturbing activities;
- Physical impacts on underwater cultural resources (e.g., archaeological sites and ancient submerged landform features), depending on the location of offshore bottom-disturbing activities, including the locations where Ocean Wind would embed the WTG and OSS into the seafloor in the Wind Farm Area and the location of the cable in the offshore export cable corridor; and
- Visual impacts on cultural resources (e.g., historic buildings, structures, objects, and districts, which could include landscapes and TCPs), depending on the design, height, number, and distance of WTGs visible from these resources.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- WTG and OSS number, size, and location: If marine cultural resources cannot be avoided, impacts can be minimized with fewer WTGs and substation footprints, smaller footprints, and the selection of footprint locations in areas of lower archaeological or ancient submerged landform sensitivity.
- WTG and substation lighting: Arrangement and type of lighting systems could affect the degree of nighttime visibility of WTGs onshore and decrease visual impacts on cultural resources for which a dark nighttime sky is a contributing element to historical integrity.

- Size of scour protection around foundations: If marine cultural resources cannot be avoided, a smaller size of scour protection around foundations can minimize disturbance or destruction of marine cultural resources.
- Offshore cable (inter-array, substation interconnector) burial location, length, depth of burial, and burial method: If marine cultural resources cannot be avoided entirely, specific location, length, and depth of burial could minimize disturbance or destruction of marine cultural resources. Cable burial method such as jetting tool, vertical injection, pre-trenching, scare plow, trenching (including leveling, mechanical cutting), plowing, and controlled-flow excavation could have varying degrees of potential to disturb or destroy marine cultural resources.
- Landfall for offshore export cable installation method: Selection of trenchless installation over open-cut installation could have decreased potential for unanticipated disturbance of terrestrial archaeology.
- Onshore export cable width and burial depth: Reduced width and burial depth to reduce overall volume of excavation in the export cable construction corridor could decrease potential for unanticipated disturbance of terrestrial archaeology.

Ocean Wind has committed to measures to minimize impacts on cultural resources, which include developing and implementing an Post-Review Discovery Plan for terrestrial and submerged archaeology (CUL-01); using G&G surveys to identify potential resources (CUL-02); consulting with the SHPO and affected tribes to support avoidance of known cultural resources to the extent practicable and identifying additional minimization or mitigation measures as necessary (CUL-03); designing the Project to minimize visual impacts on cultural resources to the extent feasible, including adjustment to WTG locations, ADLS, and markings (CUL-04); and developing an anchoring plan for vessels prior to construction to identify avoidance/no anchorage areas (COP Volume II, Table 1.1-2; Ocean Wind 2023). In addition to minimization, APMs include mitigation in the form of documentation, planning, or educational materials, developed in coordination with stakeholders (CUL-05). These measures are further described in Appendix H, Table H-1. In addition, Ocean Wind has prepared two historic property treatment plans to detail purpose, intended outcome, scope of work, methodology, standards, deliverables, and schedules associated with fulfillment of mitigation measures to resolve adverse effects on ancient submerged landform features and to resolve adverse visual effects. These documents are the *Historic Property Treatment Plan for the Ocean Wind 1 Farm Ancient Submerged Landform Features, Federal Waters on the Outer Continental Shelf* (see Attachment 3 of Appendix N, Attachment A) and *Historic Property Treatment Plan for the Ocean Wind 1 Farm Project, Historic Properties Subject to Adverse Visual Effect, Cape May and Atlantic Counties, New Jersey* (see Attachment 4 of Appendix N, Attachment A).

3.10.5 Impacts of the Proposed Action on Cultural Resources

3.10.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.10.8, *Impacts of Alternative E on Cultural Resources*.

Under the Proposed Action, Ocean Wind would install 98 WTGs and related facilities, which would have negligible to minor impacts on most cultural resources but would have moderate impacts on the Brigantine Hotel, Brigantine City; Absecon Lighthouse, Atlantic City; Atlantic City Boardwalk, Atlantic City; Atlantic City Convention Hall, Atlantic City; Ritz-Carlton Hotel, Atlantic City; Haddon Hall/ Resorts Casino Hotel, Atlantic, City; Riviera Apartments in Atlantic City; Vassar Square Condominiums, the house at 114 South Harvard Avenue; Lucy the Margate Elephant in Margate City; Great Egg Coast

Guard Station, Longport Borough; Ocean City Boardwalk, Ocean City; Ocean City Music Pier in Ocean City; the Flanders Hotel, Ocean City; Hereford Lighthouse, North Wildwood; North Wildwood Lifesaving Station, North Wildwood; U.S. Lifesaving Station #35, Stone Harbor Borough; Little Egg Harbor U.S. Lifesaving Station #23, Little Egg Harbor Township; and submerged landform features within the Wind Farm Area and the offshore export cable corridor.[1]

Potential impacts on cultural resources include damage or destruction of terrestrial archaeological sites or TCPs from onshore ground-disturbing activities and damage to or destruction of submerged archaeological sites or other underwater cultural resources (e.g., shipwreck, debris fields, ancient submerged landform features) from offshore bottom-disturbing activities, resulting in a loss of scientific or cultural value. Potential impacts also include demolition of, damage to, or alteration of historic buildings, structures, objects, or districts, including landscapes and TCPs, resulting in a loss of historic or cultural value.

Potential visual impacts also include introduction of visual elements out of character with the setting or feeling of historic properties, if that setting is a contributing element to the resource’s eligibility for listing on the NRHP. The most impactful IPFs would include light, the presence of structures, and offshore construction.

Accidental releases: Accidental release of hazardous materials and trash or debris, if any, could affect cultural resources. The 98 WTG foundations and three OSS foundations for the Proposed Action alone would include storage for up to 39,690 gallons (150,242 liters) of coolants, 426,671 gallons (1.6 million liters) of oils and lubricants, and 236,216 gallons (894,175 liters) of diesel fuel. The volume of materials released is unlikely to require cleanup operations that would permanently affect cultural resources. As a result, the impacts of accidental releases from the Proposed Action alone on cultural resources would be short term, localized, and negligible.

Anchoring and gear utilization: Anchoring and gear utilization could affect cultural resources. Of the total 19 potential submerged archaeological resources, seven are in the export cable corridors. Of the total 16 ancient submerged landform features, three are in the export cable corridors. The Proposed Action has committed to avoiding the 19 potential submerged archaeological resources identified in the Lease Area and two export cable route corridors during construction, maintenance, and decommissioning activities. However, the Project would encroach on the 50-meter avoidance buffers of two submerged archaeological resources in the BL England export cable route corridor. The Proposed Action may avoid impacts on up to three of the 16 ancient submerged landform features: Targets 20, 27, and 32, all within in the Lease Area. However, impacts from the Proposed Action on 13 ancient submerged landform features within the Lease Area cannot be avoided, as WTGs and associated work zones are proposed for locations within the defined areas of these resources.

Due to the avoidance commitments, BOEM does not anticipate impacts on the majority of known shipwrecks, submerged aircraft, or debris fields from development of the Proposed Action. However, it does anticipate impacts on the two submerged archaeological resources where the Project would encroach within the avoidance buffer and 13 ancient submerged landform features where WTGs are proposed under the current PDE. As a result, anchoring under the Proposed Action (19 acres [0.08 km^2]) would have negligible impacts on most marine cultural resources, except for potentially major impacts on the two known submerged archaeological resources and 13 of the 16 ancient submerged landform features. More substantial impacts could occur if the final Project design cannot avoid known resources or if previously undiscovered resources are discovered during construction.

[1] While the technical study to assess visual effects on historic properties identified Villa Maria by the Sea in Stone Harbor among the properties affected, that building was demolished in 2021 and is no longer included among the affected properties analyzed herein (COP Volume III, Appendix F-3; Ocean Wind 2022). See Appendix M.

Lighting: As previously discussed, development of the offshore wind industry would increase the amount of offshore anthropogenic light from vessels, area lighting during construction and decommissioning of projects (to the degree that construction occurs at night), and use of hazard/warning lighting on WTGs and OSS during operations. The susceptibility and sensitivity of cultural resources to lighting impacts from the Proposed Action would vary based on the unique characteristics of individual cultural resources. Nighttime lighting impacts would be restricted to cultural resources for which a dark nighttime sky is a contributing element to their historic integrity. The National Park Service has indicated during consultation that a dark nighttime sky should be assumed to be a character-defining feature of certain resource types such as lighthouses or resources associated with historic events that may have occurred at night, such as battlefields. Given this assumption, of the nine historic districts and 40 individual properties reviewed in the offshore visual APE, a dark nighttime sky is considered a character-defining feature of Absecon Light House, Hereford Inlet Lighthouse, Great Egg Coast Guard Station, North Wildwood Lifesaving Station, U.S. Lifesaving Station #35, and Little Egg Harbor U.S. Lifesaving Station #23.

Construction of the Proposed Action may require nighttime vessel and construction area lighting. The lighting impacts would be short term, as they would be limited to the construction phase of the Proposed Action. The intensity of nighttime construction lighting from the Proposed Action would be limited to the active construction area at any given time. Impacts would be further reduced by the distance between the nearest construction area (i.e., the closest line of WTGs) and the nearest cultural resources on the New Jersey coast. The intensity of lighting impacts would be further reduced by atmospheric and environmental conditions such as clouds, fog, and waves that could partially or completely obscure or diffuse sources of light. As previously stated, these impacts would be limited to cultural resources for which a dark nighttime sky is a contributing element to their historic integrity, limiting the scale of impacts on cultural resources. Absecon Light House, Hereford Inlet Lighthouse, Great Egg Coast Guard Station, North Wildwood Lifesaving Station, U.S. Lifesaving Station #35, and Little Egg Harbor U.S. Lifesaving Station #23 met these conditions. As such, lighting from the Proposed Action alone would have moderate impacts on cultural resources.

The Proposed Action would include nighttime and daytime use of operational phase aviation and vessel hazard avoidance lighting on WTGs and OSS. Ocean Wind has committed to voluntarily implementing ADLS to reduce operational phase nighttime lighting impacts (GEN-07; COP Volume II, Table 1.1-2; Ocean Wind 2023). ADLS would only activate the required FAA aviation obstruction lights on WTGs and OSS when aircraft enter a predefined airspace and turn off when the aircraft were no longer in proximity to the Wind Farm Area. Implementation of the ADLS or similar system to turn aviation obstruction lights on and off in response to detection of aircraft near the wind farm is estimated to be 1 hour 19 minutes and 17 seconds over a 1-year period (COP Volume III, Appendix AD; Ocean Wind 2023). As such, use of operational lighting on WTGs by the Proposed Action would result in negligible impacts on cultural resources.

Operational lighting from the Proposed Action would have moderate impacts on cultural resources because of the nine historic districts and 40 individual properties reviewed in the offshore visual APE, only Absecon Light House, Hereford Inlet Lighthouse, Great Egg Coast Guard Station, North Wildwood Lifesaving Station, U.S. Lifesaving Station #35, and Little Egg Harbor U.S. Lifesaving Station #23 meet the conditions required to be affected by this IPF. If ADLS were used by offshore wind developments, nighttime hazard lighting impacts on cultural resources from ongoing and planned activities including offshore wind and the Proposed Action would be negligible.

Presence of structures: The presence of structures, including foundations and scour protection for WTGs and OSS, in the Lease Area could affect offshore cultural resources. Of the total 19 potential submerged archaeological resources, 12 are in the Lease Area. Of the total 16 ancient submerged landform features, 13 are in the Lease Area. The Proposed Action has committed to avoiding the 12 potential submerged archaeological resources identified in the Lease Area during construction, maintenance, and decommissioning activities. The Proposed Action may avoid impacts under this IPF on up to three ancient submerged landform features within the Lease Area (Targets 20, 27, and 32) but cannot avoid impacts on the other 10 ancient submerged landform features in the Lease Area (Targets 21–26 and 28–31), as WTGs are proposed for locations within the defined areas of these resources. Due to the avoidance commitments, BOEM does not anticipate impacts on known shipwrecks, submerged aircraft, or debris fields within the Lease Area from development of the Proposed Action. However, it does anticipate impacts on the 10 ancient submerged landform features where WTGs are proposed under the current PDE. As a result, the presence of structures under the Proposed Action would have negligible impacts on most marine cultural resources, except for potentially major impacts on 10 of the 13 ancient submerged landform features within the Lease Area. More substantial impacts could occur if the final Project design cannot avoid known resources or if previously undiscovered resources are discovered during construction. However, the protocols identified in the Post-Review Discovery Plan (CUL-01) would apply to minimize impacts (see Appendix H for a summary of CUL-01, and Appendix N, Attachment A for Post-Review Discovery Plan documents). In addition, BOEM has committed to working with applicants, consulting parties, tribes, and the New Jersey SHPO to develop specific treatment plans to address impacts on ancient submerged landform features that cannot be avoided by other offshore wind development projects. Implementation of project-specific treatment plans, agreed to by all consulting parties, would likely reduce the magnitude of unmitigated impacts on ancient submerged landform features; however, the magnitude of these impacts would remain moderate to major due to the permanent, irreversible nature of the impacts, unless these ancient submerged landform features can be avoided.

In addition, Ocean Wind has conducted outreach to the SHPO, affected tribes, and consulting parties to support identification of mitigation measures as necessary (CUL-05). Based on feedback from that outreach, to mitigate for adverse effects on the 13 ancient submerged landform features that cannot be avoided, Ocean Wind has committed to funding of preconstruction geoarchaeology, open-source geographic information system and story maps, ancient submerged landform features post-construction seafloor impact inspection, and ethnographic studies to resolve adverse effects on Targets 21–26, 28–31, and 33–35.

A Historic Resources Visual Effects Assessment for the Proposed Action determined that the construction of the WTGs would adversely affect 18 historic properties: the Brigantine Hotel in Brigantine City; Absecon Lighthouse in Atlantic City; the Atlantic City Boardwalk in Atlantic City; the Atlantic City Convention Hall in Atlantic City; the Ritz-Carlton Hotel in Atlantic City; Haddon Hall/Resorts Casino Hotel in Atlantic, City the Riviera Apartments in Atlantic City; Vassar Square Condominiums in Ventnor City; the house at 114 South Harvard Avenue in Ventnor City; Lucy the Margate Elephant in Margate City; Great Egg Coast Guard Station in Longport Borough; Ocean City Boardwalk in Ocean City; Ocean City Music Pier in Ocean City; the Flanders Hotel in Ocean City; Hereford Inlet Lighthouse in North Wildwood; North Wildwood Lifesaving Station in North Wildwood; U.S. Lifesaving Station #35 in Stone Harbor Borough; and Little Egg Harbor U.S. Lifesaving Station #23 in Little Egg Harbor Township (Appendix N). The studies determined that an uninterrupted sea view, free of modern visual elements, is a contributing element to the NRHP eligibility of the 18 historic properties. Although the operational life of the Project is 35 years, and the WTGs and OSS would be removed after that period, the presence of visible WTGs from the Proposed Action would have long-term, continuous, widespread, moderate impacts on these resources. The study determined that the scale, extent, and intensity of these impacts would be partially mitigated by environmental and atmospheric factors such as clouds, haze, fog, sea spray, vegetation, and wave height that would partially or fully screen the WTGs from view during various times throughout the year. In addition, the Proposed Action would only affect seaward (southeast) views from these resources. To further minimize the Proposed Action’s effects, Ocean Wind has voluntarily committed to designing the Project to minimize visual impacts on cultural resources to the extent feasible, including adjustment to WTG locations, ADLS, and markings (CUL-04). This includes:

- Use of an ADLS to minimize nighttime effects by only activating the FAA-required warning lights when an aircraft is in the vicinity of the Wind Farm Area
- Use of non-reflective pure white (RAL Number 9010) or light gray (RAL Number 7035) paint on offshore infrastructure to minimize daytime visual effects

In addition, Ocean Wind has conducted outreach to the SHPO, affected tribes, and consulting parties to support identification of mitigation measures as necessary (CUL-05). Consultation with consulting parties regarding measures to resolve adverse effects is ongoing and will be documented in the executed Memorandum of Agreement for the Project. Based on feedback from that outreach, to mitigate for adverse effects on the 18 properties with visual impacts, Ocean Wind has committed to:

- Multi-property and Multi-county Mitigation
    - Funding of Historic Context addressing early 20th century New Jersey Shore Hotels to resolve adverse effects on Brigantine Hotel, Ritz-Carlton Hotel, Haddon Hall/Resorts Casino Hotel, and Flanders Hotel
    - Funding of Historic Context addressing mid-century high-rise residential buildings at the New Jersey shore to resolve adverse effects on Riviera Apartments and Vassar Square Condominiums
    - Funding of Historic Context addressing New Jersey shore boardwalks, including surveys and evaluations of the Atlantic City Boardwalk, Ocean City Boardwalk, and Wildwood Boardwalk to resolve adverse effects on the Atlantic City Boardwalk and Ocean City Boardwalk
- Funding of Visitor Experience and Public Access for Lucy the Margate Elephant, a National Historic Landmark (NHL)
- Atlantic County Historic Properties Mitigation
    - Funding of Visitor Experience and Public Access for Absecon Lighthouse
    - Funding of Visitor Experience and Public Access for Atlantic City Boardwalk
- Mitigation Fund to resolve visual adverse effects on the following 15 historic properties: Brigantine Hotel, Brigantine City, Atlantic County; Atlantic City Convention Hall, Atlantic City, Atlantic County; Ritz-Carlton Hotel, Atlantic City, Atlantic County; Haddon Hall/Resorts Casino Hotel, Atlantic City, Atlantic County; Riviera Apartments, Atlantic City, Atlantic County; Vassar Square Condominiums, Ventnor City, Atlantic County; House at 114 South Harvard Avenue, Ventnor City, Atlantic County; Great Egg Coast Guard Station, Longport Borough, Atlantic County; Ocean City Boardwalk, Ocean City, Cape May County; Ocean City Music Pier, Ocean City, Cape May County; Hereford Lighthouse, North Wildwood, Cape May County; North Wildwood Life Saving Station, North Wildwood, Cape May County; U.S. Lifesaving Station #35, Stone Harbor Borough, Cape May County; Flanders Hotel, Ocean City, Cape May County; and Little Egg Harbor U.S. Life Saving Station #23 (U.S. Coast Guard Station #119), Little Egg Harbor Township, Ocean County

BOEM conducted a Cumulative Historic Resources Visual Effects Assessment to evaluate visual impacts on the Brigantine Hotel in Brigantine City; the Absecon Lighthouse in Atlantic City; the Atlantic City Boardwalk in Atlantic City; the Atlantic City Convention Hall in Atlantic City; the Ritz-Carlton Hotel in Atlantic City; Haddon Hall/Resorts Casino Hotel in Atlantic City; the Riviera Apartments in Atlantic City; Vassar Square Condominiums in Ventnor City; the house at 114 South Harvard Avenue in Ventnor City; Lucy the Margate Elephant in Margate City; Great Egg Coast Guard Station in Longport Borough; Ocean City Boardwalk in Ocean City; Ocean City Music Pier in Ocean City; the Flanders Hotel in Ocean City; Hereford Inlet Lighthouse in North Wildwood, North Wildwood Lifesaving Station in North Wildwood; U.S. Lifesaving Station #35 in Stone Harbor Borough; and Little Egg Harbor U.S. Lifesaving Station #23 in Little Egg Harbor Township (BOEM 2023). The planned activities scenario effects assessment determined the number of WTGs from the Proposed Action and five offshore wind projects that could be theoretically visible (based on distance, topography, vegetation, and intervening structures) from each of the five historic properties affected by the Proposed Action. Other offshore wind projects included in the cumulative WTG count from historic properties included Atlantic Shores North, Atlantic Shores South, Ocean Wind 2, Garden State, and Skipjack.

The Cumulative Historic Resources Visual Effects Assessment demonstrated that portions of WTGs could theoretically be visible from each of the 18 resources. The Flanders Hotel would be subject to the largest-scale impacts of the 18 resources, with portions of up to 662 WTGs theoretically visible from the resource and with the closest WTG approximately 11.3 miles (18.2 kilometers) from the property. Similarly, Absecon Lighthouse would have theoretical visibility to up to 618 WTGs, but the closest WTG would be approximately 9.0 miles (14.5 kilometers) from the property. Ocean City Boardwalk and Great Egg Coast Guard Station would be similarly affected, with theoretical visibility of up to 593 and 592 WTGs, respectively; the closest WTGs would be approximately 10.9 miles (17.5 kilometers) from both Ocean City Boardwalk and Great Egg Coast Guard Station. Similarly, Ocean City Music Pier and Little Egg Harbor U.S. Lifesaving Station #23 would have comparable impacts, with theoretical visibility of up to 581 and 575 WTGs, respectively; the closest WTGs would be approximately 11.0 miles (17.7 kilometers) from Ocean City Music Pier and approximately 11.6 miles (18.7 kilometers) from Little Egg Harbor U.S. Lifesaving Station #23. The study demonstrated that the Atlantic City Boardwalk would have theoretical visibility to up to 561 WTGs, with the closest WTG approximately 8.8 miles (14.2 kilometers) away from the property. Portions of up to 561 WTGs could also theoretically be visible from the eight other properties: Atlantic City Convention Hall, with the closest WTGs approximately 9.2 miles (14.8 kilometers); Ritz-Carlton Hotel, with the closest WTGs approximately 9.3 miles (14.9 kilometers), Riviera Apartments, with the closest WTGs approximately 9.5 miles (15.2 kilometers); Brigantine Hotel, with the closest WTGs approximately 9.6 miles (15.4 kilometers); Vassar Square Condominiums, with the closest WTGs approximately 9.7 miles (15.6 kilometers); the house at 114 South Harvard Avenue, with the closest WTGs approximately 9.9 miles (15.9 kilometers); Lucy the Margate Elephant, with the closest WTGs approximately 10.8 miles (17.4 kilometers); and U.S. Lifesaving Station #35, with the closest WTGs approximately 14.5 miles (23.3 kilometers). Hereford Inlet Lighthouse would have theoretical visibility to up to 549 WTGs, with the closest WTG approximately 11.3 miles (18.2 kilometers) away; while WTG visibility data were not available for Haddon-Hall/Resorts Casino Hotel, this property is close to the Ritz-Carlton Hotel and visibility is expected to be similar. North Wildwood Lifesaving Station would be subject to smallest-scale impacts of the 18 resources, with portions of up to 528 WTGs theoretically visible from the resource and with the closest WTG approximately 15.9 miles (26.6 kilometers) from the property. The Project WTG locations represent 16 to 19 percent of the total WTGs that are potentially visible from the 18 historic properties in the planned activities scenario (see Appendix F). For this reason, the Project WTGs would foreseeably be surrounded by other offshore wind energy development activities that would constitute 82 to 83 percent of the total WTGs potentially visible from the 18 historic properties.

Views from the historic properties to the Project WTGs could be obstructed by a portion of Ocean Wind 2 and Atlantic Shores South, which include WTG locations positioned closer to shore (Ocean Wind 2 between 8.8 and 9.0 miles, and Atlantic Shores South between 10.5 and 11.1 miles). The intensity of visual impacts on the historic properties could be limited by distance and environmental and atmospheric factors. As discussed in Section 3.20, the visibility of WTGs would be further reduced by environmental and atmospheric factors such as cloud cover, haze, sea spray, vegetation, and wave height. While these factors would limit the intensity of impacts, the presence of visible WTGs from ongoing and planned activities, including offshore wind and the Proposed Action, would have long-term, continuous, moderate to major impacts on the historic properties listed above. The Proposed Action would contribute a noticeable increment to these impacts.

Cable emplacement and maintenance: The installation of array cables and offshore export cables would include site preparation activities (e.g., sand wave clearance, boulder removal) and cable installation via jet plow, mechanical plow, or mechanical trenching, which could affect cultural resources. Of the total 19 potential submerged archaeological resources, seven are in the export cable corridors. Of the total 16 ancient submerged landform features, three are in the export cable corridors. The Proposed Action has committed to avoiding the 19 potential submerged archaeological resources identified in the Lease Area and two export cable route corridors during construction, maintenance, and decommissioning activities. The Proposed Action has committed to avoiding 3 of the 16 ancient submerged landform features (Targets 20, 27, and 32, all in the Lease Area), but 13 ancient submerged landform features (Targets 21–26, 28–31, and 33–35) cannot be avoided, as WTGs and associated work zones are proposed for locations within the defined areas of these resources. Targets 21–26 and 28–31 are in the Lease Area, Target 33 is in the BL England Export Cable Route Corridor, and Targets 34 and 35 are in the Oyster Creek Export Cable Route Corridor.

Due to the avoidance commitments, BOEM does not anticipate impacts on the 16 known shipwrecks, submerged aircraft, or debris fields from development of the Proposed Action. However, it does anticipate impacts on the 13 ancient submerged landform features where WTGs and export cable routes are proposed under the current PDE. As a result, new cable emplacement and maintenance under the Proposed Action would have negligible impacts on most marine cultural resources (19 potential submerged archaeological resources and three ancient submerged landform features), except for potentially major impacts on 13 of the 16 ancient submerged landform features. More substantial impacts could occur if the final Project design cannot avoid known resources or if previously undiscovered resources are discovered during construction.

Land disturbance: Land disturbance associated with onshore export cable installation could affect cultural resources. Cultural resources review—including records reviews and a shovel test survey program in areas identified as having moderate to high archaeological sensitivity, and a historic structure analysis at the onshore landfall locations of the two export cable corridors and associated onshore cable corridors—identified eight archaeological resources and ten historic structures in the vicinity of the export cable corridor locations. Most of the resources are along the BL England corridor. Of the eight archaeological resources identified, only two appear to extend into the BL England and Oyster Creek landfall sites. Intensive archaeological survey revealed that intact archaeological deposits associated with these resources do not appear to extend into either export cable corridor. As a result, the disturbed archaeological deposits within the two export cable corridors do not appear to contribute to the NRHP eligibility of either of the archaeological resources (COP Volume III, Appendix F-2; Ocean Wind 2023). The historic structure review and analysis revealed that no direct effects on historic structures are anticipated. This review also revealed that while there are three historic structures in the visual impacts analysis area—two at the BL England area and one at the Oyster Creek area—they would not be adversely affected by the Project (COP Volume III, Appendix F; Ocean Wind 2023). Based on this information, the impacts of the Proposed Action on terrestrial cultural resources are still expected to be negligible.

Information pertaining to identification of cultural resources within onshore cable routes added to the Project in March 2022 and associated with Oyster Creek landfall locations will not be available until after the Final EIS. BOEM will use the Memorandum of Agreement to establish commitments for reviewing the sufficiency of supplemental terrestrial archaeological investigations as phased identification; assess impacts; and implement measures to avoid, minimize, or mitigate impacts in these areas prior to construction. See the Memorandum of Agreement as an attachment to Appendix N.

In the event of changes to the Project design or inadvertent archaeological discoveries during construction, BOEM could further reduce potential impacts of onshore construction by requiring compliance with the Post-Review Discovery Plan (see Appendix N, Attachment A) and fulfillment of mitigation measures (see Section 3.10.9 and Appendix H, Table H-2, and Appendix N, Attachment A) as a condition of COP approval.

3.10.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities.

Accidental releases: Impacts from planned offshore wind projects would be similar to those of the Proposed Action and be negligible in most cases, except for in rare cases of large-scale accidental releases that represent major impacts. The Proposed Action would contribute an undetectable increment to the combined impacts of accidental releases from ongoing and planned activities including offshore wind, which would be short term, localized, and negligible. The Proposed Action would account for 18 percent of the WTGs and OSS in the geographic analysis area and there is a low risk of a leak of fuel, fluids, or hazardous materials from any of the WTGs and OSS, which would include storage of these substances.

Anchoring and gear utilization: Construction of the Proposed Action and other offshore wind projects could result in anchoring occurring within the geographic analysis area that could potentially affect cultural resources. BOEM anticipates that lead federal agencies and relevant SHPOs would require the applicants for offshore wind projects to conduct extensive geophysical remote sensing surveys (i.e., similar to those conducted for the Proposed Action) to identify and avoid marine cultural resources and ancient submerged landform features as part of NEPA and NHPA Section 106 compliance activities fulfilled through the NEPA substitution process as described in 36 CFR 800.8(c). BOEM would also continue to require developers to avoid, minimize, or mitigate impacts on any identified marine archaeological resources and ancient submerged landform features during construction, operation, and decommissioning. As a result, the Proposed Action would contribute a noticeable increment to the combined anchoring and gear utilization impacts from ongoing and planned activities including offshore wind on shipwreck and debris field resources, as well as ancient submerged landform features. Impacts on cultural resources would be long term and moderate to major unless these resources could be avoided.

Lighting: Construction of planned offshore wind projects in the geographic analysis area would contribute similar lighting impacts from nighttime vessel and construction area lighting as under the Proposed Action. However, of the nine historic districts and 40 individual properties reviewed in the offshore visual APE, only Absecon Light House, Hereford Inlet Lighthouse, Great Egg Coast Guard Station, North Wildwood Lifesaving Station, U.S. Lifesaving Station #35, and Little Egg Harbor U.S. Lifesaving Station #23 meet the conditions required to be affected by this IPF. As such, nighttime construction and decommissioning lighting associated with the Proposed Action in combination with other ongoing and planned activities including offshore wind would have moderate impacts on cultural resources in the geographic analysis area. The Proposed Action would contribute a noticeable increment to the combined lighting impacts on cultural resources from ongoing and planned nighttime vessel and construction area lighting.

Permanent aviation and vessel warning lighting would be required on all WTGs and OSS built by offshore wind projects. Nighttime lighting from aviation obstruction lights on the WTG nacelles associated with the Project and other proposed offshore wind development projects and from use of an ADLS to reduce the period and intensity of effects from aviation obstruction lights on the Project would not contribute to cumulative visual adverse effects. Implementation of the ADLS or similar system to turn aviation obstruction lights on and off in response to detection of aircraft near the wind farm is estimated to be 1 hour 19 minutes and 17 seconds over a 1-year period (COP Volume III, Appendix AD; Ocean Wind 2023). Even if offshore wind projects do not commit to using ADLS, operational lighting from the Proposed Action would account for 16–19 percent of the visible WTGs and OSS in the geographic analysis area. The Proposed Action would contribute a noticeable increment to the combined lighting impacts on cultural resources from ongoing and planned aviation and vessel warning lighting on WTGs and OSS.

Presence of structures: Offshore wind projects would result in construction of WTGs and OSS, inter-array cable systems, and offshore export cable corridors. The marine G&G studies conducted for the proposed Project, a 2012 BOEM study (BOEM 2012), and the NOAA Automated Wreck and Obstruction Information System and Electronic Navigational Chart databases suggest that the entire New Jersey lease area covers areas with a high probability for containing submerged cultural resources (BOEM 2012). As with the Proposed Action, other offshore wind projects would likely be able to avoid impacts on shipwrecks, downed aircraft, and debris field cultural resources due to their relatively small, discrete size, but may be unable to avoid impacts on all ancient submerged landform features. The Proposed Action would contribute a noticeable increment to the combined cable emplacement impacts on cultural resources from ongoing and planned activities including offshore wind, which would be localized, long term, and minor for shipwrecks, downed aircraft, and debris fields; and long term, widespread, and moderate to major for ancient submerged landform features. BOEM has committed to working with applicants, consulting parties, Native American tribes, and the New Jersey SHPO to develop specific treatment plans to address impacts on ancient submerged landform features that cannot be avoided by future offshore wind development projects. Development and implementation of project-specific treatment plans, agreed to by all consulting parties, would likely reduce the magnitude of unmitigated impacts on ancient submerged landform features; however, the magnitude of these impacts would remain moderate to major, due to the permanent, irreversible nature of the impacts, unless these ancient submerged landform features can be avoided.

Land disturbance: Construction of onshore components for offshore wind activities could result in impacts on known cultural resources and undiscovered cultural resources (if present). Ground-disturbing construction activities could affect undiscovered archaeological sites. BOEM anticipates that federal (i.e., NEPA and NHPA Section 106 fulfilled through NEPA substitution) and state-level requirements to identify cultural resources, assess impacts, and implement measures to avoid, minimize, or mitigate impacts would minimize impacts on cultural resources from the reasonably foreseeable offshore wind developments. The Proposed Action would contribute an undetectable increment to the combined impacts on terrestrial cultural resources from ongoing and planned activities including offshore wind, which would be localized and long term and would range from negligible to major.

3.10.5.3. Conclusions

Impacts of the Proposed Action. The Proposed Action would have a range of negligible to major impacts on cultural resources for individual IPFs. Impacts would be reduced through the NHPA Section 106 consultation process fulfilled through NEPA substitution as described in 36 CFR 800.8(c) as a result of the commitments made by Ocean Wind and implementation of mitigation measures to resolve adverse effects on historic properties. Similarly, the analysis of impacts is based on a maximum-case scenario; impacts would be reduced by implementation of a less-impactful construction or infrastructure development scenario within the PDE.

Greater impacts would occur without the pre-construction NHPA requirements to identify historic properties, assess potential effects, and develop treatment plans to resolve effects through avoidance, minimization, or mitigation. These NHPA-required, “good-faith” efforts to identify historic properties and address impacts resulted in or contributed to Ocean Wind making a number of commitments to reduce the magnitude of impacts on cultural resources including, but not limited to:

- Post-Review Discovery Plan (CUL-01)
- G&G surveys to identify potential resources (CUL-02)

- Consulting with the SHPO and affected tribes to support avoidance of known cultural resources to the extent practicable and identifying additional minimization or mitigation measures as necessary (CUL-03), such as funding documentation or interpretation activities to resolve adverse effects on the Brigantine Hotel in Brigantine City; the Absecon Lighthouse in Atlantic City; the Atlantic City Boardwalk in Atlantic City; the Atlantic City Convention Hall in Atlantic City; the Ritz-Carlton Hotel in Atlantic City; Haddon Hall/Resorts Casino Hotel in Atlantic City; the Riviera Apartments in Atlantic City; Vassar Square Condominiums in Ventnor City; the house at 114 South Harvard Avenue in Ventnor City; Lucy the Margate Elephant in Margate City; Great Egg Coast Guard Station in Longport Borough; Ocean City Boardwalk in Ocean City; Ocean City Music Pier in Ocean City; the Flanders Hotel in Ocean City; Hereford Inlet Lighthouse in North Wildwood, North Wildwood Lifesaving Station in North Wildwood; U.S. Lifesaving Station #35 in Stone Harbor Borough; and Little Egg Harbor U.S. Lifesaving Station #23 in Little Egg Harbor Township
- Designing the Project to minimize visual impacts on cultural resources to the extent feasible, including adjustment to WTG locations, using ADLS hazard lighting (if approved), and using non-reflective pure white and light gray paint on offshore structures (CUL-04)
- Mitigation in the form of documentation, planning, or educational materials coordinated with stakeholders, as in COP Appendix F-4 (CUL-05)
- Develop an anchoring plan for vessels prior to construction to identify avoidance/no anchorage areas (CUL-06)

A treatment approach for ancient submerged landform features has already been developed and is outlined in the Memorandum of Understanding (see attachment to Appendix N). BOEM anticipates that NHPA requirements to identify historic properties and resolve adverse effects would similarly reduce the significance of potential impacts on historic properties from offshore wind projects as they complete the NHPA Section 106 review process fulfilled through NEPA substitution as described in 36 CFR 800.8(c). However, mitigation of adverse visual effects on historic properties will still be needed under the Proposed Action. Therefore, the overall impacts on historic properties from the Proposed Action would likely qualify as **moderate** because a notable and measurable impact requiring mitigation is anticipated, but in most cases resources affected by adverse visual effects would likely recover completely when the affecting agent (visible offshore WTGs) were removed.

Cumulative Impacts of the Proposed Action. The incremental impacts contributed by the Proposed Action to the cumulative impacts on cultural resources would be noticeable. BOEM anticipates that the cumulative impacts on cultural resources associated with the Proposed Action would be **moderate** due to the long-term or permanent and irreversible impacts on the Brigantine Hotel in Brigantine City; the Atlantic City Boardwalk in Atlantic City; the Atlantic City Convention Hall in Atlantic City; the Ritz-Carlton Hotel in Atlantic City; Haddon Hall/Resorts Casino Hotel in Atlantic City; the Riviera Apartments in Atlantic City; Vassar Square Condominiums in Ventnor City; the house at 114 South Harvard Avenue in Ventnor City; Lucy the Margate Elephant in Margate City; the Ocean City Boardwalk in Ocean City; the Ocean City Music Pier in Ocean City; and archaeological resources and ancient submerged landform features if they cannot be avoided.

3.10.6 Impacts of Alternative B on Cultural Resources

Impacts of Alternative B. Alternative B would reduce the severity of impacts on a small proportion of known ancient submerged landform features within the marine APE compared to the Proposed Action. Alternatives B-1 and B-2 would exclude WTGs nearest to the shore. Impacts on one ancient submerged landform feature (Target 28) would be avoided or reduced under Alternative B-1 and impacts on three ancient submerged landform features (Targets 28, 25, and 20) would be avoided or reduced under Alternative B-2. The impacts resulting from individual IPFs associated with Alternatives B-1 and B-2 alone on terrestrial cultural resources would be similar to those of the Proposed Action because the nature and physical extent of proposed activities under these alternatives would be comparable to those of the Proposed Action. Alternatives B-1 and B-2 would exclude WTGs nearest to the onshore coastal communities where onshore cultural resources are located. However, given the size, location, and number of retained WTGs, these alternatives would not substantially change the overall visual impact of the wind farm on onshore cultural resources. As such, the degree of visual impact is not substantially different from that of the Proposed Action.

Information pertaining to identification of historic properties within certain portions of the APE related to Alternatives B-1 and B-2 would not be available until after the ROD is issued and the COP is approved, should BOEM select those alternatives. However, the differences among alternatives with respect to cultural, historic, and archaeological resources are not expected to be significant. If Alternative B-1 or B-2 is selected, BOEM will use the Memorandum of Agreement as an agreement document to establish commitments for phased identification and evaluation of historic properties within the APE in accordance with BOEM's existing *Guidelines for Providing Archaeological and Historic Property Information Pursuant to Title 30 Code of Federal Regulations Part 585*, ensuring potential historic properties are identified, effects assessed, and adverse effects resolved prior to construction (see the Memorandum of Agreement as an attachment to Appendix N). If Alternative B-1 or B-2 is selected, previously un-surveyed areas associated with WTG positions and inter-array cable routing may need to be surveyed for marine archaeology.

Cumulative Impacts of Alternative B. The incremental impacts contributed by Alternatives B-1 and B-2 to the overall impacts on cultural resources would be reduced compared to those described under the Proposed Action.

3.10.6.1. Conclusions

Impacts of Alternative B. Alternatives B-1 and B-2 would have a similar range of negligible to major impacts on cultural resources as the Proposed Action assuming implementation of the mitigation measures outlined in Section 3.10.9. The degree of impact on ancient submerged landform features under Alternatives B-1 and B-2 would be slightly reduced relative to the Proposed Action. However, mitigation for impacts on 12 ancient submerged landform features would still be required if Alternative B-1 is selected and mitigation for impacts on 10 ancient submerged landform features would still be required if Alternative B-2 is selected. While the degree of visual impacts on cultural resources under Alternatives B-1 and B-2 would be lower than under the other alternatives, these impacts would still require comparable mitigation. In most cases of visual impact, the resource would likely recover completely when the affecting agent were gone or remedial or mitigating action were taken. The magnitude of impacts from disturbance to ancient submerged landform features would remain moderate to major due to the permanent, irreversible nature of the impacts, unless these ancient submerged landform features can be avoided. Therefore, as with the Proposed Action, the overall impacts on historic properties from these build alternatives would likely qualify as **moderate** because a notable and measurable impact requiring mitigation is anticipated.

Cumulative Impacts of Alternative B. The incremental impacts contributed by Alternatives B-1 and B-2 to the overall impacts on cultural resources would be noticeable, but slightly reduced when compared to the Proposed Action. BOEM anticipates that the overall impacts on cultural resources associated with Alternatives B-1 and B-2 when each combined with the impacts from ongoing and planned activities including offshore wind would be **moderate**.

3.10.7 Impacts of Alternatives C and D on Cultural Resources

Impacts of Alternatives C and D. The impacts resulting from individual IPFs associated with Alternatives C-1, C-2, and D on terrestrial and marine cultural resources would be similar to those of the Proposed Action because the nature and physical extent of proposed activities under these alternatives would be comparable to those of the Proposed Action. Turbine exclusion or turbine relocation under Alternative C-1, turbine layout compression under Alternative C-2, and turbine exclusion under Alternative D could reduce the number of WTGs visible to onshore cultural resources. However, given the size, location, and number of retained WTGs, these alternatives would not substantially change the overall visual impact of the wind farm on cultural resources onshore. These approaches would also not change the degree of impact on offshore cultural resources, given the specific locations of the ancient submerged landform features affected by the Proposed Action are not in the same locations as WTGs proposed for exclusion or relocation under Alternatives C and D. As such, the degree of impact is not substantially different from that of the Proposed Action.

Information pertaining to identification of historic properties within certain portions of the APE related to Alternatives C-1, C-2, and D would not be available until after the ROD is issued and the COP is approved, should BOEM select those alternatives. However, the differences among alternatives with respect to cultural, historic, and archaeological resources are not expected to be significant. If Alternative C-1, C-2, or D is selected, BOEM will use the Memorandum of Agreement as an agreement document to establish commitments for phased identification and evaluation of historic properties within the APE in accordance with BOEM’s existing *Guidelines for Providing Archaeological and Historic Property Information Pursuant to Title 30 Code of Federal Regulations Part 585*, ensuring potential historic properties are identified, effects assessed, and adverse effects resolved prior to construction (see the Memorandum of Agreement as an attachment to Appendix N). If Alternative C-1, C-2 with any distance other than the 0.81-nm buffer, or D is selected, previously un-surveyed areas associated with WTG positions and inter-array cable routing will need to be surveyed for marine archaeology.

Cumulative Impacts of Alternatives C and D. The incremental impacts contributed by Alternatives C-1, C-2, and D to the overall impacts on cultural resources would be similar to those described under the Proposed Action.

3.10.7.1. Conclusions

Impacts of Alternatives C and D. Alternatives C-1, C-2, and D would have the same range of negligible to major impacts on cultural resources as the Proposed Action assuming implementation of the mitigation measures outlined under Section 3.10.9. While the degree of visual impacts on cultural resources under Alternatives C-1, C-2, and D would be lower than under the other alternatives, these impacts would still require comparable mitigation for these impacts. As with the Proposed Action, the overall impacts on historic properties from these build alternatives would likely qualify as **moderate** because a notable and measurable impact requiring mitigation is anticipated, but in most cases the resource would likely recover completely when the affecting agent were gone or remedial or mitigating action were taken.

Cumulative Impacts of Alternatives C and D. The incremental impacts contributed by Alternatives C-1, C-2, and D to the overall impacts on cultural resources would be noticeable, the same as for the Proposed Action. BOEM anticipates that the overall impacts on cultural resources associated with Alternatives C-1, C-2, and D when each combined with the impacts from ongoing and planned activities including offshore wind would be **moderate**.

3.10.8 Impacts of Alternative E on Cultural Resources

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. Under Alternative E, the Oyster Creek export cable route would be modified to avoid impacts on SAV. The Oyster Creek export cables would reroute through the Swimming Beach #2 parking lots after making landfall within the adjacent auxiliary parking lot. The cables would cross Shore Road diagonally to the northwest to an existing maintenance/storage yard, where the cables would then be installed along a historically dredged remnant channel. Alternative E would be predominantly located in previously disturbed areas. A Phase 1B Cultural Resource Survey was conducted within the terrestrial archaeological portion of the APE for Alternative E and demonstrated that, given the extent of prior disturbance, the potential for terrestrial archaeology to be present and affected by Alternative E is low. Therefore, BOEM does not anticipate impacts to be materially different to those described under the Proposed Action.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the overall impacts on cultural resources would be similar to those described under the Proposed Action.

3.10.8.1. Conclusions

Impacts of Alternative E. Alternative E would have the same range of **negligible** to **major** impacts on cultural resources as the Proposed Action assuming implementation of the mitigation measures outlined under Section 3.10.9. BOEM anticipates that, given the extent of prior disturbance, the potential for terrestrial archaeology to be present and affected by Alternative E is low. Therefore, BOEM does not anticipate impacts to be materially different to those described under the Proposed Action. As with the Proposed Action, the overall impacts on historic properties from Alternative E would likely qualify as **moderate** because a notable and measurable impact requiring mitigation is anticipated, but in most cases the resource would likely recover completely when the affecting agent were gone or remedial or mitigating action were taken.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the overall impacts on cultural resources would be noticeable, the same as under the Proposed Action. BOEM anticipates that the overall impacts associated with Alternative E when combined with the impacts from ongoing and planned activities including offshore wind would be **moderate**.

3.10.9 Proposed Mitigation Measures

In the Draft EIS, BOEM analyzed several measures proposed to minimize impacts on cultural resources. After publication of the Draft EIS, BOEM continued Section 106 consultation with consulting parties to develop measures for resolving adverse effects on historic properties pursuant to 36 CFR 800.6 and will execute the Section 106 Memorandum of Agreement prior to issuance of the ROD. A copy of the revised draft Memorandum of Agreement is provided in Appendix N, *Finding of Adverse Effect for the Ocean Wind 1 Construction and Operations Plan*. These mitigation measures, analyzed in Table 3.10-3, are also identified in Appendix H, Table H-2. Ocean Wind will be required to comply with the executed Section 106 Memorandum of Agreement.

Table 3.10-3 Measures Resulting from Consultations (Also Identified in Appendix H, Table H-2): Cultural Resources

Measure	Description	Effect
Avoid or mitigate impacts on identified archaeological resources	Ocean Wind must avoid any identified archaeological resource or TCP, including avoidance of 50-meter buffers for identified archaeological resources. If Ocean Wind cannot avoid the resource, it must perform additional investigations for the purpose of determining eligibility for listing in the NRHP. Of those resources determined eligible, BOEM would require Phase III data recovery investigations for the purposes of resolving adverse effects per 36 CFR 800.6. If Ocean Wind determines it cannot avoid an archaeological resource or TCP after the ROD has been issued, additional Section 106 consultation will be required.	Avoidance would result in negligible direct impacts whereas data recovery investigations would result in minor impacts on terrestrial archaeological resources.
Terrestrial Archaeological monitoring and terrestrial post-review discovery plans	Implementation of terrestrial archaeological monitoring and terrestrial post-review discovery plan for terrestrial archaeology, which include training and orientation for construction staff, designation of a Cultural Resources Compliance Manager, and post-review discovery procedures and contacts, to reduce potential impacts on any previously undiscovered archaeological resources (if present) encountered during construction.	Enforcement of this measure would be under the jurisdiction of NJDEP. Implementation of a post-review discovery plan would reduce potential impacts on undiscovered archaeological resources to a negligible level by preventing further physical impacts on the archaeological resources encountered during construction.

Measure	Description	Effect
Historic Properties Treatment Plans	BOEM will ensure implementation by Ocean Wind of Historic Property Treatment Plans developed in consultation with consulting parties who have demonstrated interest in specific historic properties and property owners. This will include the *Historic Property Treatment Plan for the Ocean Wind 1 Offshore Wind Farm Ancient Submerged Landform Features, Federal Waters on the Outer Continental Shelf*, prepared by Ocean Wind to address impacts on ancient submerged landform features if they cannot be avoided. Specifically, this treatment plan provides details and specifications for actions consisting of mitigation measures to resolve adverse effects on Targets 21–26, 28–31, and 33–35. BOEM will also ensure implementation by Ocean Wind of the *Historic Properties Treatment Plan for the Ocean Wind 1 Offshore Wind Farm Project, Historic Properties Subject to Adverse Visual Effect,* Cape May and Atlantic Counties, New Jersey, which was prepared by Ocean Wind to provide details and specifications for actions consisting of mitigation measures to resolve adverse visual effects and cumulative adverse visual effects on Brigantine Hotel in Brigantine City; the Absecon Lighthouse in Atlantic City; the Atlantic City Boardwalk in Atlantic City; the Ritz-Carlton Hotel in Atlantic City; Haddon Hall/Resorts Casino Hotel in Atlantic City; the Riviera Apartments in Atlantic City; Vassar Square Condominiums in Ventnor City; Lucy the Margate Elephant in Margate City; Ocean City Boardwalk in Ocean City; the Flanders Hotel in Ocean City.	Development and implementation of Historic Properties Treatment Plans detailing and specifying processes, responsibilities, and schedule for completion associated with fulfilling compensatory mitigation actions appropriate to fully address the nature, scope, size, and magnitude of impacts, including cumulative impacts caused by the Project, on historic properties would not reduce impacts from the Proposed Action or change the impact level. Rather, this measure would guide fulfillment of compensatory mitigation actions.
Multi-property and Multi-county mitigation	Funding from Ocean Wind will be applied to the preparation of three historic contexts: early 20th century New Jersey Shore Hotels (Brigantine Hotel, Ritz-Carlton Hotel, Haddon Hall/Resorts Casino Hotel, and Flanders Hotel), mid-century High-rise residential buildings at the New Jersey Shore (Riviera Apartments and Vassar Square Condominiums), and Boardwalks of the New Jersey Shore (with surveys and evaluations of Atlantic City Boardwalk, Ocean City Boardwalk, and Wildwood Boardwalk).	Implementation of this mitigation measure would not reduce impacts from the Proposed Action or change the impact level. Rather, this measure would compensate appropriately for the nature, scope, size, and magnitude of visual impacts, including cumulative visual impacts, caused by the Project.

Measure	Description	Effect
Mitigation to resolve adverse effects to Lucy the Margate Elephant	Funding from Ocean Wind will be applied to compensatory mitigation actions such as funding for visitor experience and public access for Lucy the Margate Elephant.	Implementation of this mitigation measure would not reduce impacts from the Proposed Action or change the impact level. Rather, this measure would compensate appropriately for the nature, scope, size, and magnitude of visual impacts, including cumulative visual impacts, caused by the Project.
Absecon Lighthouse, Atlantic City	Funding from Ocean Wind will be used to improve visitor experience and public access; priority projects will be determined in collaboration with representatives for the property owner. This work will use already available plans or develop plans appropriate to the identified project, and submit plans for review by BOEM and representatives of the property owner; take necessary steps to ensure the project is carried out by qualified contractors, including staff who meet SOI Professional Qualifications for Architecture or Architectural History, who will execute plans; and take necessary steps to ensure planned work is completed.	Implementation of this mitigation measure would not reduce impacts from the Proposed Action or change the impact level. Rather, this measure would compensate appropriately for the nature, scope, size, and magnitude of visual impacts, including cumulative visual impacts, caused by the Project.
Atlantic City Boardwalk, Atlantic City	Funding from Ocean Wind will be applied to compensatory mitigation actions such as support for planned, preservation-related improvements to the Atlantic City Boardwalk.	Implementation of this mitigation measure would not reduce impacts from the Proposed Action or change the impact level. Rather, this measure would compensate appropriately for the nature, scope, size, and magnitude of visual impacts, including cumulative visual impacts, caused by the Project.

Measure	Description	Effect
Mitigation Fund to resolve visual adverse effects to the following 15 historic properties: Brigantine Hotel, Brigantine City; Atlantic City Convention Hall, Atlantic City; Ritz-Carlton Hotel, Atlantic City; Haddon Hall/ Resorts Casino Hotel, Atlantic City; Riviera Apartments, Atlantic City; Vassar Square Condominiums, Ventnor City; House at 114 South Harvard Avenue, Ventnor City; Great Egg Coast Guard Station, Longport Borough; Ocean City Boardwalk, Ocean City; Ocean City Music Pier, Ocean City; Hereford Lighthouse, North Wildwood; North Wildwood Life Saving Station, North Wildwood; U.S. Lifesaving Station #35, Stone Harbor Borough; Flanders Hotel, Ocean City; and Little Egg Harbor U.S. Life Saving Station #23 (U.S. Coast Guard Station #119), Little Egg Harbor Township.	Funding from Ocean Wind will be deposited into a compensatory mitigation fund to be managed by a third-party administrator for the purpose of providing grants in support of preservation, interpretation, or commemoration of historic sites, buildings, or events.	Implementation of this mitigation measure would not reduce impacts from the Proposed Action or change the impact level. Rather, this measure would compensate appropriately for the nature, scope, size, and magnitude of visual impacts, including cumulative visual impacts, caused by the Project.
Phased Identification	If Alternative B-1, B-2, C-1, C-2, or D is selected, BOEM will implement steps for phased identification and evaluation of historic properties within the Marine APE in accordance with BOEM's existing Guidelines for Providing Archaeological and Historic Property Information Pursuant to Title 30 Code of Federal Regulations Part 585. The final identification and evaluation of historic properties within the APE may occur after publication of the Final EIS, but prior to the initiation of construction.	Implementation of this mitigation measure would not reduce impacts from the Proposed Action or change the impact level, but would ensure identification and evaluation of historic properties within the marine APE that could not be surveyed prior to publication of the Final EIS.

3.10.9.1. Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.10-3 and Table H-2 in Appendix H, *Mitigation and Monitoring*, are incorporated in the Preferred Alternative. Mitigation to resolve adverse visual effects on historic properties and to comply with the stipulations of the Memorandum of Agreement would not reduce the impacts on the historic property. Rather, these measures would compensate appropriately for the nature, scope, size, and magnitude of visual impacts, including cumulative visual impacts, caused by the Project. Implementation of phased identification of marine archaeological resources would not reduce impacts or change the impact level but would ensure identification and evaluation of historic properties within the marine APE that could not be surveyed prior to publication of the Final EIS. Implementation of a Post-Review Discovery Plan would reduce potential impacts on undiscovered archaeological resources to a negligible level by preventing further physical impacts on the archaeological resources encountered during construction.

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3.11. Demographics, Employment, and Economics (see Appendix G)

The reader is referred to Appendix G for a discussion of current conditions and potential impacts on demographics, employment, and economics from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.12. Environmental Justice

This section discusses environmental justice impacts from the proposed Project, alternatives, and ongoing and planned activities in the environmental justice geographic analysis area. The geographic analysis area for environmental justice, as shown on Figure 3.12-1, Figure 3.12-2, and Figure 3.12-3, includes the counties where proposed onshore infrastructure and potential port cities are located, as well as the counties in closest proximity to the Wind Farm Area: Atlantic, Cape May, Cumberland, Gloucester, Ocean, and Salem Counties, New Jersey; Charleston County, South Carolina; and Norfolk, Virginia. These counties are the most likely to experience beneficial or adverse environmental justice impacts from the proposed Project related to onshore and offshore construction and use of port facilities.

Environmental justice impacts are characterized for each IPF as negligible, minor, moderate, or major using the four-level classification scheme outlined in Section 3.12.2.1. A determination of whether impacts are "disproportionately high and adverse" in accordance with Executive Order 12898 is provided in the conclusion sections for the Proposed Action and action alternatives.

3.12.1 Description of the Affected Environment for Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Subsection 1-101). When determining whether environmental effects are disproportionately high and adverse, agencies are to consider whether there is or will be an impact on the natural or physical environment that significantly and adversely affects a minority population, low-income population, or Indian tribe, including ecological, cultural, human health, economic, or social impacts; and whether the effects appreciably exceed those on the general population or other appropriate comparison group (CEQ 1997). Beneficial impacts are not typically considered environmental justice impacts; however, this section identifies beneficial effects on environmental justice populations, where appropriate, for completeness.

Executive Order 12898 directs federal agencies to consider the following with respect to environmental justice as part of the NEPA process (CEQ 1997):

- The racial and economic composition of affected communities;
- Health-related issues that may amplify project effects on minority or low-income individuals; and
- Public participation strategies, including community or tribal participation in the NEPA process.

According to USEPA guidance, environmental justice analyses must address disproportionately high and adverse impacts on minority populations (i.e., who are non-white, or who are white but have Hispanic ethnicity) when minority populations represent over 50 percent of the population of an affected area or when the percentage of minority or low-income populations in the affected area is "meaningfully greater" than the minority percentage in the "reference population"—defined as the population of a larger area in which the affected population resides (i.e., a county, state, or region depending on the geographic extent of the analysis area). Low-income populations are those that fall within the annual statistical poverty thresholds from the U.S. Department of Commerce, Bureau of the Census, Population Reports, Series P-60 on Income and Poverty (USEPA 2016).

The State of New Jersey's Environmental Justice Law, New Jersey Statutes Annotated 13:1D-157, directs the publishing of a list of overburdened communities. An *overburdened community,* as defined by the law, is any census block group, as determined in accordance with the most recent United States Census data, in which (NJDEP 2021):

- At least 35 percent of the households qualify as low-income households (at or below twice the poverty threshold as determined by the United States Census Bureau);
- At least 40 percent of the residents identify as minority or as members of a state-recognized tribal community; or
- At least 40 percent of the households have limited English proficiency (without an adult that speaks English "very well" according to the United States Census Bureau).

Using this definition, environmental justice communities in the New Jersey portion of the geographic analysis area are clustered around larger cities and towns (shown on Figure 3.12-1), and occur in Atlantic City, Bridgeton, Glassboro, Millville, and Vineland, which contain populations that meet the income or minority criteria. CEQ and USEPA guidance do not define *meaningfully greater* in terms of a specific percentage or other quantitative measure. As the states of Virginia and South Carolina do not provide specific thresholds, this analysis defines an environmental justice population as a block group that either (1) meets USEPA's "50 percent" criterion for race, or (2) is in the 80th or higher percentile for minority or low-income status as compared to the state population for Virginia and South Carolina. USEPA's Environmental Justice Screening and Mapping Tool's (EJSCREEN) data were used to assess the 50 percent criterion for race and the 80th percentile criterion for minority and low-income status (USEPA 2021a). Environmental justice populations meeting the minority and income criteria are present within and near North Charleston, South Carolina, and Norfolk, Virginia. Figure 3.12-2 and Figure 3.12-3 provide mapped locations of environmental justice populations in the geographic analysis area in Norfolk and Charleston, respectively.

Table 3.12-1 summarizes trends for non-white populations and the percentage of residents with household incomes below the federally defined poverty line in the counties studied in the geographic analysis area. The non-white population percentage generally increased throughout the geographic analysis area between 2000 and 2019. The percentage of population living under the poverty level has generally increased from 2000 to 2010 and declined slightly by 2019.

Table 3.12-1 State and County Minority and Low-Income Status

Jurisdiction	Percentage of Population below the Federal Poverty Level			Non-White Population Percentage[1]		
	2000	2010	2019	2000	2010	2019
State of New Jersey	8.5%	10.3%	10.0%	34.0%	40.6%	44.5%
Atlantic County	10.5%	14.3%	13.3%	36.1%	42.0%	43.6%
Cape May County	8.6%	10.5%	9.8%	10.0%	12.9%	14.5%
Cumberland County	15.0%	16.9%	16.5%	41.6%	47.2%	52.2%
Gloucester County	6.2%	6.3%	7.4%	14.3%	19.0%	21.3%
Ocean County	7.0%	11.2%	10.1%	10.1%	14.0%	15.3%
Salem County	9.5%	11.3%	12.4%	20.4%	23.1%	25.6%
State of South Carolina	14.1%	18.2%	15.2%	33.9%	35.6%	36.0%
Charleston County	8.4%	18.9%	13.7%	39.2%	37.7%	35.3%
Commonwealth of Virginia	9.6%	11.1%	10.6%	29.8%	35.0%	37.9%
Norfolk City	16.4%	16.4%	18.7%	53.0%	55.6%	56.8%

Sources: USCB 2000a, 2000b, 2010, 2019.
[1] Non-White Population Percentage is considered the White alone, not Hispanic or Latino population.

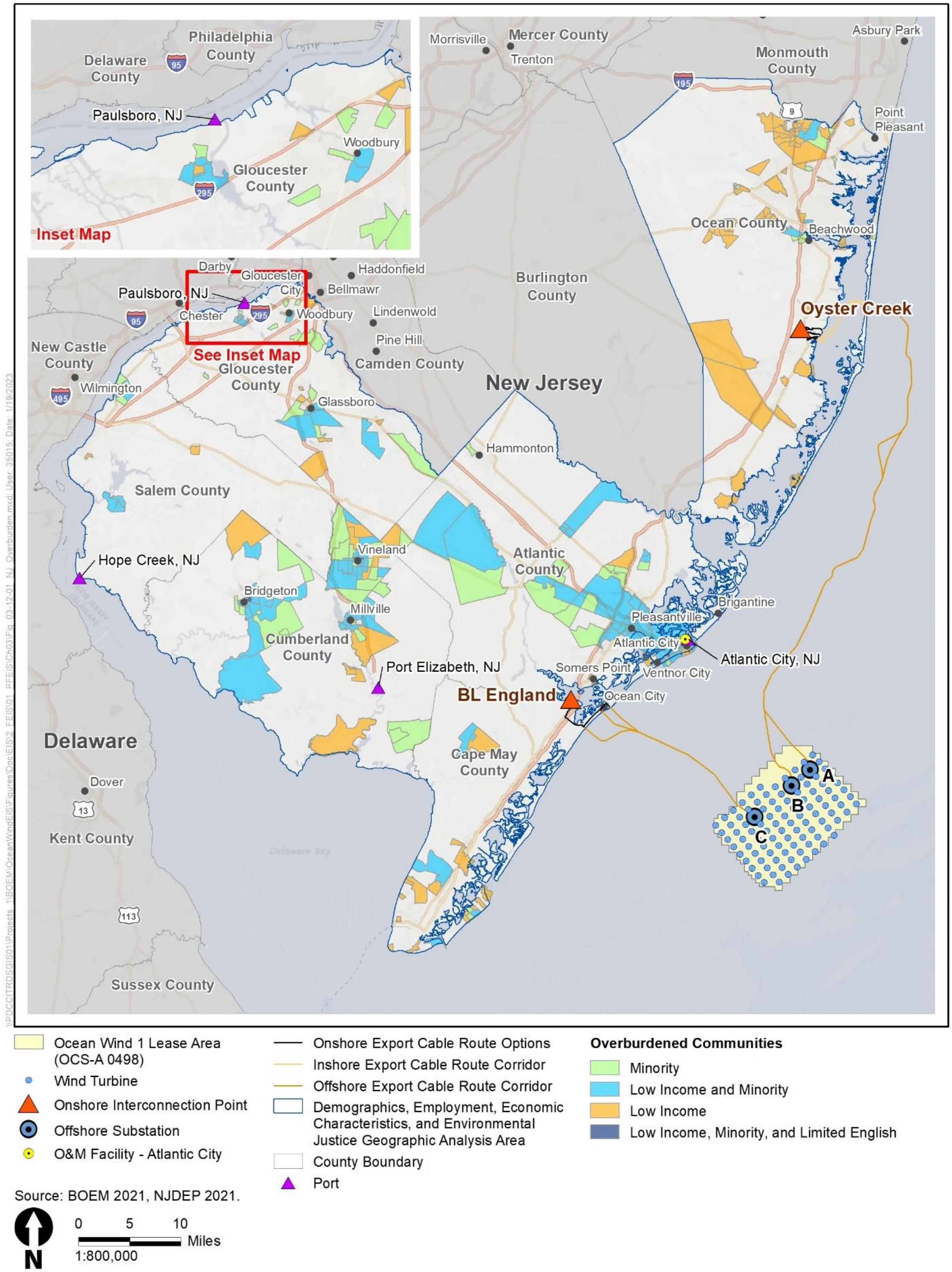

Figure 3.12-1 Environmental Justice Populations in New Jersey

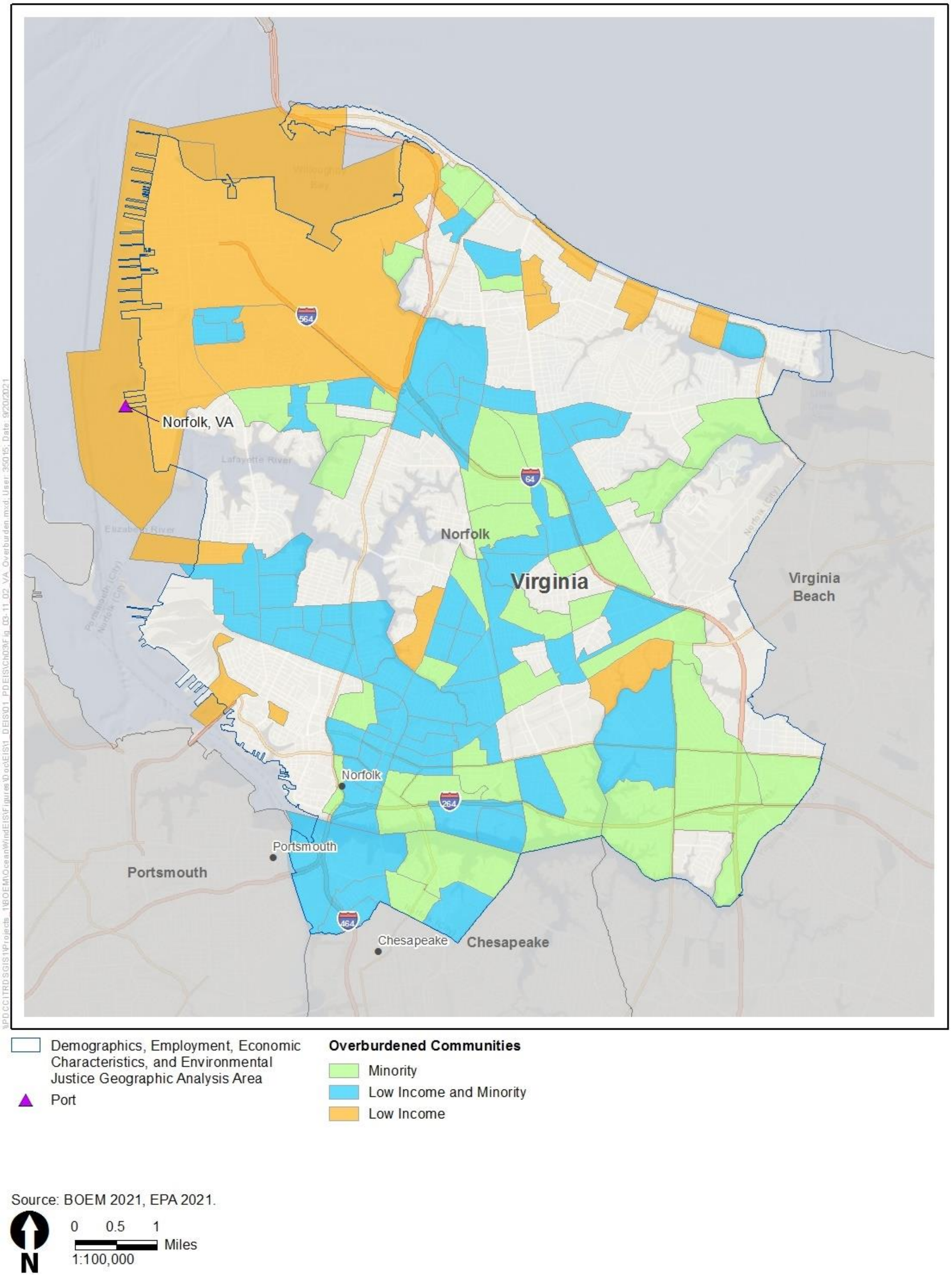

Figure 3.12-2 Environmental Justice Populations in Virginia

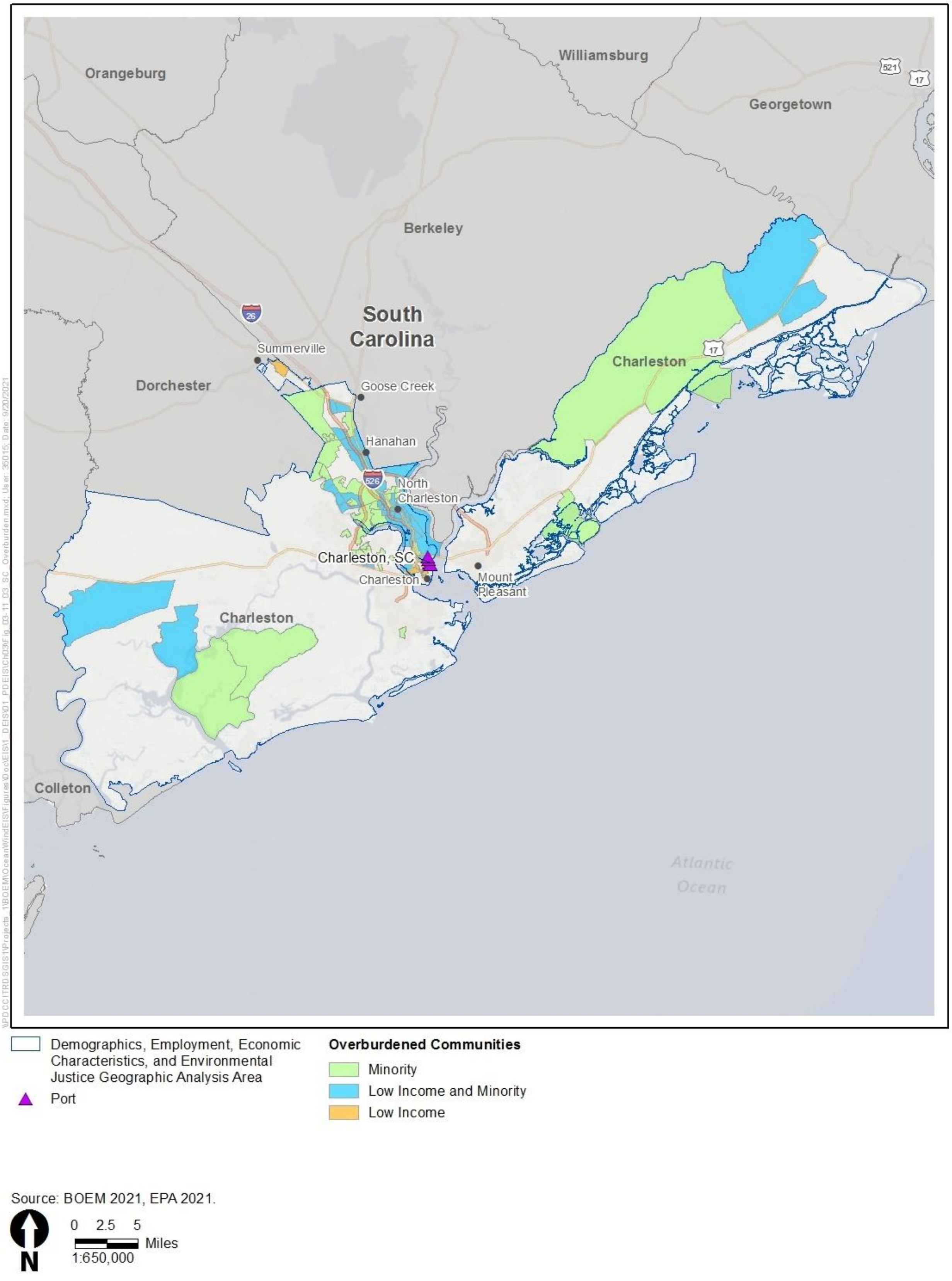

Figure 3.12-3 Environmental Justice Populations in South Carolina

Low-income and minority workers may be employed in commercial fishing and supporting industries that provide employment on commercial fishing vessels, at seafood processing and distribution facilities, and in trades related to vessel and port maintenance, or operation of marinas, boat yards, and marine equipment suppliers and retailers.

NOAA's social indicator mapping (NOAA 2022a) was used to identify environmental justice populations in the geographic analysis area that also have a high level of fishing engagement or fishing reliance. The fishing engagement and reliance indices portray the importance or level of dependence of commercial or recreational fishing to coastal communities:

- Commercial fishing engagement measures the presence of commercial fishing through fishing activity as shown through permits, fish dealers, and vessel landings. A high rank indicates more engagement.
- Commercial fishing reliance measures the presence of commercial fishing in relation to the population size of a community through fishing activity. A high rank indicates more reliance.
- Recreational fishing engagement measures the presence of recreational fishing through fishing activity estimates. A high rank indicates more engagement.
- Recreational fishing reliance measures the presence of recreational fishing in relation to the population size of a community. A high rank indicates increased reliance.

As shown on Figure 3.12-4, the coastal communities of Cape May, Atlantic City, and Barnegat Light, New Jersey have a high level of commercial fishing engagement. Cape May and Barnegat Light also have a high level of commercial fishing reliance. Within these communities that have a high level of commercial fishing engagement or reliance, Atlantic City and Cape May are determined to contain environmental justice populations (see Figure 3.12-1). Coastal communities on the northern end of Barnegat Bay (such as Bayville) and on the barrier island composing the eastern boundary of Barnegat Bay have a high level of recreational fishing engagement, as do the coastal communities of Brigantine, Atlantic City, Somers Point, Ocean City, Sea Isle City, and Cape May (see Figure 3.12-4). Within these communities that have a high level of recreational fishing engagement, Atlantic City and Cape May are determined to contain environmental justice populations. Cape May and Barnegat Light also have a high level of recreational fishing reliance (see Figure 3.12-4); of these, only Cape May contains an environmental justice population. None of the New Jersey ports that may be used for the Project are in areas with high levels of commercial or recreational fishing engagement or reliance.

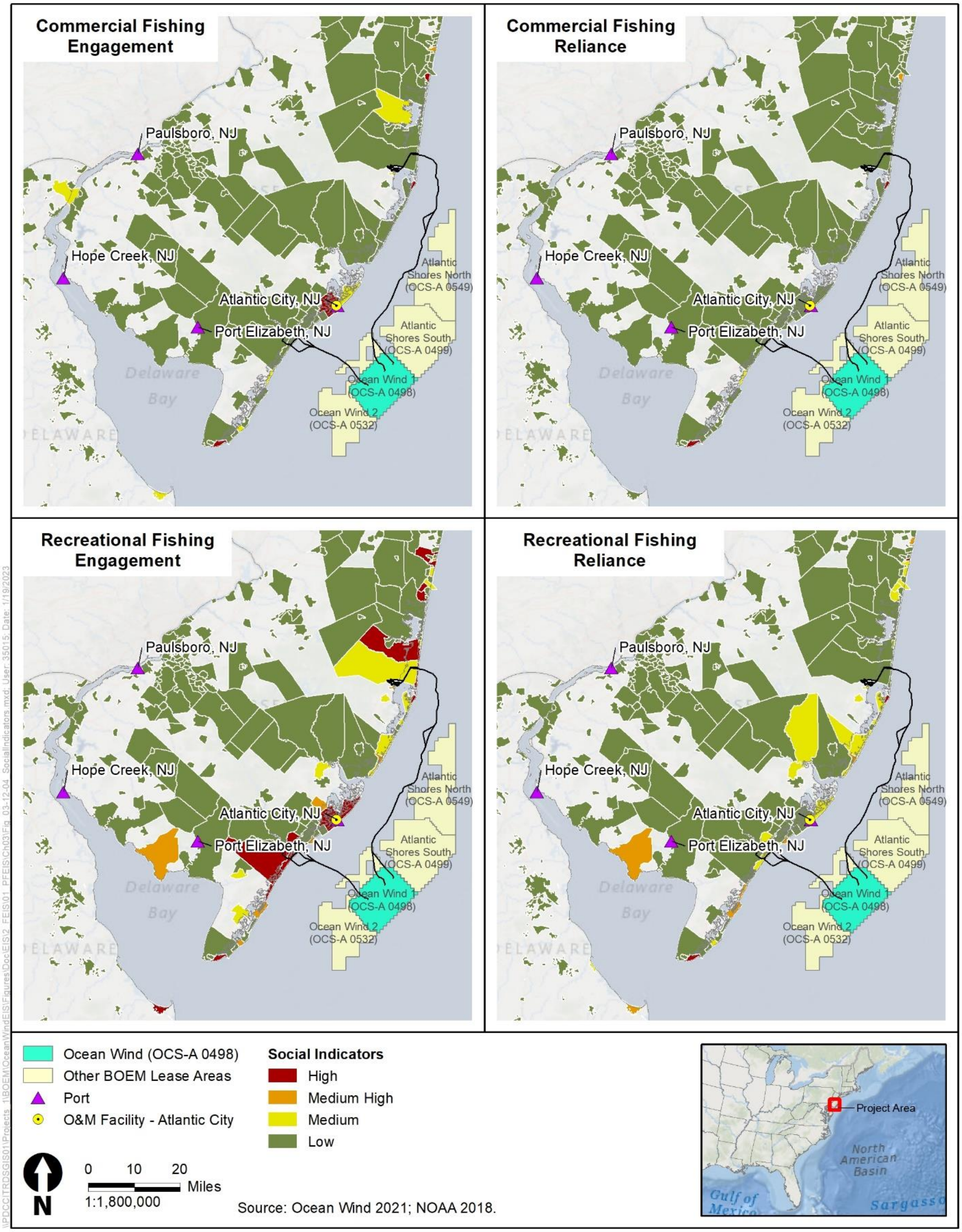

Figure 3.12-4 Commercial and Recreational Fishing Engagement or Reliance of Coastal Communities

NOAA has also developed social indicator mapping related to gentrification pressure (NOAA 2022a). The gentrification pressure indicators measure factors that, over time, may indicate a threat to the viability of a commercial or recreational working waterfront. Gentrification indicators are related to housing disruption, retiree migration, and urban spawl:

- Housing disruption represents factors that indicate a fluctuating housing market where some displacement may occur due to rising home values and rents including changes in mortgage values. A high rank means more vulnerability for those in need of affordable housing and a population more vulnerable to gentrification.
- Retiree migration characterizes communities with a higher concentration of retirees and elderly people in the population including households with inhabitants over 65 years, population receiving social security or retirement income, and level of participation in the work force. A high rank indicates a population more vulnerable to gentrification as retirees seek out the amenities of coastal living.
- Urban sprawl describes areas experiencing gentrification through increasing population density, proximity to urban centers, home values, and the cost of living. A high rank indicates a population more vulnerable to gentrification.

In a recent survey of commercial fishing crewmembers in the northeastern U.S., approximately 9 percent of participants reported annual incomes of less than $30,000 (Silva et al. 2021). Because of increasing real estate values and tax burdens in many coastal communities in the northeastern U.S. (Jimenez 2021), many crewmembers, especially those with low incomes, reside in communities far from the ports where fishing vessels are based. According to the survey results, the median distance crewmembers reported traveling from their homes to their primary ports was approximately 15 miles (Silva et al. 2021).

Mapping for gentrification indices show medium high to high levels of housing disruption and retiree migration in coastal communities along the New Jersey shore between Cape May and Barnegat Light, New Jersey, with the exception that Atlantic City has a low level of retiree migration. Urban sprawl across the same area exhibits low to medium pressure. Overall, mapping identifies lower gentrification pressure in the Atlantic City area compared to other nearby coastal areas due to low levels of retiree migration and low levels of urban sprawl.

Environmental justice analyses must also address impacts on Native American tribes. Federal agencies should evaluate "interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the proposed agency action," and "recognize that the impacts within…Indian tribes may be different from impacts on the general population due to a community's distinct cultural practices" (CEQ 1997). Factors that could lead to a finding of significance for environmental justice populations include loss of significant cultural or historical resources and the impact's relation to other cumulatively significant impacts (USEPA 2016).

While there are no tribal lands within the geographic analysis area, BOEM has invited federally recognized tribes with ancestral associations to lands within the Project area to participate in government-to-government consultation and to participate in the NHPA Section 106 consultation process. BOEM has invited the following federally recognized tribes to participate in government-to-government consultation on the proposed Project: Eastern Shawnee Tribe of Oklahoma, Shawnee Tribe, Absentee-Shawnee Tribe of Indians of Oklahoma, Stockbridge-Munsee Community Band of Mohican Indians, Delaware Nation, Delaware Tribe of Indians, Shinnecock Indian Nation, Narragansett Indian Tribe, Rappahannock Tribe, Mashantucket Pequot Tribal Nation, and Wampanoag Tribe of Gay Head (Aquinnah).

With respect to tribal and indigenous peoples, New Jersey formally recognizes the Nanticoke Lenni-Lenape Indians, Powhatan Renape Indians, Ramapough Lenape Indian Nation, and Inter-Tribal People, none of which are federally recognized.[1] The Lenni-Lenape inhabited the Delaware River area of New Jersey long before the Europeans. The Lenni-Lenape lived near the coast, but their primary resources came from inland and the rivers (Salem County 2021).

The Commonwealth of Virginia recognizes 11 tribes, seven of which are federally recognized. None of the 11 tribes recognized by the Commonwealth of Virginia reside in the geographic analysis area. The Nansemond Indian Nation in Suffolk, Virginia, is the closest tribe to the city of Norfolk. The Nansemond Indian Nation lived in settlements along the Nansemond River fishing, harvesting oysters, hunting, and farming (Nansemond Indian Nation n.d.). The State of South Carolina recognizes 10 tribes, one of which is federally recognized. None of the 10 tribes recognized by the State of South Carolina reside in the geographic analysis area (Chesapeake Bay Program 2021; USEPA 2021b; South Carolina Commission for Minority Affairs 2021; State of New Jersey 2021).The Wassamasaw Tribe of Varnertown Indians in Summerville, South Carolina, the closest tribe to Charleston County, South Carolina, was historically a farming community (South Carolina Commission for Minority Affairs 2021; Wassamasaw Tribe of Varnertown Indians 2016).

3.12.2 Environmental Consequences

Scope of the Environmental Justice Analysis

To define the scope of the environmental justice analysis, BOEM reviewed the impact conclusions for each resource analyzed in EIS Section 3.4 through Section 3.22 to assess whether the Proposed Action and action alternatives would result in impacts that would be considered “high and adverse” and whether impacts had the potential to disproportionately affect environmental justice populations given the geographic extent of the impact relative to the locations of environmental justice populations. Impacts that were determined to be high and adverse or that had the potential to disproportionately affect environmental justice populations were further analyzed to determine if the impact on environmental justice populations would be disproportionately high and adverse. Although the environmental justice analysis considers impacts of other ongoing and planned activities, including other future offshore wind projects, determinations as to whether impacts on environmental justice populations would be disproportionately high and adverse are made for the Proposed Action and action alternatives alone.

As shown on Figure 3.12-1, onshore Project infrastructure including cable landfalls, onshore export cable routes, onshore substations, and points of interconnection are predominantly not in areas where environmental justice populations have been identified and would therefore not affect environmental justice populations. One of nine potential landfall locations, neither of the onshore substation locations, and less than 3 percent of onshore export cable routes are in areas identified as low-income or minority, and any impacts related to onshore construction would not disproportionately affect low-income or minority populations. Because onshore construction would not disproportionately affect environmental justice populations identified in the geographic analysis area, impacts associated with construction, O&M, and decommissioning of onshore Project components are not carried forward for further analysis of disproportionately high and adverse effects within the environmental justice analysis. Based on the geographic extent of onshore construction impacts relative to the location of environmental justice populations, BOEM concludes that environmental justice populations would not experience disproportionately high and adverse effects related to construction, O&M, and decommissioning of onshore infrastructure.

Ocean Wind has identified the following locations for ports that could support construction of the Project: Paulsboro, Hope Creek, and Port Elizabeth, New Jersey; Norfolk, Virginia; and Charleston, South

[1] Inter-Tribal People refers to American Indian people who reside in New Jersey but are members of federally or state-recognized tribes in other states.

Carolina. In addition, Ocean Wind plans to use an O&M facility in Atlantic City for long-term O&M of the Project. As shown on Figure 3.12-1 through Figure 3.12-3, ports in Norfolk and Charleston and the proposed location for the O&M facility in Atlantic City are all in areas where environmental justice populations have been identified. Therefore, port utilization and use of the O&M facility in Atlantic City are carried forward for analysis of disproportionately high and adverse effects in this environmental justice analysis under the port utilization and air emission IPFs.

Construction, O&M, and decommissioning of offshore structures (WTGs and OSS) could have major impacts on some commercial fishing operations that use the Lease Area, with potential for indirect impacts on employment in related industries that could affect environmental justice populations. Cable emplacement and maintenance and construction noise would also contribute to impacts on commercial fishing. The long-term presence of offshore structures (WTGs and OSS) would also have major impacts on scenic and visual resources and viewer experience from some onshore viewpoints that could affect environmental justice populations. Therefore, impacts of construction, O&M, and decommissioning of offshore Project components is carried forward for analysis of disproportionately high and adverse effects in this environmental justice analysis under the IPFs for presence of structures, cable emplacement and maintenance, and noise.

Section 3.10 determined that construction of offshore wind structures and cables could result in potentially major impacts on ancient submerged landform features if the final Project design cannot avoid known resources or if previously undiscovered resources are discovered during construction. BOEM worked with Native American tribes, the New Jersey SHPO, the lessee, and other consulting parties to develop a treatment plan to address adverse impacts on ancient submerged landform features that cannot be avoided. Implementation of the *Historic Property Treatment Plan for the Ocean Wind 1 Farm Ancient Submerged Landform Features, Federal Waters on the Outer Continental Shelf* (see Attachment 3 of Appendix N, Attachment A) would likely reduce the magnitude of unmitigated impacts on ancient submerged landforms; however, the magnitude of these impacts would remain moderate to major due to the permanent, irreversible nature of the impacts, unless these ancient submerged landforms can be avoided. Government-to-government consultation with Native American tribes is ongoing. No other tribal resources such as cultural landscapes, traditional cultural properties, burial sites, archaeological sites with tribal significance, treaty-reserved rights to usual and accustomed fishing or hunting grounds, or other potentially affected tribal resources have been identified to date.

Other resource impacts that concluded less-than-major impacts for the Proposed Action and action alternatives or were unlikely to affect environmental justice populations were excluded from further analysis of environmental justice impacts. This includes impacts related to bats; benthic resources; birds; coastal habitat and fauna; finfish, invertebrates, and EFH; land use and coastal infrastructure; marine mammals; navigation and vessel traffic; recreation and tourism; sea turtles; water quality; and wetlands. See Table S-2 for a summary of impact levels determined for each of these resource topics.

3.12.2.1. Impact Level Definitions for Environmental Justice

Definitions of potential impact levels are provided in Table 3.12-2. Determination of a “major” impact corresponds to a “high and adverse” impact for the environmental justice analysis. Major (or high and adverse) impacts will be further analyzed to determine if those impacts would be disproportionately high and adverse for low-income or minority populations.

Table 3.12-2 Impact Level Definitions for Environmental Justice

Impact Level	Impact Type	Definition
Negligible	Adverse	Adverse impacts on environmental justice populations would be small and unmeasurable.
	Beneficial	Beneficial impacts on environmental justice populations would be small and unmeasurable.
Minor	Adverse	Adverse impacts on environmental justice populations would be small and measurable but would not disrupt the normal or routine functions of the affected population.
	Beneficial	Environmental justice populations would experience a small and measurable improvement in human health, employment, facilities or community services, or other economic or quality-of-life improvement.
Moderate	Adverse	Environmental justice populations would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts.
	Beneficial	Environmental justice populations would experience a notable and measurable improvement in human health, employment, facilities or community services, or other economic or quality-of-life improvement.
Major	Adverse	Environmental justice populations would have to adjust to significant disruptions due to notable and measurable adverse impacts. The affected population may experience measurable long-term effects.
	Beneficial	Environmental justice populations would experience a substantial long-term improvement in human health, employment, facilities or community services, or other economic or quality-of-life improvement.

3.12.3 Impacts of the No Action Alternative on Environmental Justice

When analyzing the impacts of the No Action Alternative on environmental justice, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for environmental justice. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*.

3.12.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for environmental justice described in Section 3.12.1, *Description of the Affected Environment for Environmental Justice*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing activities that have the potential to affect environmental justice populations include onshore development and land uses; utilization of ports, marinas, and working waterfronts; port improvements or expansions; and commercial fishing operations. These activities support beneficial employment and also generate sources of air emissions, noise, lighting, and vehicle and vessel traffic that can adversely affect the quality of life in affected communities. There are no ongoing offshore wind activities within the geographic analysis area for environmental justice.

Coastal development that leads to gentrification of coastal communities may create space-use conflicts and reduce access to coastal areas and working waterfronts that communities rely on for recreation, employment, and commercial or subsistence fishing. Gentrification can also lead to increased tourism and recreational boating and fishing that provide employment opportunities in recreation and tourism. As described in Section 3.12.1, mapping of gentrification indices show medium high to high levels of housing disruption and retiree migration in coastal communities along the New Jersey shore between Cape May and Barnegat Light, New Jersey, with the exception that Atlantic City has a low level of retiree migration. More inland areas of the state typically have lower gentrification pressure. Housing disruption caused by rising home values and rents can displace affordable housing, with disproportionate effects for low-income populations.

See Table F1-10 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for environmental justice.

3.12.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned activities (without the Proposed Action). Planned non-offshore wind activities that may affect environmental justice populations include port utilization and expansion, construction and maintenance of coastal infrastructure (marinas, docks, and bulkheads), and onshore coastal development that can lead to gentrification of coastal communities and working waterfronts (see Section F.2 in Appendix F for a description of ongoing and planned activities).

Planned non-offshore wind activities would have impacts similar to those of ongoing non-offshore wind activities and would range from minor to moderate adverse to minor beneficial. BOEM expects that most impacts of ongoing and planned activities would be minor because while they would be measurable, they would not disrupt the normal or routine functions of the affected population. Impacts of gentrification are expected to be moderate because low-income populations would have to adjust somewhat in response to housing disruptions caused by rising home values and rents. These changes would be long term but the intensity would vary across the geographic analysis area, with higher intensity in coastal communities with waterfront access and lower intensity in more inland areas. BOEM expects that improvements related to employment for ongoing and planned activities would be measurable but small and minor beneficial. See Table F1-10 for a summary of potential impacts associated with planned non-offshore wind activities by IPF for environmental justice.

BOEM expects planned offshore wind activities to affect environmental justice populations through the following primary IPFs.

Air emissions: Increased port activity would generate short-term, variable increases in air emissions. The largest emissions for regulated air pollutants would occur during construction from diesel construction equipment, vessels, and commercial vehicles. Emissions at offshore locations would have regional impacts, with no disproportionate impacts on environmental justice populations. However, environmental justice populations near ports could experience disproportionate air quality impacts depending upon the ports that are used, ambient air quality, and the increase in emissions at any given port.

There are three planned offshore wind projects within the air quality geographic analysis area: Atlantic Shores North, Atlantic Shores South, and Ocean Wind 2 (Figure 3.4-1). Construction periods as estimated in Table F2-1 in Appendix F could result in concurrent construction of Ocean Wind 1 and Atlantic Shores South in 2024 and 2025. Ocean Wind 1 construction could be supported by two ports near environmental justice populations in Charleston, South Carolina, and Norfolk, Virginia. In addition, the O&M facility in Atlantic City, New Jersey, could be used as a construction management base. As stated in Section 3.4, *Air Quality*, during the construction phase, the total emissions of criteria pollutants and ozone precursors from offshore wind projects other than Ocean Wind 1 proposed within the air quality geographic analysis area,[2] summed over all construction years, are estimated to be 6,034 tons of carbon monoxide (CO), 27,571 tons of nitrogen oxides (NO_X), 913 tons of particulate matter smaller than 10 microns in diameter (PM_{10}), 880 tons of particulate matter smaller than 2.5 microns in diameter ($PM_{2.5}$), 181 tons of sulfur dioxide (SO_2), 618 tons of volatile organic compounds (VOC), and 1,738,387 tons of CO_2 (Table F2-4). This area is larger than the environmental justice geographic analysis area and a large portion of the emissions would be generated along the vessel transit routes and at the offshore work areas. Emissions of NO_X and CO are primarily due to diesel construction equipment, vessels, and commercial vehicles. Emissions would vary spatially and temporally during construction phases. Emissions from vessels, vehicles, and equipment operating in ports could affect environmental justice populations adjacent or close to ports in Charleston, South Carolina, or Norfolk, Virginia. Environmental justice populations are not adjacent or close to potential ports in Paulsboro, Hope Creek, or Elizabeth, New Jersey. Emissions attributable to the No Action Alternative affecting any neighborhood have not been quantified; however, it is assumed that emissions from the No Action Alternative at high-volume ports in Charleston or Norfolk would contribute a small proportion of total emissions from those facilities. Therefore, air emissions during construction would have small, short-term, variable impacts on environmental justice populations due to temporary increases in air emissions. The air emissions impacts would be greater if multiple offshore wind projects simultaneously use the same port for construction staging. If construction staging is distributed among several ports, the air emissions would not be concentrated near certain ports and impacts on proximal environmental justice populations would be lower.

As explained in Section 3.4, operational activities under the No Action Alternative within the air quality geographic analysis area would generate 121–262 tons per year of CO, 519–1,107 tons per year of NO_X, 17–36 tons per year of PM_{10}, 16–35 tons per year of $PM_{2.5}$, 1–3 tons per year of SO_2, 9–20 tons per year of VOCs, and 33,566–73,226 tons per year of CO_2 (Table F2-4). The O&M facility for Atlantic Shores South is proposed in Atlantic City, New Jersey, similar to the Proposed Action. Operational emissions would overall be intermittent and widely dispersed throughout the vessel routes from the onshore O&M facilities and would generally contribute to small and localized air quality impacts. Emissions would largely be due to vessel traffic–related to O&M and operation of emergency diesel generators. These emissions would be intermittent and widely dispersed, with small and localized air quality impacts. Only the portion of those emissions resulting from ship engines and equipment operating within and near the O&M facilities in Atlantic City would affect environmental justice populations. Therefore, during operations of offshore wind projects, the air emissions volumes resulting from O&M activities are not anticipated to be large enough to have impacts on environmental justice populations.

The power generation capacity of offshore wind development could potentially lead to lower regional air emissions by displacing fossil fuel plants for power generation, resulting in a potential reduction in regional GHG emissions, as analyzed in further detail in Section 3.4. A 2019 study found that nationally, exposure to fine particulate matter from fossil fuel electricity generation in the U.S. varied by income and by race, with average exposures highest for Black individuals, followed by non-Hispanic white individuals. Exposures for other groups (i.e., Asian, Native American, and Hispanic) were somewhat lower. Exposures were higher for lower-income populations than for higher-income populations, but disparities were larger by race than by income (Thind et al. 2019). Specific to New Jersey, a 2016 study found a higher percentage increase in mortality associated with $PM_{2.5}$ in census tracts with more Black individuals, lower home values, or lower median incomes (Wang et al. 2016).

Exposure to air pollution is linked to health impacts, including respiratory illness, increased health care costs, and mortality. A 2016 study for the Mid-Atlantic region found that offshore wind could produce

[2] The air quality geographic analysis area, depicted on Figure 3.4-1, includes the airshed with 25 miles (40 kilometers) of the Wind Farm Area (corresponding to the OCS permit area) and the airshed within 15.5 miles (25 kilometers) of onshore construction areas and ports that may be used for the Project.

measurable benefits related to health costs and reduction in loss of life due to displacement of fossil fuel power generation (Buonocore et al. 2016). Environmental justice populations tend to have disproportionately high exposure to air pollutants, likely leading to disproportionately high adverse health consequences. Accordingly, offshore wind generation analyzed under the No Action Alternative would have potential benefits for environmental justice populations through reduction or avoidance of air emissions and concomitant reduction or avoidance of adverse health impacts.

Cable emplacement and maintenance: Cable emplacement and maintenance for future offshore wind projects would result in seafloor disturbance and temporary increases in turbidity. Cable emplacement and maintenance could displace other marine activities temporarily within work areas. As described in Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, cable emplacement and maintenance would have localized, temporary, short-term impacts on the revenue and operating costs of commercial and for-hire fishing businesses. Commercial fishing operations may temporarily be less productive during cable installation or repair, resulting in reduced income and also leading to short-term reductions in business volumes for seafood processing and wholesaling businesses that depend upon the commercial fishing industry. Although commercial and for-hire fishing businesses could temporarily adjust their operating locations to avoid revenue loss, impacts would be greater if multiple cable installation or repair projects are underway offshore at the same time. Business impacts could affect environmental justice populations due to the potential loss of income or jobs by low-income or minority workers in the commercial fishing industry. In addition, cable installation and maintenance could temporarily disrupt subsistence fishing, resulting in short-term, localized impacts on individuals who rely on subsistence fishing as a food source.

Noise: As described in greater detail in Sections 3.9, 3.11, *Demographics, Employment, and Economics*, and 3.18, noise from G&G survey activities, pile driving, trenching, and vessels is likely to result in temporary revenue reductions for commercial fishing and for-hire recreational fishing businesses that are based in the geographic analysis area. Construction noise, especially site assessment G&G surveys and pile driving, would affect fish populations, with impacts on commercial and for-hire fishing. The severity of impacts would depend on the proximity and temporal overlap of offshore wind survey and construction activities, and the location of noise-generating activities in relation to preferred locations for commercial and for-hire fishing. The localized impacts of offshore noise on fishing could also affect subsistence fishing. In addition, noise would affect some for-hire recreational fishing businesses, as these visitor-oriented services are likely to avoid areas where noise is being generated due to the disruption for customers.

Impacts of offshore noise on marine businesses would be short term and localized, occurring during surveying and construction, with no noticeable impacts during operations and only periodic, short-term impacts during maintenance. Noise impacts during surveying and construction would be more widespread when multiple offshore wind projects are under construction at the same time. The impacts of offshore noise on marine businesses could be short term and localized on low-income and minority workers in communities with a high level of commercial or recreational fishing engagement or reliance as well as residents who practice subsistence fishing.

Port utilization: Offshore wind project construction would require port facilities for berthing, staging, and loadout. Future offshore wind development would also support planned expansions and improvements at ports in the geographic analysis area. For example, the State of New Jersey is investing in development of the New Jersey Wind Port on the eastern shore of the Delaware River in Salem County and is also investing in a manufacturing facility to build steel components for offshore wind turbines at the Port of Paulsboro (see Appendix F, Section F.2.13). Offshore wind projects that utilize ports near environmental justice populations may contribute to adverse impacts on these populations from increased air emissions, lighting, noise, and vessel and vehicle traffic generated by port utilization or expansion.

Air emissions and noise from vessels, vehicles, and equipment operating in ports; lighting of port facilities; and vessel and vehicle traffic to and from port locations could affect environmental justice populations adjacent or close to those ports. Baseline levels of air emissions, noise, lighting, and traffic at port locations and increases associated with planned offshore wind construction and decommissioning have not been quantified; however, BOEM expects that future offshore wind projects would contribute to small increases in these IPFs relative to baseline operations at major ports such as Norfolk, Virginia, and Charleston, South Carolina. At New Jersey ports planning expansions to support the offshore wind industry (such as the New Jersey Wind Port and the Port of Paulsboro), the contribution of future offshore wind projects to these IPFs would be substantially greater. Increases in air emissions, noise, lighting, and vessel and vehicle traffic from increases in port utilization would occur during the construction and decommissioning phases for each planned offshore wind project. Impacts at ports would be greater if multiple offshore wind projects use the same port(s) for construction and decommissioning simultaneously and would be reduced at each port location if construction and decommissioning for each planned offshore wind project is distributed among several ports.

Offshore wind construction and decommissioning would generate increased vessel traffic. However, none of the New Jersey ports that may be used for the Project (and for which there is potential for cumulative effects) are in areas with high levels of commercial fishing engagement or reliance (Figure 3.12-4), reducing the potential for space-use conflicts between commercial fishing vessels and vessels used for future offshore wind at ports in New Jersey. Areas adjacent to Charleston Harbor have medium to medium high levels of commercial fishing engagement, while Norfolk, Virginia, supports a medium level of commercial fishing engagement; however, the incremental contribution of future offshore wind vessel traffic to space-use conflicts with commercial fishing operations near major high-volume ports is expected to be minor.

Port use and expansion would have beneficial impacts on employment at ports. Future offshore wind projects would contribute to minor increases in employment at major ports such as Norfolk, Virginia, and Charleston, South Carolina, that are in environmental justice communities. Planned port expansions for the New Jersey Wind Port and Port of Paulsboro would have long-term, moderate beneficial impacts on employment; however, these ports are not in environmental justice communities.

Atlantic Shores South has proposed use of an O&M facility in Atlantic City. O&M of future offshore wind projects would generate vessel trips and air emissions from vessels transiting between the O&M facility and the offshore wind lease area for each planned project. Operational emissions associated with vessels would be intermittent and widely dispersed along the vessel routes and would generally contribute to small and localized air quality impacts. BOEM does not expect that O&M facilities would generate levels of air emissions, noise, lighting, or vessel and vehicle traffic that would be disruptive to nearby communities. Operation of O&M facilities would also have long-term, minor beneficial employment impacts, creating employment opportunities in the Atlantic City area.

Presence of structures: Construction, decommissioning, and, to a lesser extent, O&M of future offshore wind projects could affect employment and economic activity generated by commercial fishing and marine-based businesses. Commercial fishing vessels would need to adjust routes and fishing grounds to avoid offshore work areas during construction and to avoid WTGs and OSS during operations. Concrete cable covers and scour protection could result in gear loss and would make some fishing techniques unavailable in locations where the cable coverage exists. Future offshore wind activities would generate increased vessel traffic, which would increase navigational complexity in offshore construction areas during construction and within each project’s offshore wind lease area long term due to the presence of WTGs and OSS. For-hire recreational fishing businesses would also need to avoid construction areas and offshore structures. A decrease in revenue, employment, and income within commercial fishing and marine industries could affect low-income and minority workers in communities with a high level of commercial fishing engagement or reliance. The impacts during construction would be short term and would increase in magnitude if multiple offshore construction areas are being used at the same time. Impacts during operations would be long term but may lessen in magnitude as business operators adjust to the presence of offshore structures and as any temporary marine safety zones needed for construction are no longer needed.

In addition to the potential impacts on commercial and for-hire recreational fishing activity and supporting businesses, WTGs are anticipated to provide new opportunities for recreational fishing through fish aggregation and reef effects, and to provide attraction for recreational sightseeing businesses, potentially benefitting for-hire recreational fishing and low-income employees of fishing-dependent businesses.

The long-term presence of WTGs associated with future offshore wind may also cause major adverse impacts on scenic and visual resources in coastal communities that are within the viewshed of future offshore wind projects. The level of impact on onshore viewers would depend on the distance to the WTGs offshore, the number and height of the WTGs associated with each future offshore wind project, and the design of the aviation warning lighting system, which could introduce continuous nighttime lighting. Lighting impacts would be reduced if the emerging technology of ADLS is used. ADLS lighting would be activated only when an aircraft approaches (Section 3.20). Depending on exact location and layout of offshore wind projects, ADLS would likely limit the frequency of WTG aviation warning lighting use. This technology, if used, would significantly reduce the impacts of lighting.

3.12.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, environmental justice populations within the geographic analysis area would continue to be influenced by regional environmental, demographic, and economic trends. While the Project would not be built under the No Action Alternative, BOEM expects ongoing activities to have continuing impacts on environmental justice populations through the following trends: ongoing coastal development and gentrification of coastal communities; ongoing commercial fishing, seafood processing, and tourism industries that provide job opportunities for low-income residents; and air emissions, noise, lighting, and traffic associated with onshore construction and land uses when these occur near environmental justice populations. BOEM anticipates that the environmental justice impacts of these ongoing activities would range from minor to moderate adverse to minor beneficial. The No Action Alternative would result in impacts on environmental justice populations that range from **minor** to **moderate** adverse to **minor beneficial**.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and activities would continue, and environmental justice populations would continue to be affected by natural and human-caused IPFs. Reasonably foreseeable trends affecting environmental justice populations, other than offshore wind, include continued operation of commercial fishing and supporting marine businesses; growing recreational and tourism industries for coastal economies; new development that would result in increased construction and vehicle emissions; and gentrification of industrial waterfront locations and coastal communities. BOEM anticipates that the impacts of these trends and planned activities on environmental justice populations would range from minor to moderate adverse to minor beneficial. BOEM anticipates that the cumulative impacts of the No Action Alternative would be **moderate** because environmental justice populations would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts. This reflects moderate impacts on environmental justice populations from gentrification and potential loss of income for low-income and minority workers in communities with a high level of commercial fishing engagement or reliance; minor adverse impacts from air emissions, noise, lighting, and traffic associated with onshore construction, land uses, and port utilization; and minor beneficial employment benefits associated with future offshore wind construction and O&M, increased port utilization, and improved opportunities for for-hire recreational fishing.

3.12.4 Relevant Design Parameters & Potential Variances in Impacts for Action Alternatives

Effects on environmental justice populations would occur when the action alternative's adverse effects on other resources, such as air quality, commercial and for-hire recreational fishing, or scenic and visual resources, are felt disproportionately within environmental justice populations due either to the location of these communities in relation to the action alternatives or to their higher vulnerability to impacts.

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than described in the sections below. The following PDE parameters (Appendix E) would influence the magnitude of environmental justice impacts:

- Overall size of the Project (approximately 1,100 MW) and number of WTGs;
- The Project layout including the number, type, height, and placement of the WTGs and OSS, and the location of export cable routes;
- The extent to which Ocean Wind hires local residents and obtains supplies and services from local vendors;
- The port(s) selected to support construction, installation, and decommissioning and the port(s) selected to support O&M;
- Arrangement of WTGs and accessibility of the Wind Farm Area to commercial and for-hire recreational fishing; and
- The time of year during which offshore and nearshore construction occurs and the duration of offshore and nearshore construction activities.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts on environmental justice populations:

- WTG number and layout: More WTGs and closer spacing could increase space-use conflicts with commercial and for-hire recreational fishing vessels.
- Utilization of ports that are near or within low-income and minority populations would have greater impacts.

Ocean Wind has committed to measures to minimize impacts on other resource areas that would reduce the potential for effects on environmental justice populations. Examples include measures to minimize impacts on the commercial and for-hire recreational fishing industry (CFHFISH-01, CFHFISH-02) and reduce impacts on local tourism and businesses from onshore construction (REC-01, REC-02) (COP Volume II, Table 1.1-2; Ocean Wind 2023).

3.12.5 Impacts of the Proposed Action on Environmental Justice

3.12.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.12.7, *Impacts of Alternative E on Environmental Justice*.

The Proposed Action would affect low-income and minority populations in the geographic analysis through the primary IPFs of cable emplacement and maintenance, noise, port utilization, and presence of structures.

Air emissions: Emissions at offshore locations would have regional impacts, with no disproportionate impacts on environmental justice populations, because (1) emissions generated during construction, O&M, and decommissioning of offshore infrastructure in the Lease Area would occur 15 miles offshore, (2) emissions would be mixed and dispersed into the atmosphere, (3) the prevailing wind direction (west to east, or westerlies) would generally not direct emissions back toward shore, and (4) the pollutant concentrations generated by the Proposed Action are predicted to be within the NAAQS at all locations (see Section 3.4 and Section I.1.2 for additional information on air quality modeling results and wind conditions within the geographic analysis area).

However, environmental justice populations near ports could experience disproportionate air quality impacts, depending upon the ports that are used. Appendix N to the COP (Ocean Wind 2023) provides maximum annual construction emissions (in tons) for nonattainment/maintenance areas. Emissions are estimated for onshore construction (Year 1) and for offshore construction utilizing vessels (Year 2). Emissions reported for the Atlantic City, New Jersey Carbon Monoxide Maintenance Area can be used to estimate emissions associated with utilization of the O&M facility in Atlantic City during Project construction as shown in Table 3.12-3. While Ocean Wind has quantified estimated emissions by calendar year within the nonattainment area that includes Atlantic City, compliance with the NAAQS cannot be determined based on the emission inventory alone. Dispersion modeling would be required to characterize concentrations for comparison to the NAAQS.

Table 3.12-3 General Conformity Construction Emissions in Atlantic City, New Jersey Nonattainment Area (tons)

Year	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	Lead	VOC
Year 1	0.084	1.70	0.10	0.08	0.01	-	0.12
Year 2	2.02	10.27	0.29	0.28	0.05	0.00004	0.18
Total	2.86	11.97	0.39	0.37	0.06	0.00004	0.30

The Proposed Action’s contributions to increased air emissions at the ports of Norfolk, Virginia, and Charleston, South Carolina, which are near environmental justice populations, are not quantitatively evaluated because the nonattainment/maintenance areas that include these ports are much larger and include multiple counties, which does not allow for meaningful conclusions regarding emissions at specific ports. However, as stated in Section 3.4, BOEM expects that overall air emissions impacts would be minor during Proposed Action construction, operations, and decommissioning, with the greatest quantity of emissions produced in the Lease Area and by vessels transiting between ports and the Lease Area.

Construction of the Proposed Action would use ports at Port Elizabeth, Paulsboro, and Hope Creek, New Jersey; Norfolk Virginia; or Charleston, South Carolina, staging and shipping of Project components. Increased short-term and variable emissions from Proposed Action construction and operations would have negligible to minor disproportionate, adverse impacts on the communities near the ports of Norfolk, Virginia, and Charleston, South Carolina, and at the O&M facility in Atlantic City, New Jersey. Environmental justice populations are not identified near the other ports that could be used in Port Elizabeth, Paulsboro, and Hope Creek, New Jersey, and air emissions generated at these locations would not affect environmental justice populations.Net reductions in air pollutant emissions resulting from the Proposed Action alone would result in long-term benefits to communities (regardless of environmental justice status) by displacing emissions from fossil-fuel-generated power plants. As explained in Section 3.4, by displacing fossil fuel power generation, once operational, the Proposed Action would result in annual avoided emissions of 2,362 tons of NO_X, 114 tons of $PM_{2.5}$, 5,705 tons of SO_2, and 2,989,161 tons of CO_2 (COP Volume II, Table 2.1.3-5; Ocean Wind 2023). Estimates of annual avoided health effects would range from 213 to 539 million dollars in health benefits and 21 to 48 avoided mortality cases (Section 3.4, Table 3.4-5). Environmental justice populations are disproportionately affected by emissions from fossil fuel power plants nationwide and by higher levels of air pollutants. Therefore, the Proposed Action alone could benefit environmental justice populations by displacing fossil fuel power-generating capacity within or near the geographic analysis area.

Cable emplacement and maintenance: The Proposed Action would install up to 143 miles (230 kilometers) of offshore export cable on the approach to Oyster Creek and up to 32 miles (51 kilometers) of offshore export cable on the approach to BL England, while inter-array cables would involve up to 190 miles (300 kilometers) of cable emplacement (COP Volume I, Section 4.4, Table 4.4-1; Ocean Wind 2023). Offshore cable emplacement for the Proposed Action would temporarily affect commercial and for-hire recreational fishing businesses, marine recreation, and subsistence fishing during cable installation and infrequent maintenance. As noted in Sections 3.9 and 3.11, installation of the Proposed Action's cables would have short-term, localized, minor impacts on commercial and for-hire recreational fishing businesses. Cable installation could affect fish of interest for commercial, recreational, or subsistence fishing through dredging and turbulence, although fish species would recover upon completion of installation activities (see Sections 3.9 and 3.13). Cable emplacement and maintenance for the Proposed Action could therefore have a short-term, minor impact on low-income and minority workers in businesses that support commercial and recreational fishing and on individuals that rely on subsistence fishing.

The geographic extent and intensity of subsistence fishing in the vicinity of cable routes are not well documented. Data specific to subsistence fishing are limited; however, trends in subsistence fishing are captured in recreational fishing data. As such, BOEM expects that subsistence angling by low-income or minority residents near cable routes would be predominantly shore-based or nearshore. Public fishing access points in proximity to proposed landfalls that could be used by subsistence anglers include the Holiday Harbor Marina in the vicinity of proposed landfalls for Oyster Creek, Fisherman's Walkway at Island Beach State Park, and the Ocean City Fishing Pier (NOAA 2022b). Because cable laying would occur predominantly farther offshore, BOEM expects that subsistence anglers would experience only minor, short-term disruptions during cable emplacement and maintenance.

Noise: Noise from Proposed Action construction (primarily pile driving) could temporarily affect fish near construction activity within the Wind Farm Area, and discourage some fishing businesses from operating in these areas during pile driving (see Sections 3.9 and 3.18). This would result in a localized, short-term, negligible impact on jobs supported by these businesses, as well as on subsistence fishing.

Port utilization: The Proposed Action would require port facilities for berthing, staging, fabrication, assembly, and loadout of Project components. Air emissions, lighting, noise, and vessel and vehicle traffic generated by the Proposed Action's activities at ports would affect communities near ports that may be used for the Project, including ports in Paulsboro, New Jersey, for foundation fabrication and load out; Norfolk, Virginia, or Hope Creek, New Jersey, for WTG pre-assembly and load out; and Port Elizabeth, New Jersey, or Charleston, South Carolina, for cable staging. In addition, the Proposed Action would use a location in Atlantic City, New Jersey, as a construction management base and long-term O&M facility.

As described in Appendix F, Section F.2.13, the State of New Jersey is making substantial investments in a manufacturing facility to build steel components for offshore wind turbines at the Port of Paulsboro and is also developing the New Jersey Wind Port adjacent to the Hope Creek Nuclear Generating Station on the eastern shore of the Delaware River to support the offshore wind industry. Because the State of New Jersey is investing in these ports for the purpose of supporting offshore wind, BOEM expects that these port facilities could see substantial use for Proposed Action construction. Port facilities with high levels of activity related to fabrication, staging, and assembly of WTG components could have moderate impacts on surrounding communities due to disruptions and notable adverse impacts associated with port operations (i.e., due to air emissions, noise, lighting, and vessel and vehicle traffic). However, none of the New Jersey ports proposed for use by the Project are in areas where environmental justice populations have been identified (see Figure 3.12-1), and potential use of ports in Paulsboro, Hope Creek, or Port Elizabeth, New Jersey, would not affect environmental justice populations.

The Port of Virginia in Norfolk, Virginia, and Charleston, South Carolina, are major ports that ranked in the top 50 ports in the United States for total tons of cargo shipped in 2019. The Port of Virginia ranked in the top 10 ports and shipped 61.7 million tons of cargo while Charleston, South Carolina, ranked number 27 and shipped 24.6 million tons of cargo (U.S. Department of Transportation 2021). Ports in Norfolk, Virginia, and Charleston, South Carolina, are in areas where environmental justice populations have been identified and environmental justice populations would be affected by use of vessels, vehicles, and equipment at ports that generate air emissions, noise, light, and vessel and vehicle traffic. Increased port utilization would also have beneficial impacts due to greater economic activity and increased employment at ports. The impact of Proposed Action port utilization cannot be quantitatively evaluated because port usage has not been quantified for each of the ports that could be used during construction or decommissioning of the Proposed Action. However, given the scale of ongoing operations at these ports, BOEM expects that the Proposed Action’s contribution to both adverse and beneficial impacts at ports in Norfolk, Virginia, and Charleston, South Carolina, would be minor.

Ocean Wind proposes to use an O&M facility in Atlantic City, New Jersey, as a construction management base and regional O&M center for multiple Ørsted projects in the mid-Atlantic, including for the Proposed Action. The O&M facility would contain office, warehouse, and workshop space; dockside harbor facilities; and parking facilities. In-water and upland improvements for the O&M facility are being separately reviewed and authorized by USACE and state and local agencies, and analysis of impacts related to the O&M facility in this EIS are limited to use of the O&M facility during construction, O&M, and decommissioning of the Proposed Action. Public fishing access points in proximity to the O&M facility that could be used by subsistence anglers include the Kammerman A.C. Marina, Farley State Marina, Gardiner’s Basin, Brigantine South End Beach & Jetty, and Atlantic City Jetties North and South (NOAA 2022b). BOEM expects that use of the O&M facility would involve activities consistent with working waterfronts in the area (e.g., vessel berthing, crew transfers, vessel loading and unloading) and result in minor impacts that would not disrupt the normal or routine functions of the affected community. These minor impacts would be borne by environmental justice populations present in the Atlantic City area.

Overall, BOEM expects that Proposed Action impacts of port utilization on environmental justice populations would be minor, because port locations in closest proximity to the Lease Area where dedicated facilities to support offshore wind would be located would not affect environmental justice populations. Use of more distant ports in Norfolk, Virginia, and Charleston, South Carolina, would affect environmental justice populations; however, the Proposed Action’s contribution to overall impacts at these major ports would be minor given the high volume of cargo shipped through these ports. Use of the O&M facility in Atlantic City would be typical of working waterfronts and would have minor impacts on environmental justice populations. Therefore, BOEM determined that port utilization would not result in “high and adverse” impacts for environmental justice populations. Furthermore, BOEM concludes that impacts related to port utilization would not disproportionately affect environmental justice populations because the New Jersey ports likely to see the most activity during construction and decommissioning are not in areas with environmental justice populations. Given these findings, BOEM has determined that port utilization would not result in disproportionately high and adverse effects on environmental justice populations.

Presence of structures: The Proposed Action's establishment of offshore structures, including up to 98 WTGs, three OSS, and hardcover for cables, would result in both adverse and beneficial impacts on marine businesses supporting commercial and for-hire recreational fishing. Beneficial impacts would be generated by the reef effect of offshore structures, providing additional opportunity for tour boats and for-hire recreational fishing businesses. Adverse impacts would result from navigational complexity within the Wind Farm Area, disturbance of customary routes and fishing locations, and the presence of scour protection and cable hardcover, leading to possible equipment loss and limiting certain commercial fishing methods.

As discussed in Section 3.9, BOEM anticipates that the adverse impacts of the Proposed Action on commercial fisheries and for-hire recreational fishing would vary by fishery and fishing operation due to differences in target species abundance in the Offshore Project area, gear type, and predominant location of fishing activity. It is possible that some of the small number of fishing operations that derive a large percentage of their total revenue from areas where Project facilities would be located would choose to avoid these areas once the facilities become operational. In the event that these specific fishing operations are unable to find suitable alternative fishing locations, they could experience long-term, major disruptions. However, it is estimated that the majority of fishing vessels would adjust somewhat to account for disruptions due to impacts associated with the presence of structures. In addition, the impacts of the Proposed Action could include long-term, minor beneficial impacts for some for-hire recreational fishing operations due to the artificial reef effect. Therefore, BOEM expects that impacts of the Proposed Action on commercial fishing and for-hire recreational fishing would range from negligible to major, depending on the fishery and fishing operation.

Impacts of the Proposed Action on commercial fishing and for-hire recreational fishing would have a greater impact on communities that have a high level of commercial or recreational fishing engagement or reliance. As shown on Figure 3.12-4, Atlantic City and Cape May have a high level of commercial fishing engagement and Cape May also has a high level of commercial fishing reliance. Both Atlantic City and Cape May are also determined to have environmental justice populations (see Figure 3.12-1), while other affected communities in the geographic analysis area generally have lower levels of commercial fishing engagement and reliance and are also not identified as environmental justice populations. Therefore, BOEM has determined that commercial fishing impacts on environmental justice populations in Atlantic City and Cape May would be disproportionate. Impacts of the Proposed Action on commercial fishing landings and secondary impacts for employment at onshore seafood processors and distributors would vary depending on the specific fisheries and fishing operations affected by the presence of structures in the Offshore Project area. Because onshore seafood processors and distributors process catch from a broad geographic area and because the impact on specific fishing operations would vary and would not be industry-wide, BOEM expects that secondary impacts for employment on fishing vessels and at onshore seafood processing and distribution facilities would be moderate overall and would not be "high and adverse."

Many coastal communities along the New Jersey shore have a high level of recreational fishing engagement (Figure 3.12-4) and most of these communities do not contain an environmental justice population (Figure 3.12-1). Impacts on for-hire recreational fishing are also not "high and adverse," as impacts of the Proposed Action could include long-term, minor adverse and minor beneficial impacts for some for-hire recreational fishing operations due to space-use conflicts and the artificial reef effect, respectively. Therefore, BOEM has determined that impacts of the Proposed Action on for-hire recreational fishing would not be disproportionately "high and adverse" for environmental justice populations.

Based on analysis in Section 3.20, Proposed Action WTGs would have negligible to major impacts on viewer experience within the geographic analysis area. Views of WTGs would be sustained from many coastal communities along the New Jersey shore and would not disproportionately affect environmental justice populations. Therefore, BOEM has determined that impacts of the Proposed Action on viewer experience would not be disproportionately "high and adverse" for environmental justice populations.

3.12.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities.

Air emissions: As noted in Appendix F, other offshore wind projects using ports within the geographic analysis area would overlap with the Project's operations phase, and short-term air quality impacts during the construction phase would be likely to vary from minor to moderate levels. The impacts at specific ports close to environmental justice populations cannot be evaluated because port usage has not been identified; however, most air emissions would occur at offshore locations rather than at the ports. Generation of offshore wind energy within offshore wind lease areas for future offshore wind projects would result in greater potential displacement of fossil fuel power generation than the Proposed Action alone. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the combined air quality impacts on environmental justice populations from ongoing and planned activities including future offshore wind would likely be negligible to minor, due to short-term emissions near ports during construction and decommissioning, or at the O&M facility during operations. The proposed Project could also have beneficial effects for environmental justice populations, due to long-term reduction in air emissions from fossil fuel power generation.

Cable emplacement and maintenance: The incremental impacts contributed by the Proposed Action to the combined offshore cable emplacement impacts on environmental justice populations from ongoing and planned activities including future offshore wind would likely be short term and minor, resulting from the impact on subsistence fishing and reduced employment and income of workers employed in industries supporting commercial fishing. Because impacts of Proposed Action cable emplacement on environmental justice populations would be short term and minor, BOEM has determined that impacts of this IPF on environmental justice populations would not be "high and adverse" for the purpose of the environmental justice analysis.

Noise: Ongoing activities and future non-offshore wind activities would occasionally generate additional pile-driving noise near ports and marinas, some of which may be near environmental justice populations. Future offshore wind activities would have similar contributions as the Proposed Action over a wider area and longer time period. The increased impacts would affect commercial and for-hire recreational fishing and supporting marine businesses, resulting in impacts on employment and income (Sections 3.9, 3.11, and 3.18). The incremental impacts contributed by the Proposed Action to the combined pile driving impacts on environmental justice populations from ongoing and planned activities including future offshore wind would be negligible to minor, based on the assessment of potential impacts of pile driving on boating, fisheries, and supporting marine businesses. Because impacts of Proposed Action noise on environmental justice populations would be negligible to minor, BOEM has determined that impacts of this IPF on environmental justice populations would not be "high and adverse" for the purpose of the environmental justice analysis.

Presence of structures: The Proposed Action in combination with other offshore wind energy projects would result in a greater number of offshore structures affecting larger offshore areas. The Proposed Action would contribute a noticeable increment to the combined impacts on environmental justice populations from ongoing and planned activities, which are anticipated to range from minor to moderate adverse to minor beneficial.

3.12.5.3. Conclusions

Impacts of the Proposed Action. During construction and operation of the Proposed Action, impacts on commercial fishing from IPFs including the presence of structures, cable emplacement, and noise would vary depending on the fishery and fishing operation. The long-term presence of structures in the offshore environment and resulting space-use conflict with commercial fishing vessels could have long-term impacts on employment on fishing vessels that utilize the Lease Area and at onshore seafood processing and distribution facilities where commercial fishermen land their catch. Environmental justice populations with a high level of commercial fishing engagement have been identified in Atlantic City and Cape May. BOEM expects that the effect of reduced employment in commercial fishing would be moderate because environmental justice populations would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts. Potentially small and measurable minor beneficial impacts on environmental justice populations could result from port utilization and the resulting employment and economic activity at ports as well as from enhanced opportunities for for-hire recreational fishing due to the artificial reef effect.

Because the populations of Atlantic City and Cape May would be disproportionately affected by adverse impacts on commercial fishing due to the high level of commercial fishing engagement in Atlantic City and Cape May (and lower levels of engagement throughout most of the geographic analysis area), BOEM has determined that commercial fishing impacts on environmental justice populations in Atlantic City and Cape May would be disproportionate. However, because impacts are expected to be moderate, BOEM has determined that impacts would not be “high and adverse” for environmental justice populations. BOEM determined that impacts on for-hire recreational fishing would not be “high and adverse” and would also not disproportionately affect environmental justice populations due to expected minor impacts and high levels of recreational fishing engagement across the geographic analysis area.

The presence of offshore structures (WTGs and OSS) would have negligible to major impacts on viewer experience within the geographic analysis area; however, high and adverse impacts would not disproportionately affect environmental justice populations because viewer experience would be affected from many locations along the New Jersey shore and would not be concentrated in areas with environmental justice populations. Therefore, BOEM has determined that impacts of the Proposed Action on viewer experience would not be disproportionately “high and adverse” for environmental justice populations.

Overall, BOEM expects that impacts of the Proposed Action on environmental justice populations would be **moderate** because environmental justice populations would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts.

Cumulative Impacts of the Proposed Action. The Proposed Action in combination with other offshore wind energy projects would result in a greater number of offshore structures affecting larger offshore areas, and additional onshore construction and port utilization within the geographic analysis area. The Proposed Action would contribute a noticeable increment to the cumulative impacts on environmental justice populations, which are anticipated to be **moderate** overall.

3.12.6 Impacts of Alternatives B, C, and D on Environmental Justice

Impacts of Alternatives B, C, and D. The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Project under Alternatives B-1, B-2, C-1, C-2, and D would be similar to those described under the Proposed Action. The construction of Alternatives B-1 and B-2 would install fewer WTGs (up to nine fewer WTGs for Alternative B-1; up to 19 fewer WTGs for Alternative B-2) and associated inter-array cables, which would reduce the construction impact footprint for WTGs by approximately 10 to 20 percent. Alternative C-1 would relocate eight WTGs, and Alternative C-2 would compress the WTG array layout. The construction of Alternative D would install up to 15 fewer WTGs and associated inter-array cables to avoid sand ridge and trough features, which would reduce the construction impact footprint for WTGs by approximately 15 percent, with reduced impacts on commercial fishing due to WTG removal from the sand ridge and trough habitat in the northeastern portion of the Lease Area. All other design parameters and potential variability in the design would be the same as under the Proposed Action.

During construction and operations, the impacts on environmental justice populations would range from minor to moderate adverse to minor beneficial. Negligible to minor impacts would result from disruption of marine activities during offshore cable installation and maintenance, from the impacts of noise on commercial and for-hire fishing, and from port utilization. Impacts of Alternatives B-1, B-2, C-1, C-2, and D would result in moderate impacts on environmental justice populations due to the long-term presence of structures in the offshore environment and secondary impacts on employment on fishing vessels or at onshore seafood processing and distribution facilities. Potentially minor beneficial impacts on environmental justice populations would result from port utilization and the resulting employment and economic activity at ports as well as from enhanced opportunities for for-hire recreational fishing due to the artificial reef effect.

Because the populations of Atlantic City and Cape May would be disproportionately affected by adverse impacts on commercial fishing due to the high level of commercial fishing engagement in Atlantic City and Cape May (and lower levels of engagement throughout most of the geographic analysis area), BOEM has determined that commercial fishing impacts on environmental justice populations in Atlantic City and Cape May would be disproportionate. However, because impacts are expected to be moderate, BOEM has determined that impacts would not be “high and adverse” for environmental justice populations. BOEM determined that impacts on for-hire recreational fishing would not be “high and adverse” and would also not disproportionately affect environmental justice populations due to expected minor impacts and high levels of recreational fishing engagement across the geographic analysis area.

The presence of offshore structures (WTGs and OSS) would have negligible to major impacts on viewer experience within the geographic analysis area; however, “high and adverse” impacts would not disproportionately affect environmental justice populations because viewer experience would be affected from many locations along the New Jersey shore and would not be concentrated in areas with environmental justice populations. Therefore, BOEM has determined that impacts of Alternatives B-1, B-2, C-1, C-2, or D on viewer experience would not be disproportionately “high and adverse” for environmental justice populations.

Cumulative Impacts of Alternatives B, C, and D. Alternatives B-1, B-2, C-1, C-2, or D in combination with other offshore wind energy projects would result in a greater number of offshore structures affecting larger offshore areas, and additional onshore construction and port utilization within the geographic analysis area. Alternatives B-1, B-2, C-1, C-2, or D would contribute a noticeable increment to the cumulative impacts on environmental justice populations, which are anticipated to range from minor to moderate adverse to minor beneficial, and would be moderate overall.

3.12.6.1. Conclusions

Impacts of Alternatives B, C, and D. Impacts of Alternatives B-1, B-2, C-1, C-2, and D would be similar to those of the Proposed Action for environmental justice populations and would range from minor to moderate adverse to minor beneficial, and are anticipated to be **moderate** overall. These action alternatives would not result in disproportionately “high and adverse” impacts on environmental justice populations.

Cumulative Impacts of Alternatives B, C, and D. Alternatives B-1, B-2, C-1, C-2, or D in combination with other offshore wind energy projects would result in a greater number of offshore structures affecting larger offshore areas, and additional onshore construction and port utilization within the geographic analysis area. These action alternatives would contribute a noticeable increment to the cumulative impacts on environmental justice populations, which are anticipated to be **moderate** overall.

3.12.7 Impacts of Alternative E on Environmental Justice

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. Under Alternative E, the export cable route on Island Beach State Park would require installation of the export cable along 0.38 mile of Island Beach State Park. The location of additional onshore cable installation would not occur in areas with environmental justice populations. Impacts of cable installation on Island Beach State Park would be localized and short term while the cables are being installed and BOEM does not anticipate impacts to be materially different than those described under the Proposed Action. The impacts of Alternative E would be the same as those of the Proposed Action for environmental justice populations. Impacts would range from minor to moderate adverse to minor beneficial for individual IPFs, and would be moderate overall.

Cumulative Impacts of Alternative E. The cumulative impact of Alternative E would be the same as described for the Proposed Action. Alternative E would contribute a noticeable increment to the cumulative impacts on environmental justice populations, which are anticipated to range from minor to moderate adverse to minor beneficial, and would be moderate.

3.12.7.1. Conclusions

Impacts of Alternative E. Impacts of Alternative E would be the same as those of the Proposed Action for environmental justice populations and would range from minor to moderate adverse to minor beneficial and are anticipated to be **moderate** overall. Alternative E would not result in disproportionately "high and adverse" impacts on environmental justice populations.

Cumulative Impacts of Alternative E. Alternative E would contribute a noticeable increment to the cumulative impacts on environmental justice populations, which are anticipated to be **moderate** overall.

3.12.8 Proposed Mitigation Measures

No additional measures to mitigate impacts on environmental justice have been proposed for analysis.

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3.13. Finfish, Invertebrates, and Essential Fish Habitat

This section discusses potential impacts on finfish, invertebrates, and EFH from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area, as shown on Figure 3.13-1, includes the Northeast Continental Shelf Large Marine Ecosystem (LME),[1] which extends from the southern edge of the Scotian Shelf (in the Gulf of Maine) to Cape Hatteras, North Carolina, is likely to capture the majority of movement ranges for most invertebrates and finfish species. The entirety of the geographic analysis area includes only U.S. waters. Due to the size of the geographic analysis area, the analysis in this EIS focuses on finfish and invertebrates that would be likely to occur in the Project area and be affected by Project activities.

EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 USC 1802(10)). This section provides a qualitative assessment of the impacts of each alternative on finfish, invertebrates, and EFH, which has been designated under the MSA as “essential” for the conservation and promotion of specific fish and invertebrate species. More detailed information regarding the status of all species with EFH in the Project area and impacts on species listed under the ESA, as well as on EFH, can be found in the EFH Assessment (BOEM 2022a) and the BA (BOEM 2022b). A discussion of benthic species is provided in Section 3.6, *Benthic Resources*, and a discussion of commercial fisheries and for-hire recreational fishing is provided in Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*.

3.13.1 Description of the Affected Environment for Finfish, Invertebrates, and Essential Fish Habitat

Finfish

The geographic analysis area was selected based on the likelihood of capturing the majority of movement range for most finfish species that would be expected to pass through the Project area. This area is large and has very diverse and abundant fish assemblages that can be generally categorized based on life history and preferred habitat associations (e.g., pelagic, demersal, resident, and highly migratory species). Benthic habitats within the Project area are characterized in Section 3.6, *Benthic Resources*. In general, the Project area is relatively flat with ridge and trough features that are found throughout the mid-Atlantic OCS. Sand waves are also present as small-scale microhabitats formed by prevailing currents and winds that are generally mobile slopes of sediment on the seabed (NYSERDA 2019). Sand waves documented in the Wind Farm Area have wavelengths of up to 1,640 feet (500 meters) and heights up to 4.9 feet (1.5 meters).

[1] LMEs are delineated based on ecological criteria including bathymetry, hydrography, productivity, and trophic relationships among populations of marine species, and NOAA uses them as the basis for ecosystem-based management.

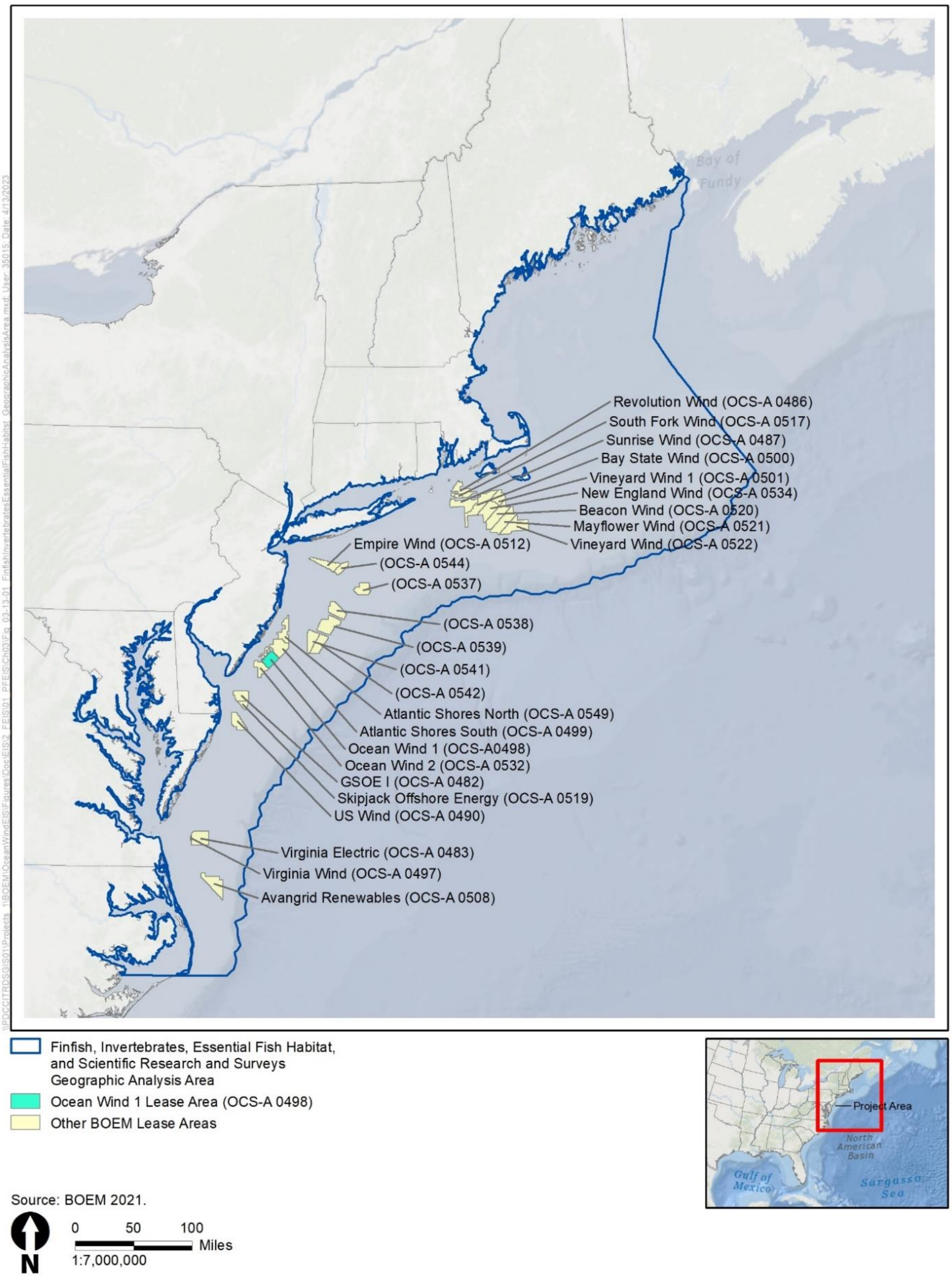

Figure 3.13-1 Finfish, Invertebrates, Essential Fish Habitat, and Scientific Research and Surveys Geographic Analysis Area

Sand ridges and troughs are closely oriented in a northeast-southwest direction, although side slopes are typically less than 1 degree (Guida et al. 2017). Ridge and trough habitat features are common in the Mid-Atlantic OCS and not unique to the Project area (Pickens et al. 2020). Sand ridge and trough features provide macroscale habitats for finfish and macro-invertebrates on the inner continental shelf of the U.S. Mid-Atlantic region and the Gulf of Mexico. These habitat complexes are described as transition zones that may enhance biological productivity and concentrate organisms at several trophic levels and are a link between the invertebrate community and the demersal fish assemblage (Byrnes et al. 2000). At a regional level, previous studies of the Mid-Atlantic Bight have found that ridge crests may be 5 meters or more higher than troughs (Byrnes et al. 2000), resulting in higher wave-generated currents and a graded substrate where much of the silt and clay have been removed, leaving a coarser substrate on the crests (when compared with the troughs). A 2022 survey (Inspire 2022a) of the ridge and trough habitats in the northeastern portion of the Lease Area indicated physical and biological differences between the crests (ridges) and troughs of these habitats that differed from the results of the previous regional study by Byrnes et al. (2000). The 2022 study found that in general, ridge crests were more homogeneous than troughs, and the sediments on the crests were primarily fine to medium sands compared with troughs that exhibited greater variation in sediments, ranging from very fine sand to sandy gravel. Sands with shells (shelly sand) were also found along the troughs.

Differences in benthic invertebrate assemblages in troughs, likely driven by differences in sediment characteristics, have been observed that include increased diversity and biomass within troughs (Rutecki et al. 2014). This may subsequently influence distribution of fish, as found by Vasslides and Able (2008) and Slacum et al. (2010), where within the large ridge and trough shoal complexes of the Mid-Atlantic Bight, there were greater fish abundance and diversity in the troughs than on the ridges. Similarly, species abundance on ridge tops was significantly lower than in areas on either side of the ridge in the southern New Jersey shoal complex (Vasslides 2007). Cutter and Diaz (2000) determined that troughs adjacent to shoals in the Mid-Atlantic Bight contained higher densities of benthic invertebrates than the shoals themselves, which likely provides greater availability of benthic forage and may be the primary reason for increased fish abundance and diversity in these habitats. Several artificial reefs are documented in the Project area. As shown on Figure 3.6-2 in Section 3.6, *Benthic Resources*, four artificial reef areas are mapped offshore, adjacent to the Oyster Creek offshore export cable corridor, and one is mapped offshore adjacent to the BL England offshore export cable corridor (COP Volume II, Section 2.2.3.1.5; Ocean Wind 2023).

Various inshore habitat types are crossed by the proposed Oyster Creek export cable, including shoals, intertidal, subtidal flats, and SAV. Intertidal and subtidal flats serve as important habitat to a diverse assemblage of infaunal and epifaunal organisms and also serve as a protective barrier against erosional impacts; additionally, intertidal and subtidal flats when submerged serve as critical grazing and predation habitat for finfish (Savarese n.d.). SAV is a highly productive habitat that is important to inshore fish production and acts as important nursery habitat for many fish species. Growth of SAV is limited by water depth/light penetration and wave/current energy (Long Island Sound Study 2003) and SAV is limited to the nearshore areas of Barnegat Bay, a back-bay estuary, and Peck Bay. Additional discussion of previously conducted studies related to SAV presence and density along the proposed export cable is provided in the EFH Assessment (BOEM 2022a) and COP Volume II, Appendix E (Ocean Wind 2023).

BOEM has funded several surveys of finfish species occurrence in the northeast WEAs, which are summarized by Guida et al. (2017). The Mid-Atlantic Bight region is identified as one of the most productive fishing areas along the East Coast of the United States, largely due to the diversity and density of finfish that occur in the region (NJDEP 2010). In this region, fish distribution is largely influenced by seasonal temperature fluctuation (NJDEP 2010). Furthermore, many recreationally and commercially important fishes thrive in the region due to coastal ecosystems such as estuaries, with features such as intertidal mudflats, salt marshes, and seagrass beds that provide nursery habitat for many of these species (NJDEP 2010).

A number of state- and federally managed fishes found within the geographic analysis area and potentially within the Project area include the following finfish species: American eel (*Anguilla rostrata*), Atlantic croaker (*Micropogonias undulatus*), Atlantic herring (*Clupea harengus*), Atlantic menhaden (*Brevoortia tyrannus*), Atlantic striped bass (*Morone saxatilis*), Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*), black drum (*Pogonias cromis*), black sea bass (*Centropristis striata*), bluefish (*Pomatomus saltatrix*), cobia (*Rachycentron canadum*), scup (*Stenotomus chrysops*), shad (American shad [*Alosa sapidissima*] and hickory shad [*Alosa mediocris*]) and river herring (alewife [*Alosa pseudoharengus*] and blueback herring [*Alosa aestivalis*]), Spanish mackerel (*Scomberomorus maculatus*), monkfish (*Lophius* spp.), spiny dogfish (*Squalus acanthias*), spot (*Leiostomus xanthurus*), summer flounder (*Paralichthys dentatus*), tautog (*Tautoga onitis*), weakfish (*Cynoscion regalis*), winter flounder (*Pseudopleuronectes americanus*), and coastal shark species. The Project area is also host to important forage species such as sand lance (*Ammodytes* spp.), which have been found to be prey species to at least 45 species of fish in the northwest Atlantic Ocean (Staudinger et al. 2020). The Project area includes a portion of Barnegat Bay, an Estuary of National Importance under the National Estuary Program,[2] which is a regionally important estuary providing unique and diverse habitats, especially for early life stage development and survival. A recent study investigating the fish community and potential impacts from rapid urbanization around Barnegat Bay found 69 fish species within the bay throughout the spring, summer, and fall over a period of 3 years (Valenti et al. 2017). Moreover, this study determined that urbanization did not appear to be affecting fish populations; however, annual variation in recruitment and biotic factors could have cumulative impacts, masking the potential impacts of urbanization around Barnegat Bay (Valenti et al. 2017).

The outlook for finfish species throughout the geographic analysis area includes presumed increased anthropogenic pressure as human population size along the northeastern seaboard increases (Ecosystem Assessment Program 2012). Based on a 2021 MAFMC stock assessment document, most fishery stocks for the region are not overfished and ecosystem biomass trends are stable (NOAA 2021). However, ASMFC's most recent stock reports (those available) indicate that 13 of the total 26 species managed by ASMFC are currently overfished (ASMFC 2022). Species-selective harvesting has led to shifts in fish community composition, with dominant populations comprising small pelagic fish, skates, and small sharks, which are of relatively low economic value (NOAA 2009). To establish a general baseline of population conditions, the following discussion relates to fishery stocks for finfish species either known or considered likely to occur within the Project area; this is not an exhaustive list but is meant to provide context related to current fishery stocks. It is important to note that the population analysis is specific to the NEFMC management area, which extends to the Gulf of Maine, Georges Bank, and southern New England. The following species are identified as having populations above target population levels: monkfish, haddock, Atlantic pollock, Acadian redfish, red hake, and silver hake. Species identified as having populations either below or significantly below target population levels include Atlantic herring, Atlantic spiny dogfish, Atlantic cod, winter flounder, yellowtail flounder, Atlantic halibut, and white hake (NEFMC 2021).

Invasive species are those organisms introduced to new habitats from various vectors that produce harmful impacts on the natural marine ecosystem. While there have been no studies in offshore waters encompassing the geographic analysis area, invasive species are known to inhabit nearshore waters in this region and include species such as green crab, Asian shore crab, Chinese mitten crab, common periwinkle (*Littorina littorea*), and lionfish. In addition to these inshore or nearshore invasive species, there are few

[2] The National Estuary Program is a non-regulatory program established by Congress and authorized by Section 320 of the CWA in 1987.

instances of invasive offshore species; one of the most successful offshore invasive species is the colonial tunicate, *Didemnum* sp., which is not among the most dominant species in estuarine and coastal waters of the New England states (Pederson et al. 2005).

Warming of coastal and shelf waters is resulting in a northward shift in the distributions of some fish species that prefer cooler waters; based on future increases in surface water temperatures, it is expected that this trend would continue (Morley et al. 2018; Ecosystem Assessment Program 2012). Fish species managed by the NMFS Southeast Regional Office that may experience a northward shift toward the Project area and could ultimately be affected by the Project during operation and decommissioning include mahi mahi (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri*), black sea bass, and Spanish mackerel (*Scomberomorus maculatus*). Trends of fish populations shifting toward the northeast and generally into deeper waters alter both species interactions and fishery interactions (Hare et al. 2016; NOAA 2021). Recent habitat climate vulnerability analyses link black sea bass, scup, and summer flounder to several highly vulnerable nearshore habitats including estuarine systems, suggesting that populations are facing additional pressures that could lead to further population decline (Hare et al. 2016; NOAA 2021). Multiple drivers interact with each fish species differently; however, underlying climate change is likely linked to these changes. Most notably, fishes such as striped bass and flounder species may be affected due to increased predation levels at early life stages, where warmer average winters may be affected fishery resources during critical life stages. Striped bass surveys suggest that recruitment success has decreased dramatically relative to the long-term average. Low recruitment could be caused by a mismatch in striped bass larval and prey abundance as a result of warm winter conditions, leading to decreased larval survival rates (NOAA 2021). Moreover, warm winters trigger early phytoplankton and zooplankton blooms, including key prey species for juvenile striped bass (NOAA 2021).

Many species of finfish belonging to pelagic, demersal, shark, resident, or highly migratory assemblages occur in the geographic analysis area, suggesting that these species could potentially occur within or pass through the Project area. Moreover, several species with potential to occur within the Project area have designated EFH either within or in the vicinity of the Project area (see BOEM 2022a). In addition to those species with designated EFH, several species of commercial and recreational importance would be expected to occur within the geographic analysis area and Project area, including but not limited to striped bass, which are discussed in further detail in Section I.2 of Appendix I.

Pelagic finfish species are generally schooling fish that occupy the surface to midwater depths (0 to 3,281 feet [0 to 1,000 meters]) from the shoreline to the continental shelf and beyond as juveniles and adults. Some species are highly migratory and may be present in the near-coastal and shelf surface waters of the Mid-Atlantic Bight in the summer, taking advantage of the abundant prey in the warm surface waters. Demersal fishes spend their adult life on or close to the ocean bottom. Common species of this assemblage include skates, summer flounder, and black sea bass. Highly migratory finfish species travel long distances and often cross domestic and international boundaries. Table 2.2.6-1 of the COP Volume II provides a summary of finfish species that could occur within the Project area and would therefore occur within the greater geographic analysis area (Ocean Wind 2023).

Finfish species are characterized as estuarine, marine, or anadromous species. Estuarine species generally reside in nearshore areas where waters have lower salinity levels than ocean waters (e.g., where rivers meet the ocean) and include species such as white perch (*Morone americana*) and juvenile bluefish (*Pomatomus saltatrix*). Marine finfish species are found offshore in deeper waters and utilize the open water column; examples of marine finfish include Atlantic menhaden (*Brevoortia tyrannus*) and Atlantic herring (*Clupea harengus*). Anadromous fish species prefer both nearshore and offshore waters but annually migrate up rivers to lower-salinity environments for spawning. Juvenile anadromous species leave coastal rivers and estuaries to enter the ocean, where they grow to sexual maturity prior to returning to freshwater environments for spawning. Several species of anadromous fish are present in the geographic analysis area and thus could occur in the Project area, including American shad, alewife, and striped bass. In addition to estuarine, marine, and anadromous fish species, less common are the catadromous species, which are fish species that behave in the opposite fashion of anadromous fish, where adults migrate from freshwater to spawn in the sea, such as the American eel (*Anguilla rostrata*), which are known to occur in riverine systems throughout New Jersey and make their way to the Atlantic Ocean to spawn (Able et al. 2015).

The only ESA-listed fish species considered for analysis in the BA (BOEM 2022b) for the Ocean Wind 1 Project is the federally listed as endangered Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). There are five distinct population segments (DPS) of Atlantic sturgeon present or likely to be present in the geographic analysis area. Four ESA-listed fish species that may occur in the Project area but eliminated from analysis due to their unlikely presence in the Project area and corresponding unlikely potential for adverse impacts were the endangered Gulf of Maine DPS of Atlantic salmon (*Salmo salar*), threatened giant manta ray (*Manta birostris*), threatened oceanic whitetip shark (*Carcharhinus longimanus*), and endangered shortnose sturgeon (*Acipenser brevirostrum*). Each of these species and rationale for elimination from further analysis are provided in the NMFS BA (BOEM 2022b). The findings presented in the BA for the Atlantic sturgeon are summarized here.

The Atlantic sturgeon has suffered significant population declines across its range as a result of historical overfishing and degradation of freshwater and estuarine habitats by human development (ASSRT 2007). Bycatch mortality, water quality degradation, and dredging activities remain persistent threats. Some populations are affected by unique stressors, such as habitat impediments and apparent ship strikes (ASSRT 2007). Critical habitat has been designated for the New York Bight DPS in the Delaware River that begins where the main stem of the river discharges into Delaware Bay at approximately river mile 48.5 (river kilometer 78) and stretches upriver to the Trenton-Morrisville Route 1 Toll Bridge at approximately river mile 132.5 (river kilometer 213.5) (NMFS 2021a).

Historical levels of abundance within the New York Bight DPS of Atlantic sturgeon sharply declined by the early 1900s as a result of a sharp increase in harvest. Based on harvest from 1880–1901, estimated 180,000 adult females were supported by the Delaware River prior to 1890. All DPSs of Atlantic sturgeon are considered depleted relative to historical levels, although all DPSs have demonstrated qualitative signs of improving populations such as increased presence of Atlantic sturgeon, including in rivers where species interactions had not been reported in recent years, and the discovery of spawning in rivers where it had not been previously documented (ASSRT 2007). The estimate of the 2014 Hudson River Atlantic sturgeon spawning run was 450 individuals; the annual run estimate of Atlantic sturgeon, accounting for skipped spawning, was found to be similar to the total adult population (873) (Kahnle et al. 2007) for the last decade of the commercial fishery.

More recently, however, the estimated number of adults in the Delaware River was believed to have declined to fewer than 300 individuals in 2007 (ASSRT 2007). Based on 1880–1901 harvest rates from New York, abundance was estimated at 6,000 spawning females in the Hudson River. The Atlantic Sturgeon Status Review Team (2007) estimated an abundance (using fishery-dependent data [1985–1995 for females and 1968–1995 for males] and sex-specific exploitation) of approximately 863 spawning adults in the Hudson River (267 mature females and 596 mature males). The Atlantic Sturgeon Status Review Team review reported that more recent estimates of recruitment have focused on river-specific (i.e., natal) populations to examine how populations have responded to the significant decline in biomass associated with directed harvest, bycatch, and habitat degradation/loss. Previous population estimates of age-1 Atlantic sturgeon in the Hudson River estimated the 1976 cohort at 25,647 individuals and 4,314 individuals in 1995, suggesting decline in recruitment. The Atlantic Sturgeon Status Review Team reported on several study estimates, including estimating the abundance of Delaware River age 0–1 Atlantic sturgeon at 3,656 individuals in 2014, which is similar in magnitude to the age-1 estimates in the Hudson River in 1995.

Invertebrates

Invertebrate resources assessed in this section include the planktonic zooplankton community and megafauna species that have benthic, demersal, or planktonic life stages. Macrofaunal and meiofaunal invertebrates associated with benthic resources are assessed in Section 3.6. The description of invertebrate resources is supported by studies conducted by Ocean Wind as well as other studies reviewed in the literature listed in Section I.3 of Appendix I. Benthic invertebrates within the geographic analysis area include polychaetas, crustaceans (e.g., amphipods, crabs, lobsters), mollusks (e.g., gastropods, bivalves), echinoderms (e.g., sand dollars, brittle stars, sea cucumbers), and various other groups (e.g., sea squirts, burrowing anemones) (Guida et al. 2017). Benthic invertebrates are commonly characterized by size (i.e., megafauna, macrofauna, or meiofauna). Macrofaunal and meiofaunal invertebrates associated with benthic resources are assessed in Section 3.6, *Benthic Resources*. In this section, the description of invertebrate resources focuses on the planktonic zooplankton community and megafauna species that have one or more of the following life stages: benthic, demersal, or planktonic.

Zooplankton

Zooplankton are a type of heterotrophic plankton in the marine environment that range from small, microscopic organisms to large species, such as jellyfish. These invertebrates play an important role in marine food webs and include both organisms that spend their whole life cycles in the water column and those that spend only certain life stages (larvae) in the water column (meroplankton). In the marine environment, zooplankton dispersion patterns vary on a large spatial scale (from meters to thousands of kilometers) and over time (hours to years). Zooplankton exhibit diel vertical migrations up to hundreds of meters; however, horizontal largescale distributions over large distances are dependent on ocean currents and the suitability of prevailing hydrographic regimes. Historical information is available for zooplankton in the vicinity of the offshore Project area, along with information from ongoing data collection surveys (e.g., the NEFSC Ecosystem Monitoring program surveys of the OCS and slope of the northeastern United States, i.e., the Mid-Atlantic Bight, Southern New England, Georges Bank, and the Gulf of Maine).

In the vicinity of the Offshore Project area, the zooplankton community tends to be dominated by copepods (NJDEP 2010). Zooplankton productivity, spatial distribution, and species composition are regulated by seasonal water changes off the New Jersey coast. Strong seasonal patterns with increased zooplankton biomass are observed in spring within the upper few hundred meters of the water column (NJDEP 2010). Maximum abundance tends to occur between April and May on the OCS and in August and September on the inner shelf. The lowest zooplankton densities occur in February (NJDEP 2010). Thermal stratification is seasonal, and when it breaks down, nutrients are released to the surface waters, driving seasonal patterns. High productivity is typical of the Northeast Continental Shelf LME, but productivity varies both spatially and seasonally. Large seasonal changes in water temperature occur in the Project area due to the influence of the Gulf Stream and ocean circulation patterns, which strongly regulate the productivity, species composition, and spatial distribution of zooplankton (NJDEP 2010). In 2021, for example, increasing zooplankton diversity in the Mid-Atlantic Bight was attributed to the declining dominance of a calanoid copepod (*C. typicus*), while the zooplankton community maintained a similar composition of other species (NOAA 2021). The temporal and spatial patterns of *Calanus* copepods (zooplankton) have been linked to the phases of the North Atlantic Oscillation, which has a direct effect on the position and strength of important North Atlantic Ocean currents (Fromentin and Planque 1996; Taylor and Stephens 1998). Shifts in copepod patterns can influence reproduction in marine mammals that depend on these zooplankton as a food resource (Greene et al. 2010).

A recent 3-year study of zooplankton in Barnegat Bay to characterize the zooplankton community found that the abundance and diversity of the estuarine zooplankton community was subject to spatial, seasonal, and interannual trends (Howson et al. 2017). The study concluded that bay zooplankton abundance can be sensitive to direct and indirect effects of weather and climate, such that climate change has the potential to result in long-term shifts in the zooplankton community. Changes in the nutrient status in areas of Barnegat Bay and habitat alteration have also resulted in an increase in gelatinous zooplankton and the development of resident populations of the Atlantic sea nettle (*Chrysaora quinquecirrha*) in the bay (Bologna et al. 2017), which can influence zooplankton communities.

Megafaunal Invertebrates Associated with Soft and Hard Substrates

Some megafaunal invertebrates found in the geographic analysis area are migratory (e.g., American lobster, Jonah crab, longfin inshore squid, and northern shortfin squid [*Illex illecebrosus*]), while others are sessile or have more limited mobility, meaning they would be expected to reside in the Project area (e.g., Atlantic scallop [*Placopecten magellanicus*], Atlantic surfclam [*Spisula solidissima*], ocean quahog [*Arctica islandica*], some crab species) (Section I.3 of Appendix I). Atlantic sea scallop, Atlantic surfclam, and ocean quahog were identified as shellfish species of concern for the New Jersey WEA by Guida et al. (2017). NEFSC seasonal trawl survey catches within the New Jersey WEA between 2003 and 2016 found that longfin squid were one of the dominant species in the warmer seasons along with some finfish species. In the colder seasons, finfish species were dominant (Guida et al. 2017). Notable seasonal temperature changes within the Northeast Continental Shelf LME influence the distribution and movement of invertebrates with latitudinal (north-south) seasonal migrations and longitudinal (inshore-offshore) seasonal migrations (NJDEP 2010). Resident species often exhibit adaptations to the changing environment within the New Jersey Continental Shelf and the Northeast Continental Shelf LMEs.

Highly mobile invertebrates with broad habitat requirements have more flexibility to respond to disturbance and anthropogenic impacts compared to other invertebrates that are more sensitive because they have limited mobility or require specific habitats during one or more life stages. This category includes commercially valuable shellfish species with limited mobility as juveniles and adults: Atlantic sea scallops, Atlantic surfclams, and ocean quahogs. Economically and ecologically important species associated with soft sediments in the vicinity of the Lease Area include Atlantic sea scallop, bay scallop (*Argopecten irradians*), horseshoe crab (*Limulus polyphemus*), Atlantic surfclam, squid, and ocean quahog. Sea scallops are widespread in the New Jersey WEA but were trawled up in small numbers in surveys summarized in Guida et al. (2017) and were not found to be abundant.

Other soft-sediment invertebrates include decapod crab species, sand dollars, starfish, and sea urchins. The majority of the Lease Area comprises soft-sediment habitats; however, hard substrates may also occur (NJDEP 2010). Hard substrates provide important nursery habitat for juvenile lobster and areas where squid species can attach egg masses, called mops (NJDEP 2010). Both squid and American lobster (*Homarus americanus*) are of economic importance. The commercial importance of other species, such as Jonah crab (*Cancer borealis*), has increased with the decline of the American lobster fishery. Jonah crabs are typically associated with rocky habitats as well as soft sediment, while lobsters prefer hard-bottom habitats.

Ecologically sensitive cobble and boulder habitat that can act as nursery areas for juvenile lobster and is preferable habitat for squid egg deposition was not observed within the Offshore Project area (Inspire 2021). Squid were documented at a few sampling stations within the Lease Area, and squid eggs were found at one offshore export cable corridor station. Live Atlantic surfclams and scallops were found within the Lease Area but were not observed within either export cable route corridor. A lobster was observed at one of the stations surveyed across the offshore Lease Area (Inspire 2021).

Blue crab and hard clam (quahog) (*Mercenaria mercenaria*) are recreationally and commercially harvested species that also have ecological importance in estuarine environments such as Barnegat Bay. Blue crabs are known to use both shallow and deeper habitats within Barnegat Bay, including shallow areas with SAV. Jivoff et al. (2017) found that SAV habitat was important for both adult male and female blue crabs but was particularly important for female crabs. The hard clam population has been in significant decline in the Barnegat Bay—Little Egg Harbor Estuary for decades, such that clams are absent from substantial areas of Little Egg Harbor. Bricelj et al. (2017) found no evidence that eutrophication and hypoxia were directly responsible for the decline and concluded an increase in clam mortality rate due to unknown cause(s) may have been a significant factor. The authors also acknowledged that there was a lack of documentation on historical fishing pressure. In a related study, Fantasia et al. (2017) found that algal food quality appeared to be more important for clam growth than total algal biomass.

General Biological Trends in Primary Invertebrate Species

The most recent trends in primary invertebrate species have been summarized by NOAA (2021, 2022) in the 2021 and 2022 State of the Ecosystem reports for the mid-Atlantic and recent information about individual invertebrate stock assessment is available through Stock SMART data records (www.st.nmfs.noaa.gov/stocksmart). For both information sources, the most recent invertebrate information was typically available for the years 2019, 2020, and 2021 but there was a delay in some analyses due to COVID-19.

- Climate-related stress is increasing, which is expected to affect stock distributions and is a warning sign for the potential for ecosystem-level changes. The mid-Atlantic has incurred more frequent and intense marine heatwaves and a less stable Gulf Stream. The cold pool is becoming warmer and smaller and occurs for a shorter time period, which can affect invertebrate species distributions.
- In general, finfish and invertebrate stocks are changing throughout the Northeast U.S. LME, with a general movement of stocks in a northeasterly direction and into deeper areas.
- Combined landings of surfclam and ocean quahog decreased in 2020, while landings of combined squid species increased. Since 2017 northern shortfin squid has been more available in the mid-Atlantic, with a higher fishery catch per unit effort.
- The analysis by NOAA (2022) concluded that the decline in surfclam and ocean quahog was not likely due to major shifts in feeding guilds, shifts in ecosystem trophic structure, stock status, or management restrictions. NOAA (2022) noted that climate change appears to be affecting distributions of surfclam and ocean quahog because both species are sensitive to warmer temperatures and acidification, although acidification in surfclam summer habitat is approaching (and not at) conditions that could potentially affect clam growth.

The diversity of zooplankton was found to be increasing in 2019 in the Mid-Atlantic Bight, driven by the decreasing dominance of a calanoid species. Krill and large gelatinous zooplankton are increasing over time.

Essential Fish Habitat

The MSA requires federal agencies to consult with NMFS on activities that could adversely affect EFH. NOAA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (NOAA 2004, 2013). NMFS, NEFMC, and MAFMC have defined EFH for various species in the Northeastern United States offshore and nearshore coastal waters. EFH designations have been described based on 10- by 10-foot (3- by 3-meter) squares of latitude and longitude along the coast. The majority of EFH for species occurring in the waters of the New England and Mid-Atlantic OCS and nearshore coastal waters is managed under federal FMPs developed by NEFMC and MAFMC (MAFMC 2020; NEFMC 2021). In addition to these species, several highly migratory species managed through an FMP developed by NMFS (NMFS 2021b) are known or likely to occur in the geographic analysis area.

BOEM has prepared an EFH Assessment for the Project (BOEM 2022a). In summary, EFH has been designated for the following species or management groups that occur in the New England and Mid-Atlantic OCS and nearshore coastal waters (NMFS 2021c):

- Atlantic herring (*Clupea harengus*)
- Bluefish (*Pomatomus saltatrix*)
- Highly migratory species (e.g., tunas [Thunnini], swordfish [*Xiphias gladius*], and sharks [Selachimorpha])
- Mackerel (*Scomber scombrus*), squids (Decapodiformes), and butterfish (*Peprilus triacanthus*)
- Monkfish (*Lophius americanus*)
- Northeast multispecies (large mesh) (e.g., Atlantic cod [*Gadus morhua*], Atlantic pollock [*Pollachius virens*], and windowpane flounder [*Scophthalmus aquosus*])
- Northeast multispecies (small mesh) (e.g., red hake [*Urophycis chuss*] and silver hake [*Merluccius bilinearis*])
- Shellfish, Atlantic sea scallop (*Placopecten magellanicus*), Atlantic surfclam (*Spisula solidissima*), and ocean quahog (*Arctica islandica*)
- Skates (Rajidae)
- Spiny dogfish (*Squalus acanthias*)
- Summer founder (*Paralichthys dentatus*), scup (*Stenotomus chrysops*) and black sea bass (*Centropristis striata*)

NOAA, NEFMC, and MAFMC also identified HAPCs as a component of EFH. HAPCs are high-priority areas for conservation and exhibit one or more of the following characteristics: rare, sensitive, stressed by development, provide important ecological functions for federally managed species, or especially vulnerable to anthropogenic degradation. HAPCs can cover specific localities or cover habitat types that could be found at many locations (NOAA 2004). HAPCs that could be directly affected by Project activities include specific habitat for both juvenile and adult summer flounder. The summer flounder HAPC includes all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes (i.e., SAV) in any size bed, as well as loose aggregations, within currently designated adult and juvenile summer flounder EFH (MAFMC 2016). In New Jersey, sandbar shark HAPC is in the Mullica River estuary (Great Bay/Little Egg Harbor) and in Delaware Bay. The BL England export cable route would pass within 3.9 miles of the southernmost point of the Great Bay/Little Egg Harbor HAPC but would not overlap it.

In addition to SAV being an EFH HAPC, it is also a Special Aquatic Site under the CWA. SAV is an important inshore habitat component for many marine species. Once affected, SAV can be difficult to replace and such efforts are often deemed unsuccessful (Lefcheck et al. 2019). Seagrass loss has been attributed primarily to indirect impacts of anthropogenic activities, including global warming (e.g., seagrass wasting disease), sea-level rise, CO_2 and ultraviolet increase (Duarte 2002), degraded water quality and increased turbidity, shading, altered currents, resuspension of contaminated sediments, contamination from spills and discharges, and altered food webs and competition (Nascimento et al. 2019; Waycott et al. 2022). Therefore, avoidance and minimization of impacts on these habitats are important. SAV is discussed further in Section 3.6, *Benthic Resources*.

Although not yet approved by NOAA, NEFMC approved a new HAPC designation (July 20, 2022) that includes the entire geographic analysis area. The proposed Southern New England HAPC comprises all large-grained complex and complex benthic habitats used by Atlantic herring, Atlantic sea scallop, little skate, monkfish, ocean pout, red hake, silver hake, windowpane flounder, winter flounder, winter skate, and yellowtail flounder, wherever present within the area bounded by a 10-kilometer (6.2-mile) buffer around the Rhode Island/Massachusetts and Massachusetts WEAs (Plante 2022). The designation is intended to protect high-value complex habitats within this area, emphasizing currently known and potentially suitable areas used by Atlantic cod (*Gadus morhua*) for spawning, and is based a recent acoustic survey and other data sources (Bachman and Couture 2022; NEFMC 2022a). The proposed HAPC was considered necessary to provide conservation focus for specific NEFMC-managed species with EFH in the area due to concerns about impacts from offshore development, specifically offshore wind in the near term, and possible offshore aquaculture in the future (NEFMC 2022a). If approved by NOAA, the HAPC would include all areas in Southern New England with complex habitats, defined by NEFMC (2022b) as:

- Hard-bottom substrates, defined by the Coastal and Marine Ecological Classification Standard as Substrate Class Rock Substrate and by the four Substrate Groups: Gravels, Gravel Mixes, Gravelly, and Shell. This Coastal and Marine Ecological Classification Standard modifier was developed by NOAA Fisheries for its habitat mapping recommendations, including both large-grained and small-grained hard habitats.
- Hard-bottom substrates with epifauna or macroalgae cover.
- Vegetated habitats (e.g., SAV and tidal wetlands).

The proposed HAPC designation would apply within EFH designated for the following species and life stages with stock boundaries within the Southern New England area: Atlantic cod juveniles and adults; Atlantic herring eggs; Atlantic sea scallop eggs, juveniles, and adults; little skate juveniles and adults; monkfish juveniles and adults; ocean pout eggs, juveniles, and adults; red hake juveniles and adults; winter flounder eggs, juveniles, and adults; and winter skate juveniles and adults.

In addition to identifying, protecting, and restoring EFH and HAPC, to help maintain productive fisheries and rebuild depleted fish stocks in the United States, NOAA also conducts stock assessments to monitor the condition of federally managed fish stocks and provide the science information necessary for resource managers to sustainably manage commercial and recreational fisheries. Stock assessments for federally managed species potentially affected by the Project can be found on NMFS's Stock Status, Management, Assessment, and Resource Trends website (www.st.nmfs.noaa.gov/stocksmart) and NMFS's NEFSC Stock Assessment Review Index website (NEFSC 2021) and summaries are provided in the EFH Assessment (BOEM 2022a). Fishing regulations ensure that fishery removals are sustainable over the long term.

3.13.2 Environmental Consequences

3.13.2.1. Impact Level Definitions for Finfish, Invertebrates, and Essential Fish Habitat

Definitions of potential impact levels are provided in Table 3.13-1.

Table 3.13-1 Impact Level Definitions for Finfish, Invertebrates, and Essential Fish Habitat

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on species or habitat would be so small as to be unmeasurable.
	Beneficial	Impacts on species or habitat would be beneficial but so small as to be unmeasurable.
Minor	Adverse	Most impacts on species would be avoided; if impacts occur, they may result in the loss of a few individuals. Impacts on sensitive habitats would be avoided; impacts that do occur would be temporary or short term in nature.
	Beneficial	If beneficial impacts occur, they may result in a benefit to some individuals and would be temporary to short term in nature.
Moderate	Adverse	Impacts on species would be unavoidable but would not result in population-level effects. Impacts on habitat may be short term, long term, or permanent and may include impacts on sensitive habitats but would not result in population-level effects on species that rely on them.
	Beneficial	Beneficial impacts on species would not result in population-level effects. Beneficial impacts on habitat may be short term, long term, or permanent but would not result in population-level benefits to species that rely on them.
Major	Adverse	Impacts would affect the viability of the population and would not be fully recoverable. Impacts on habitats would result in population-level impacts on species that rely on them.
	Beneficial	Beneficial impacts would promote the viability of the affected population or increase population resiliency. Beneficial impacts on habitats would result in population-level benefits to species that rely on them.

3.13.3 Impacts of the No Action Alternative on Finfish, Invertebrates, and Essential Fish Habitat

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on finfish, invertebrates, and EFH, BOEM considered the impacts of past and ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for finfish, invertebrates, and EFH. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.13.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for finfish, invertebrates, and EFH described in Section 3.13.1, *Description of the Affected Environment for Finfish, Invertebrates, and Essential Fish Habitat*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing activities within the geographic analysis area that contribute to impacts on finfish, invertebrates, and EFH are generally associated with commercial harvesting and fishing activities, fisheries bycatch, water quality degradation and pollution, effects on benthic habitat dredging and bottom trawling, accidental fuel leaks or spills, and climate change.

The effects of approved projects have been evaluated through previous NEPA review and are incorporated by reference. Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on finfish, invertebrates, and EFH include:

- Continued O&M of the Block Island project (five WTGs) installed in state waters;
- Continued O&M of the Coastal Virginia Offshore Wind project (two WTGs) installed in OCS-A 0497; and
- Ongoing construction of two offshore wind projects, the Vineyard Wind 1 project (62 WTGs and 1 OSS) in OCS-A 0501 and the South Fork project (12 WTGs and 1 OSS) in OCS-A 0517.

Ongoing O&M of the Block Island and Coastal Virginia Offshore Wind projects and ongoing construction of the Vineyard Wind 1 and South Fork projects would affect finfish, invertebrates, and EFH through the primary IPFs of accidental releases, anchoring, EMF, lighting, cable emplacement and maintenance, noise, port utilization, presence of structures, gear utilization, traffic (vessel strikes), and discharges. Ongoing offshore wind activities would have the same type of impacts from accidental releases, anchoring, EMF, lighting, cable emplacement and maintenance, noise, port utilization, presence of structures, gear utilization, traffic (vessel strikes), and discharges that are described in detail in Section 3.13.3.2 for planned offshore wind activities but the impacts would be of lower intensity.

Some mobile invertebrates can migrate long distances and encounter a wide range of stressors over broad geographical scales (e.g., longfin and shortfin squid). Their mobility and broad range of habitat requirements may also mean that limited disturbance may not have measurable effects on their stocks (populations). This would apply to finfish, where populations are composed largely of long-range migratory species; it would be expected that their mobility and broad ranges would preclude many temporary and short-term impacts associated with ongoing offshore impacts throughout the geographic analysis area. Invertebrates with more restricted geographical ranges or sessile invertebrates or life stages can be subject to the above stressors over time and can be more sensitive (Guida et al. 2017).

Seafloor habitat is routinely disturbed through dredging (for navigation, marine minerals extraction, and military purposes) and commercial fishing use of bottom trawls and dredge fishing methods. Abandoned or lost fishing gear remains in the aquatic environment for extended time periods, often entangling or trapping mobile invertebrate and fish species. Based on data from NOAA, bycatch affects many species throughout the geographic analysis area—most notably, windowpane flounder, blueback herring, shark species, and hake species; the majority of bycatch is a result of open area scallop trawls, large-mesh otter trawls, conch pots, and fish traps (NOAA 2019). Water-quality impacts from ongoing onshore and offshore activities affect nearshore habitats, and accidental spills can occur from pipeline or marine shipping. Invasive species can be accidentally released in the discharge of ballast water and bilge water from marine vessels. The resulting impacts on invertebrates and finfish depend on many factors but can be widespread and permanent, especially if the invasive species becomes established and outcompetes native species.

Regulated fishing effort: Fishing activity in the geographic analysis area is considered an ongoing activity that affects finfish and invertebrates through intensity of fishing and, potentially, distribution of finfish and invertebrates. Regulated fishing results in substantial removal of biomass of commercially regulated finfish and invertebrate populations, as well as impacts through bycatch and ghost fishing by abandoned and lost fishing gear. Fish regulations may also limit the removal of resources but would not necessarily eliminate the removal or lead to an increase in fisheries biomass. Changes to the management of commercial fisheries enforced by states, municipalities, or NOAA (depending on jurisdiction) could result in changes to the distribution and intensity of fishing-related impacts on finfish and invertebrate populations. However, the commercial fisheries buffer zone regulations and recreational catch limits are not expected to change or result in any population decline. Fishing regulations are not an IPF associated with the Proposed Action and positive and negative effects are therefore not analyzed here.

Traffic (vessel strikes): The presence of vessels introduces the risk of vessel collision with marine life, and vessel collisions with marine life are an ongoing threat in the geographic analysis area due to vessels from numerous industries such as trade, tourism, resource development, and offshore wind development. Marine species that spend a significant time near the water surface or in areas where vessel routes overlap with migration, feeding, or breeding grounds have the potential to be struck by vessels. Vessel collisions may result in blunt-force and sharp-force trauma, both of which can result in death, but are likely to be underrepresented due to a lack of reporting awareness and because not all struck marine animals are recoverable for documentation. Vessel speed reductions and route restrictions have shown to be effective mitigation measures for reducing the probability of injury and mortality related to vessel collisions. Impacts of vessel collisions can result in injury and mortality and may affect populations in some ESA-listed species.

Noise: In-water noise is transmitted through the water column and seabed would continue to occur as a result of ongoing activities in the geographic analysis area. Noise impacts for offshore wind projects would include short-term stress and behavioral changes as well as injury to and mortality of finfish and invertebrates, primarily in the vicinity of pilings. Sound transmission depends on many environmental parameters, such as the sound speeds in the water and substrates. It also depends on the sound production parameters of a pile and how it is driven, including the pile material, size (length, diameter, and thickness), and make and energy of the hammer (COP Volume III, Appendix R-2; Ocean Wind 2023). Fish response would be highest near impact pile driving (within tens of meters), moderate at intermediate distances (within hundreds of meters), and low far from the pile (within thousands of meters) (COP Volume III, Appendix R-2; Ocean Wind 2023). During active pile-driving activities, highly mobile finfish likely would be displaced from the area, most likely showing a behavioral response; however, fish in the immediate area of pile-driving activities could suffer injury or mortality. Affected areas would likely be recolonized by finfish in the short term following completion of pile-driving activity. Early life stages of finfish, including eggs and larvae, could experience mortality or developmental issues as a result of noise; however, thresholds of exposure for these life stages are not well studied (Weilgart 2018).

UXO interactions: UXO interactions would be expected to continue due to ongoing development of aquaculture, fishing, wind farms, power cables, and oil or gas pipeline development, as well as increasing ship traffic in general, resulting in an overall increase in the potential for interactions with UXO and the associated corrosion of UXO and subsequent release of their constituents to the marine environment and adverse impacts on marine habitats. Therefore, the potential for disturbance, injury, or mortality to fish and loss of habitat would also persist.

Climate change: Global climate change has the potential to affect the distribution and abundance of invertebrates and their food sources, primarily through increased water temperatures but also through changes to ocean currents and increased acidity. The New Jersey shelf has experienced increasingly elevated temperatures in both surface and bottom depths (NOAA 2021). Finfish and invertebrate migration patterns can be influenced by warmer waters, as can the frequency or magnitude of disease (Hare et al. 2016). Regional water temperatures that increasingly exceed the thermal stress threshold may affect the recovery of the American lobster fishery off the East Coast of the United States (Rheuban et al. 2017). Ocean acidification driven by climate change is contributing to reduced growth and, in some cases, decline of invertebrate species with calcareous shells. Increased freshwater input into nearshore estuarine habitats can result in water quality changes and subsequent effects on invertebrate species (Hare et al. 2016).

Based on a recent study, northeastern marine, estuarine, and riverine habitat types were found to be moderately to highly vulnerable to stressors resulting from climate change (Farr et al. 2021). In general, rocky and mud bottom, intertidal, SAC, kelp, coral, and sponge habitats were considered the most vulnerable habitats to climate change in marine ecosystems (Farr et al. 2021). Similarly, estuarine habitats considered most vulnerable to climate change include intertidal mud and rocky bottom, shellfish, kelp, SAV, and native wetland habitats (Farr et al. 2021). Riverine habitats found to be most vulnerable to climate change include native wetland, sandy bottom, water column, and SAV habitats (Farr et al. 2021). As invertebrate habitat, finfish habitat, and EFH may overlap with these habitat types, this study suggests that marine life and habitats could experience dramatic changes and decline over time as impacts from climate change continue.

Table F1-11 in Appendix F provides additional information on finfish, invertebrates, and EFH impacts associated with ongoing activities.

3.13.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with planned activities (without the Proposed Action). Impacts of planned non-offshore wind projects are considered although cumulative impacts are attributable to primarily planned offshore wind projects. Planned non-offshore wind activities within the geographic analysis area that contribute to cumulative impacts on finfish, invertebrates, and EFH include new submarine cables and pipelines, tidal energy projects, marine minerals extraction, dredging, military use, marine transportation, fisheries use and management, global climate change, and oil and gas activities (see Section F.2 in Appendix F for a complete description of planned activities and Table F1-11 for additional information on finfish, invertebrates, and EFH impacts associated with planned activities).

BOEM expects planned offshore wind activities to affect finfish, invertebrates, and EFH through the primary IPFs of accidental releases, anchoring, EMF, lighting, presence of structures, cable emplacement and maintenance, noise, vessel traffic, and discharges.

Accidental releases: Offshore wind energy development could result in the accidental release of contaminants or trash/debris that could affect water quality. The risk of any type of accidental release would increase, primarily during construction but also during operations and decommissioning of offshore wind facilities (Section A.8.2 in Appendix A discusses the nature of releases anticipated). Hazardous materials that could be released include coolant fluids, oils and lubricants, and diesel fuels and other petroleum products. These materials tend to float in seawater, so they are less likely to directly contact the benthic environment; however, zooplankton communities and planktonic stages of invertebrates would be more likely to be exposed. Accidental release of contaminants such as trash and debris can also affect fish and invertebrates. Accidental release in the water column could also affect finfish species through consumption of material and smothering, both of which could result in mortality. Accidental releases could thus potentially result in lethal or sublethal effects, particularly on finfish and invertebrates, especially sensitive life stages such as planktonic larvae. Any accidental releases are expected to be localized and subject to mitigation to minimize environmental impacts. In most cases, the corresponding impacts on benthic habitats are unlikely to be detectable unless there is a catastrophic spill (e.g., an accident involving a tanker ship) or the spill involves heavy fuel oil that would sink to the seabed and persist in the aquatic environment for a longer time period. Compliance with USCG regulations would minimize the risk of accidental release of trash or debris. Therefore, with mitigation measures in place, the total volume of contaminants and trash or debris from accidental releases would be negligible and not measurably contribute to potential adverse impacts in the geographic analysis area.

A wide variety of marine vessels utilize anti-fouling and anti-corrosion paints to protect hulls from biofouling and corrosive processes induced by the marine environment in order to improve vessel longevity. Moreover, subsurface components of WTGs and OSS may also utilize anti-fouling and anti-corrosion coatings to prevent degradation of project components. Potential chemical leaching from anti-fouling and anti-corrosion coatings may cause toxic effects on finfish, invertebrates, and EFH. Increased offshore wind development could increase the potential toxic effect of anti-fouling and anti-corrosion coatings on marine organisms.

Epoxied resins and polyurethane-based coatings are a state-of-the-art technique for corrosion protection in a wide range of marine applications and are an artificial barrier to separate the steel from the corrosive environment (Lyon et al. 2017; Price and Figueira 2017). Organic compounds and Bisphenol A, common components of epoxied resins used in marine applications, were seen to leach from epoxy coatings in a laboratory setting (Bruchet et al. 2014; Rajasärkkä et al. 2016). Copper-based anti-fouling paints are also used in many marine applications and have replaced previous anti-fouling paints such as Tributyltin paints, which were found to have toxic effects on marine organisms (Alzieu et al. 1986; Michel and Averty 1999). Katranitsas et al. 2003 found copper-based anti-fouling paint to be substantially toxic to *Artemia nauplii.* Although the extent of emissions from anti-fouling and anti-corrosion coatings are currently unknown at scales such as the Wind Farm Area and greater WEA, increased usage of such coatings due to future wind generation activities may be a point source of toxic chemicals potentially affecting finfish, invertebrates, and EFH.

The overall impacts of anti-fouling and anti-corrosion paints on finfish, invertebrates, and EFH at the scale of the Wind Farm Area and greater WEA require further evaluation and are difficult to adequately quantify; however, impacts are likely to be negligible, resulting in little change to these resources. As such, anti-fouling and anti-corrosion paints used during offshore wind development processes would not be expected to appreciably contribute to population-level impacts on these resources.

Another potential impact related to vessels and vessel traffic is the accidental release of invasive species, especially during ballast water and bilge water discharges from marine vessels. Increasing vessel traffic related to the offshore wind industry would increase the risk of accidental releases of invasive species, primarily during construction. Vessels are required to adhere to existing state and federal regulations related to ballast and bilge water discharge, including USCG ballast discharge regulations (33 CFR 151.2025) and USEPA National Pollutant Discharge Elimination System Vessel General Permit standards, both of which aim at least in part to prevent the release and movement of invasive species. Adherence to these regulations would reduce the likelihood of discharge of ballast or bilge water contaminated with invasive species. Although the likelihood of invasive species becoming established due to offshore wind activities is low, the impacts of invasive species invertebrates could be strongly adverse, widespread, and permanent if the species were to become established and out-compete native fauna. The increase in this risk related to the offshore wind industry would be small in comparison to the risk from ongoing activities (e.g., trans-oceanic shipping).

The cumulative impacts of accidental releases on finfish, invertebrates, and EFH are likely to be localized and short term, resulting in little change to these resources. As such, accidental releases from offshore wind development would not be expected to appreciably contribute to cumulative impacts on these resources, and impacts would be minor.

Anchoring: There would be increased vessel anchoring during survey activities and during the construction, installation, maintenance, and decommissioning of offshore components associated with planned offshore wind activities. In addition, anchoring/mooring of meteorological towers or buoys could be increased. Anchoring causes temporary disturbance to seafloor, which would be considered temporary, short-term impacts that occur regularly throughout the geographic analysis area. These activities would increase turbidity and could result in direct mortality of benthic, finfish, and invertebrate resources or degradation of sensitive hard-bottom habitats, including EFH. Anchoring would cause increased turbidity levels and would have the potential for physical contact to cause lethal or sublethal effects on invertebrates. Planned offshore wind projects could disturb up to 3,057 acres (12.4 km^2) of seafloor habitat, increasing turbidity and potentially disturbing, displacing, or injuring benthic habitat, finfish, and invertebrates. This disturbance would be localized and temporary, representing considerably less than 1 percent of the total available benthic habitat within the geographic analysis area. Potential impacts would be minimized by the implementation of mitigation measures. For finfish specifically, it is unlikely that adult fish would be directly affected by anchoring and impacts would be negligible. However, less-mobile life stages such as eggs and larvae could experience direct mortality or smothering from turbidity with impacts occurring at a local, small scale, not at population or species level, and they would be temporary, minor, and localized. It would be expected that recovery of any affected species would occur in the short term, although degradation of sensitive habitats could persist in the long term.

Physical seabed disturbance due to anchoring would generally result in localized and temporary impacts on invertebrate resources, with recovery in the short term, with the exception of sensitive inshore habitats such as areas where SAV is present. Anchoring in SAV could cause loss of sensitive habitat, resulting in long-term impacts. Studies related to the impacts of recreational boating in the Mediterranean Sea indicate that anchoring (and chains associated with anchors) was the largest human-related impact affecting sensitive habitats, which include seagrass meadows (Carreno and Lloret 2021). Mobile invertebrates would be temporarily displaced, whereas sessile and slow-moving invertebrates could be subject to localized lethal and sublethal impacts. Demersal eggs and larvae would be particularly vulnerable to sediment disturbance and resettlement. High rates of mortality can occur in longfin squid egg masses if exposed to abrasion.

Impacts would be expected to be localized, turbidity would be temporary, and mortality of sessile invertebrate and life stages from contact would be recovered in the short term. Degradation of sensitive habitats, such as eelgrass beds and hard-bottom habitats, if it occurs, could be long term to permanent. The cumulative impacts of anchoring on finfish, invertebrates, and EFH are likely to be minor, localized, and short term.

EMF: The marine environment continuously generates a variable ambient EMF. Additional EMF would also emanate from new offshore export cables and inter-array cables constructed for offshore wind projects. Up to 10,953 miles (17,627 kilometers) of cable would be added in the geographic analysis area from planned offshore wind activities, producing EMF in the immediate vicinity of each cable during operations. BOEM would require future submarine power cables to have appropriate shielding and burial depth to minimize potential EMF effects from cable operation. EMF effects from these planned projects on finfish, invertebrates, and EFH would vary in extent and significance depending on overall cable length, the proportion of buried versus exposed cable segments, and project-specific transmission design (e.g., HVAC or HVDC, transmission voltage). EMF strength diminishes rapidly with distance, and EMF that could elicit a behavioral response in an organism would likely extend less than 50 feet (15.2 meters) from each cable. When submarine cables are laid, installers typically maintain a minimum separation distance of at least 330 feet (100 meters) from other known cables to avoid inadvertent damage during installation, which also precludes any additive EMF effects from adjacent cables.

Population-level impacts on finfish have not been documented for EMF from alternating current cables (CSA Ocean Sciences, Inc. and Exponent 2019). There is no evidence to indicate that EMF from undersea alternating current power cables adversely affects commercially and recreationally important fish species within the southern New England area (CSA Ocean Sciences, Inc. and Exponent 2019). A more recent review by Gill and Desender (2020) supports these findings, where fish were found to be affected by EMF at high intensity for a small number of individual finfish species; however, response in finfish was not found to occur at the EMF intensities associated with marine renewable energy projects. For example, behavioral impacts have been documented for benthic species such as skates near operating direct current cables (BOEM 2018; Hutchison et al. 2020). Skates exhibited changes in behavior in the form of increased exploratory searching and slower movement speeds near the EMF source, but EMFs did not appear to present a barrier to animal movement.

To date, the effects of EMF on invertebrate species have not been extensively studied, and studies of the effects of EMF on marine animals have mostly been limited to commercially important species such as lobster and crab (e.g., Love et al. 2017; Hutchison et al. 2020). Burrowing infauna may be exposed to stronger EMFs, but scientific data are limited. Recent reviews by Gill and Desender (2020), Albert et al. (2020), and CSA Ocean Sciences, Inc. and Exponent (2019) of the effects of EMF on marine invertebrates in field and laboratory studies concluded that measurable effects can occur for some species, but not at the relatively low EMF intensities representative of marine renewable energy projects. For example, behavioral impacts were documented for lobsters near a direct current cable (BOEM 2018) and a domestic electrical power cable (Hutchison et al. 2020), including subtle changes in activity (e.g., broader search areas, subtle effects on positioning, and a tendency to cluster near the EMF source), and only when the lobsters were within the EMF. There was no evidence of the cable acting as a barrier to lobster movement and no effects were observed for lobster movement speed or distance traveled. Additionally, faunal responses to EMF by marine invertebrates, including crustaceans and mollusks (BOEM 2018; Taormina et al. 2018; Normandeau et al. 2011), include interfering with navigation that relies on natural magnetic fields, predator/prey interactions, avoidance or attraction behaviors, and physiological and developmental effects (Taormina et al. 2018).

Other studies have found that EMF does not affect invertebrate behavior. For example, Schultz et al. (2010) and Woodruff et al. (2012, 2013) conducted experiments exposing American lobster and Dungeness crab (*Metacarcinus magister*) to EMF ranging from 3,000 to 10,000 milligauss and found that EMF did not affect their behavior. Assuming the other wind projects with HVAC cables in the geographic analysis area have similar array and export cable voltages as the Proposed Action, the induced magnetic field levels expected for the offshore wind projects are two to three orders of magnitude lower than those tested by Schultz et al. (2010) and Woodruff et al. (2012, 2013). Similarly, a field experiment in Southern California and Puget Sound, Washington, found no evidence that the catchability of two crab species was influenced by the animals crossing an energized low-frequency submarine alternating current power cable (35 and 69 kV, respectively) to enter a baited trap. Whether the cables were unburied or lightly buried did not influence the crab responses (Love et al. 2017). While these voltages are between two and eight times lower than those proposed for the Project, the array and export cables for the Project would be shielded and buried at depth to reduce potential EMF from cable operation.

Impacts of EMF on benthic habitats is an emerging field of study; as a result, there is a high degree of uncertainty regarding the nature and magnitude of effects on all potential receptors (Gill and Desender 2020). Recent reviews by Bilinski (2021), Gill and Desender (2020), Albert et al. (2020), and Snyder et al. (2019) of the effects of EMF on marine organisms in field and laboratory studies concluded that measurable, though minimal, effects can occur for some species, but not at the relatively low EMF intensities representative of marine renewable energy projects. Behavioral impacts from EMF, though observed at higher levels than are representative of offshore wind projects, were documented for lobsters near a direct current cable (BOEM 2018) and a domestic electrical power cable (Hutchison et al. 2020), including subtle changes in activity (e.g., broader search areas, subtle effects on positioning, and a tendency to cluster near the EMF source). There was no evidence of the cable acting as a barrier to lobster movement and no effects were observed for lobster movement speed or distance traveled. Additionally, faunal responses to EMF by marine fauna, including crustaceans and mollusks, include attraction to the source, interference with navigation that relies on natural magnetic fields, predator/prey interactions, avoidance or attraction behaviors, increased burrowing by polychaetes, increased exploratory and foraging behavior, and physiological and developmental effects (Bilinski 2021; Jakubowska et al. 2019; BOEM 2018; Taormina et al. 2018; Normandeau et al. 2011). Burrowing infauna and finfish may be exposed to stronger EMF, but little information is available regarding the potential consequences. Non-mobile infauna would be unable to move to avoid EMF. A recent study concludes that impacts on finfish from EMF are minor or short term, specifically for species that are known to sense EMF more acutely than pelagic fish species, such as elasmobranchs and benthic species (Bilinski 2021). This study indicated that impacts were limited to minor responses in elasmobranchs and benthic species, which included attraction to cabled areas. It is important to reiterate that EMF impacts on finfish have not been extensively studied and it remains unknown if finfish experience physiological impacts, what life stages of finfish are most affected by EMF, and if long-term impacts develop later in life (Bilinski 2021). Any effects, however, would be localized and would not have population-level impacts due to the small spatial scale of the impact relative to the available benthic habitat in the geographic analysis area.

EMF levels would be highest at the seabed and in the water column above cable segments that cannot be fully buried and are laid on the bed surface under protective rock or concrete blankets. Invertebrates in proximity to these areas could experience detectable EMF levels and minimal associated behavioral effects. These unburied cable segments would be short and widely dispersed. CSA Ocean Sciences, Inc. and Exponent in 2019 found that offshore wind energy development as currently proposed would have negligible effects, if any, on bottom-dwelling finfish and invertebrates residing within the southern New England area. For pelagic species within the same area, no negative effects were expected from offshore wind energy development as currently proposed because of their preference for habitats located at a distance from the seabed.

The information summarized above indicates that EMF impacts on finfish, invertebrates, and EFH would be biologically insignificant, highly localized, and limited to the immediate vicinity of cables and would be undetectable beyond a short distance; however, localized impacts would persist as long as cables are in operation. Most exposure is expected to be of short duration, and the affected area would represent an insignificant portion of the available habitat for finfish and mobile invertebrate species; therefore, cumulative impacts on finfish, invertebrates, and EFH would be expected to be negligible.

Lighting: Light can attract finfish and invertebrates, including potential prey for finfish, further acting as an attractant for finfish. As such, light could potentially affect finfish movement in highly localized areas. Light can also affect natural reproductive cycles for finfish, e.g., spawning; however, light would need to be persistent and present for long periods of time to influence natural reproductive cycles (Longcore and Rich 2004). Light is important in guiding the settlement of invertebrate larvae, and artificial light can change the behavior of aquatic invertebrates such as squid, although the direction of response can be species and life stage specific. Planned activities include up to 2,952 offshore WTGs in the geographic analysis area. Construction and O&M of these structures would introduce short-term and long-term sources of artificial light to the offshore environment in the form of vessel lighting and navigation and safety lighting on offshore WTGs. Zooplankton diel migration and movement may be also influenced by changes in light exposure. Offshore wind development would result in increased light from offshore structures and vessels. Vessels would be lit during construction, maintenance, and decommissioning. Impacts from vessel lighting would likely be insignificant relative to activities not related to offshore wind that occur throughout the geographic analysis area. Furthermore, potential impacts from lighting would be anticipated to have little impact on finfish and invertebrates during daylight hours and would be limited by the depth of the water in the offshore wind lease areas.

The cumulative impacts of light on finfish, invertebrates, and EFH are likely to be negligible, localized, and short term, resulting in little change to these resources. As such, light from offshore wind development would not be expected to appreciably contribute to cumulative impacts on these resources and impacts would be negligible.

Cable emplacement and maintenance: Dredging for cable emplacement results in short-term, localized impacts, such as habitat alteration and change in complexity, on finfish, invertebrates, and EFH such as SAV. Dredging would be expected to occur most often in areas of sand waves where jet plowing would not be sufficient to meet target burial depths for cables. It would be expected that plumes of sediment resulting from dredging activities would redeposit to areas composed of similar sediments, due to the sandy nature of the seafloor throughout much of the geographic analysis area. Sandy or silty habitats, which are abundant in the geographic analysis area, are quick to recover from dredging disturbance. According to Newcombe and MacDonald (1991), impacts from settlement of resuspended sediment plumes increase with the concentration of resuspension and the duration over which invertebrates are exposed to that plume. When studying the dredge plume dynamics of New York/New Jersey Harbor, USACE (2015) noted that sediment concentrations decreased exponentially with time and distance in the down-current direction (within 15 minutes of release, concentrations were noted to be less than 50 milligrams per liter [mg/L]). Resuspension of coarse-grained sands within the offshore wind lease areas is expected to be limited in duration, resulting in a relatively short exposure of finfish and invertebrates to the plume. Seabed profile alterations could cause long-term or permanent impacts on EFH. Mechanical trenching, used in more resistant sediments (e.g., gravel, cobble), causes seabed profile alterations during use, although the seabed is typically restored to its original profile after utility line installation in the trench. Habitat function in most of these areas would be expected to recover in the short term following dredging activities.

Cable installation through SAV beds would be expected to result in long-term, potentially permanent habitat loss due to the slow rate of recovery in seagrasses. A study of 33 seagrass restorations ranging in age from 3 to 32 years found that 88 percent of restoration projects continued to support seagrass, although restored percentage cover values were 37 percent lower than references (Rezek et al. 2019). Restoration from vessel damage recovered to reference conditions, while beds with sediment modification had significantly lower diversity than reference beds. The authors concluded that restored seagrass beds, once established, often exhibit long-term persistence, but survival of seagrass in the early stages of projects is important to success. Therefore, it would be anticipated that habitat alterations resulting from dredging would have negligible to minor impacts on finfish and invertebrates that would be temporary or short term; however, long-term or permanent impacts on EFH (e.g., SAV) are possible.

Dredging activities result in plumes of sediments into the water column that will eventually settle on the seafloor (estimated to last 1 to 6 hours at a time, after which the sediment is deposited on the seafloor). Additional activities such as trenching for new cables, as well as maintenance activities, also periodically disturb sediments. In general, sediment plumes are localized, which results in larger and coarser sediment falling out of the water column and settling on the seafloor in the area near or immediately adjacent to the activity, while smaller, fine sediments may remain suspended in the water column for a longer time period before settling potentially at a greater distance from the disturbance. In addition to dredging, pile-driving activities can produce sediment plumes that would result in sediment deposition and burial of invertebrates and non-motile organisms and life stages, such as benthic eggs and larvae. Additional discussion related to effects from turbidity and sedimentation is provided in the EFH Assessment (BOEM 2022a).

Finfish are unlikely to be affected by sediment deposition or burial; however, sessile life stages of some finfish such as eggs and larvae could be smothered by sediments, causing mortality. Impacts would be expected to vary by time of year, based on when any finfish species may spawn. Additionally, visual predators and suspension feeders could be affected by sediment plumes on a short-term and temporary basis where hunting/foraging success could decrease; however, it would be expected that sediment deposition would occur relatively quickly due to the mostly coarse nature of sediments in the geographic analysis area. Impacts due to sediment deposition and burial would be considered negligible to minor, localized, and temporary or short term.

Dredging activities associated with cable installation could affect the Atlantic sturgeon through impingement, entrainment, and capture associated with mechanical and hydraulic dredging techniques. Impacts on the Atlantic sturgeon from cable emplacement and maintenance may include temporary habitat disturbance, turbidity, and loss of prey. Adult Atlantic sturgeon are expected to be well distributed throughout the Project area (Dunton et al. 2010). Ingram et al. (2019) tagged Atlantic sturgeon off the New York WEA using acoustic tags to track the movement of fish seasonally from November 2016 through February 2018. Their study showed that offshore migrations peaked from November through January and were uncommon or entirely absent during July to September. While Atlantic sturgeon are known to be struck and killed by vessels in rivers and estuaries, there are no reports of vessel strikes in the marine environment, likely due to the space between bottom-oriented sturgeon and the propellers and hulls of vessels (BOEM 2021). Dunton et al. (2010) reported that approximately 95 percent of all Atlantic sturgeon captured in sampling off New Jersey occurred in depths less than 66 feet (20 meters), with the highest catch per unit of effort at depths of 33 to 49 feet (10 to 15 meters). At these depths in open coastal and marine environments, which would not constrain the distribution or movement of Atlantic sturgeon, they are not likely to be struck by vessels.

Sturgeon forage at the sediment (Dadswell 2006). This behavior may increase the susceptibility of capture with a dredge bucket. For entrapment to occur, an individual sturgeon would have to be present directly below the dredge bucket at the time of operation. As such, entrapment of sturgeon during the temporary performance of mechanical dredging operations is unlikely. Due to their bottom foraging and swimming behavior, adult Atlantic sturgeon have been known to become entrained in hydraulic-cutterhead dredges as they move across the seabed (Novak et al. 2017; Balazik et al. 2020; NMFS 2022). Given the need for a sturgeon to approach within 1 meter of the dredge head to become entrained and the lack of attraction or deterrence relationship observed between Atlantic sturgeon and dredges, the likelihood of effects on Atlantic sturgeon from dredging is low (Balazik et al. 2020; NMFS 2022). Therefore, an Atlantic sturgeon becoming entrained in a mechanical dredge is considered unlikely to occur.

Atlantic sturgeon prey upon small, bottom-oriented fish such as the sand lance, mollusks, polychaete worms, amphipods, isopods, and shrimp, with polychaetes and isopods being the primary and important groups consumed in the Project area (Smith 1985; Johnson et al. 1997; Dadswell 2006). Sand lances could become entrained in a hydraulic dredge due to their bottom orientation and burrowing within sandy sediments that require clearing. Reine and Clarke (1998) found that not all fish entrained in a hydraulic dredge are expected to die. Studies summarized in Reine and Clarke (1998) indicate a mortality rate of 37.6 percent for entrained fish. It is expected that dredging in sandwaves to allow for cable installation would result in the entrainment and mortality of some sand lances. However, it is expected any impact of the loss of Atlantic sturgeon prey items to be so small that it cannot be meaningfully measured, evaluated, or detected.

Prior to cable emplacement, seabed preparation often requires mapping and subsequent removal of obstructions along the cable route. UXO (e.g., bombs, bullets, shells, grenades, mines) is often present on the ocean floor (as described in Section 3.6, *Benthic Resources*). If UXO cannot be avoided, removal or detonation may be required. UXOs that are exploded in place disturb the ocean floor and can result in habitat loss, reduced water quality, and physical disturbance, harm, and mortality in fish and marine invertebrates. A UXO blast in a Scotland offshore wind farm mobilized sediments into the water column in the vicinity of the explosion, although high sediment suspension was reportedly short lived and smaller in magnitude than the effects of a storm event (Beatrice Offshore Windfarm 2016). Other effects reported for the same offshore wind farm included loss of benthic habitat due to sediment suspension and deposition in addition to the seafloor disturbance, although the recovery of the seafloor due to inputs from surrounding unaffected areas was anticipated to be rapid. An assessment of the sediments found no raised levels of any hydrocarbon or metals across the wind farm and concluded the potential effects of resuspended sediment contaminants on benthic resources were negligible.

UXO clearance activities during critical periods can affect spawning or migration behavior in fish. At the Beatrice Offshore Windfarm, UXO clearance was undertaken outside the spawning window and no impacts on cod spawning were anticipated. UXO clearance activities may result in temporary loss or disturbance of spawning, nursery, or feeding habitat. The clearance of UXO has the potential to result in the loss of benthic habitat in the vicinity of the blast site that is of importance to fish species. This impact is, however, predicted to be highly localized and therefore would not result in substantial areas of seabed being disturbed. Following disturbance, levels of suspended sediment in the water column are not expected to be substantially higher than background levels and the sandy and coarse sand sediments would settle back to the seabed relatively rapidly. Given the relatively high susceptibility of eggs and larvae to suspended and resettling sediment, there is the potential for early life stages to be affected.

Dredging and mechanical trenching used in the course of cable installation could cause localized, short-term impacts (habitat alteration, lethal and sublethal effects) on invertebrates through sediment deposition and seabed profile alterations. Sediment deposition could result in adverse impacts on invertebrates, including smothering. The tolerance of invertebrates to being covered by sediment (sedimentation) varies among species and life stage. Some sessile shellfish may only tolerate 0.4 to 0.8 inch (1 to 2 centimeters), while other benthic organisms can survive burial in upward of 7.9 inches (20 centimeters) (Essink 1999). Demersal eggs and larvae would be particularly vulnerable to sediment disturbance and resettlement. For example, high rates of mortality can occur in longfin squid egg masses if exposed to abrasion. For migratory invertebrate species, impacts would be expected to vary by time of year, based on the species' presence in the vicinity of the dredge area. Dredged material disposal during construction, if any occurs in the geographic analysis area, would cause localized, temporary turbidity increases and long-term sedimentation or burial of invertebrates at the immediate disposal site. The impacts of burial would be mostly short term with less potential for long-term impacts.

Cable emplacement and maintenance activities (including dredging) would disturb sediments and cause sediment suspension, which could disturb, displace, and directly injure finfish species and EFH. Short-term disturbance of seafloor habitats could disturb, displace, and directly injure or result in mortality of invertebrates in the immediate vicinity of the cable-emplacement activities. Sediment disturbance and resettlement could also affect eggs and larvae, particularly demersal eggs such as longfin squid eggs, which have high rates of mortality if egg masses are exposed to abrasion. When new cable emplacement and maintenance cause resuspension of sediments, increased turbidity could have an adverse impact on filter-feeding fauna such as bivalves. Depending on the substrate being disturbed, invertebrates could be exposed to contaminants via the water column or resuspended sediments, but effects would depend on the degree of exposure.

Cable emplacement and maintenance activities could result in short-term, temporary impacts and over time may result in long-term habitat alterations. The intensity of impacts would be dependent on multiple factors, including time of year, sediment type, and habitat type being affected where activities occur. For example, sand is the predominant sediment type within the New Jersey WEA (Guida et al. 2017), so disturbed sediments would be expected to settle out of the water column relatively quickly and travel shorter distances than if the seabed was dominated by finer sediments (mud). The impact of increased turbidity on invertebrates depends on both the concentration of suspended sediment and the duration of exposure. Plume modeling completed for other wind development projects within the region and with similar sediment characteristics (Vineyard Wind 1, Block Island Wind Farm, and Virginia Offshore Wind Technology Advancement) predict that suspended sediment would usually settle well before 12 hours have elapsed (COP Volume II, Section 2.1.2.2.1; Ocean Wind 2023). BOEM, therefore, expects relatively little impact from increased turbidity (separate from the impact of direct sediment deposition) due to cable-emplacement and maintenance activities. The cable routes for other offshore wind projects are under review and have not been fully determined at this time. This IPF could cause impacts during construction and maintenance activities. Assuming projects use installation procedures similar to those proposed in Appendix E, the extent of impacts would be limited to approximately 6 feet (0.9 meter) to either side of each cable. Therefore, the duration and extent of impacts would be limited and short term, and it would be expected that finfish and invertebrates would recover following this disturbance; however, EFH and other habitats such as eelgrass or hard-bottom habitats, discussed further in Section 3.6, may remain permanently altered (Hemery 2020), as eelgrass would be expected to require a greater amount of time to recover. Long-term loss of eelgrass and other complex habitats could affect finfish and invertebrate species that utilize these habitats, potentially resulting in increased predation pressure due to loss of refuge habitat as well as decreased hunting success, again due to loss of cover habitat. These impacts would be expected to primarily affect inshore species, particularly those in Barnegat Bay, including summer flounder. Affected hard-bottom habitat would not be expected to recover but the extent of hard-bottom habitat that could potentially be affected is assumed to be low relative to the amount of this habitat available throughout the geographic analysis area.

Some types of cable installation equipment use water withdrawals, which can entrain planktonic invertebrate larvae (e.g., squid, crab, lobster) with assumed 100-percent mortality of entrained individuals (COP Volume II, Section 2.2.5.2.1; Ocean Wind 2023). Due to the surface-oriented intake, water withdrawal could entrain pelagic eggs and larvae but would not affect resources on the seafloor. However, the rate of egg and larval survival to adulthood for many species is very low (MMS 2009). Due to the limited volume of water withdrawn, BOEM does not expect population-level impacts on any given species.

Based on the assumptions provided in Appendix F, offshore cables associated with wind projects would be similar to those of the Project, including inter-array cables, substation interconnection cables, and offshore export cables. The geographic analysis area for finfish and invertebrates is over 16 million acres (64,750 km^2) in size. The total seafloor disturbance would represent less than 0.1 percent of the geographic analysis area, and suspended sediment should settle well before 12 hours.

Cable routes that intersect sensitive EFH such as eelgrass beds or rocky bottom and other more complex habitats may cause long-term or permanent impacts; otherwise, impacts of habitat disturbance and mortality from physical contact with finfish and invertebrates would be recovered in the short term, and overall impacts would be expected to be minor to moderate.

Noise: Noise impacts caused by offshore construction, G&G, and O&M activities, cable laying/trenching, and pile driving could affect finfish and invertebrates. Of these noise-producing factors, noise from pile driving would likely have the greatest impact. Pile-driving noise is a temporary impact that occurs during installation of foundations for offshore wind structures. Pile-driving noise is produced intermittently during construction for a period of 4 to 6 hours per day. Pile driving for construction of more than one offshore wind project may occur concurrently within the geographic analysis area over an 8-year period.

Impacts from pile-driving noise on finfish would also depend on other factors that affect local fish populations, including time of year. Impacts from noise would be greater if occurring during spawning periods or in spawning habitat, particularly for species that are known to aggregate in specific locations to spawn, use sound to communicate, or spawn once in their lifetime. Prolonged localized behavioral impacts on specific finfish populations over the course of years could reduce reproductive success for multiple spawning seasons for those populations, which could result in long-term decline in local populations. However, based on behavioral studies of black sea bass (Jones et al. 2020), fish behavior returns to a pre-exposure state following completion of noise impacts. Additionally, as acoustic impacts decline with distance, it is unlikely that impacts of pile driving from wind farms outside of a certain threshold distance would result in any local population being subject to multiple years of acoustic impacts that would result in long-term impacts on the population. Therefore, impacts on finfish from pile driving are anticipated to be temporary and intermittent during periods when pile driving is actively occurring. It is important to note that no planned non-offshore wind pile-driving activities have been identified within the geographic analysis area for this resource other than current ongoing activities.

Marine invertebrates lack internal air spaces and gas-filled organs needed to detect sound pressure and so are considered less likely to experience injury from over-expansion or rupturing of internal organs, the typical cause of lethal noise-related injury in vertebrates (Popper et al. 2001). Noise thresholds for adult invertebrates have not been developed because of a lack of available data, but some invertebrates are responsive to particle motion and are therefore capable of vibration reception (e.g., crustaceans, squid) (Mooney et al. 2020). This is supported by other studies that found American lobster and shore crabs (*Carcinus maenas*) to have some capability to detect and respond to sound (Jézéquel et al. 2021; Aimon et al. 2021). Noise has also been shown to affect bivalves based on reactions where bivalves close their valves and burrow deeper when subjected to noise and vibration stimuli (Roberts and Elliott 2017). Prolonged valve closure could result in reduced respiration and growth in bivalves, prevent expulsion of wastes, and lead to mortality at a local level.

The longfin squid has been found to exhibit an initial startle response, comparable to that of a predation threat, to pile-driving impulses recorded from a wind farm installation, but upon exposure to additional impulses, the squid's startle response diminished quickly, indicating potential habituation to the noise stimulus (Jones et al. 2020). After a 24-hour period, the squid seem to re-sensitize to the noise, which is an expected response to natural stimuli, as well. Squid schooling and shoaling behavior could be interrupted when exposed to pile-driving impulse noises, which could affect predation risk. Feeding behavior in longfin squid was disrupted by exposure to playbacks of pile-driving noise, resulting in increased failure of predation attempts on killfish (*Fundulus heteroclitus*). Regardless of whether they were hunting, squids exhibited comparable alarm responses to noise. Hearing measurements confirmed the noise was detected by the squid (Jones et al. 2021).

Noise transmitted through water and through the seabed can cause a disturbance response in invertebrates within a limited area around each pile and short-term stress and behavioral changes in individuals over a greater area (e.g., discontinuation of feeding activity). The extent depends on pile size, hammer energy, and local acoustic conditions, with the affected areas recolonized in the short term. These impacts are therefore anticipated to be temporary and intermittent, occurring only during active impact and vibratory pile driving.

Noise impacts from G&G activities are anticipated to occur annually for the foreseeable future but will be localized. Seismic surveys that are used for oil and gas exploration create high-intensity impulsive noise that penetrate the seabed and could potentially cause injury or behavioral impacts on finfish and invertebrates (BOEM 2012). It is important to note that seismic surveys for the purposes of offshore wind are generally used to investigate shallow hazards and hard-bottom areas for the purposes of evaluating the feasibility of turbine installation; as such, seismic surveys for offshore wind do not require use of seismic air guns (used for oil and gas exploration), which penetrate miles into the seabed. Consequently, seismic surveys for offshore wind have far fewer impacts than those for oil and gas exploration. Oil and gas exploration on the Atlantic OCS is currently unlikely. These impacts would be highly localized around the sound source and would be short term in duration. Finfish and invertebrates in the general area but not in the immediate vicinity of the sound source could experience short-term stress and temporary behavioral changes in a larger area affected by the sound. HRG surveys would be anticipated to occur within the geographic analysis area for the purpose of collecting data on conditions at the seafloor and the shallow subsurface. HRG surveys require the use of sparkers and boomers, which generally operate within discrete frequency bands for short durations (relative to seismic airguns). Sparkers and boomers put out less energy relative to seismic airguns and operate in smaller areas and would only be expected to potentially affect finfish and invertebrates close to the activity. During HRG activities, finfish and invertebrates close to sparkers and boomers may experience short-term and very localized impacts that could include displacement.

Noise from trenching equipment for placement of new or expanded submarine cables and pipelines is likely to occur within the geographic analysis area. It is assumed that while these disturbances are likely to occur, they would be infrequent over the next 35 years. Trenching noise is dependent on the substrate being trenched, where sandy sediments would be expected to create lower noise levels compared to rocky substrate or larger cobbles. In a study by Subacoustech, noise from trenching was found to be composed of broadband noise, tonal machinery noise, and transients, likely associated with rock breakage; a source level of 178 dB re 1 µPa at 1 meter distance was measured during the study (Nedwell et al. 2007), which is lower than the thresholds where injury to fish would be expected but above the threshold where behavioral changes may occur. As such, noise impacts from trenching would be expected to alter fish behavior at close range. Noise impacts associated with submarine cables and pipelines would be temporary and localized and extend only a short distance beyond the emplacement corridor. Impacts from noise would be lower than impacts from the trenching and disturbance to the seafloor; regardless, the most prominent noise-producing activities would be related to trenching and seafloor excavation, if burial of pipeline or cables is determined to be necessary. Noise from trenching could result in injury or mortality for finfish in the immediate vicinity of the activity and would likely result in temporary behavioral changes in a broader area. These impacts would be short term, and finfish would be expected to return to the areas of impact following any cable or pipeline activities.

Noise from aircraft, vessels, and WTG O&M is expected to occur within the geographic analysis area, but it is anticipated that these activities would have little impact on finfish and invertebrates. Offshore wind projects may require use of aircraft for crew transport during construction and maintenance; however, little noise from aircraft propagates through the water column. Therefore, impacts on finfish from aircraft use are not likely to occur. Future activities related to offshore wind presumably would be related to increased vessel traffic associated with both construction and maintenance of WTGs and associated facilities. Vessels associated with construction were found to be loud enough at a distance of up to 10 feet (3 meters) to induce avoidance of finfish and invertebrates but not cause physical harm to the fish (MMS 2009). The behavioral avoidance impacts would be short term. WTGs are known to produce ambient noise that barely exceeds ambient noise levels at 164 feet (50 meters) from the base of the WTG (Thomsen et al. 2015); this noise would persist for the life of any offshore wind project.

Underwater explosions from UXO generate high pressure levels that could kill, injure, or disturb marine fish. Injury to fish from exposures to blast pressure waves is attributed to compressive damage to tissue surrounding the swim bladder and gastrointestinal tract, which may contain small gas bubbles. Hannay and Zykov (2022) describe the effects of detonation pressure exposures to fish as assessed according to the peak sound level limits for onset of mortality or injury leading to mortality due to explosives, as recommended by the American National Standards Institute expert working group (Popper et al. 2014). Their review indicates injurious effects thresholds for all fish species groups are the same: peak sound level = 229–234 dB re 1 µPa. For fish species that use swim bladders for hearing, Popper et al. suggest a high likelihood of hearing loss, measured as TTS, and recoverable injury at near and intermediate distances, where *near* refers to within a few tens of meters and *intermediate* refers to a few hundreds of meters. For fish species with swim bladders not used for hearing, the guidelines indicate high likelihood of recoverable impairment at near and intermediate distances but low levels of TTS at intermediate distances. For fish without swim bladders, the guidelines indicate low likelihood of recoverable injury at intermediate distances and moderate likelihood of TTS at intermediate distances and low levels of both effects at far distances of a few kilometers. The resulting impacts on invertebrates and finfish can be localized or widespread and temporary or permanent.

Impacts of noise on finfish, invertebrates, and EFH are likely to be negligible to minor, localized, and temporary or short term. As such, the cumulative impacts of noise from offshore wind development would be expected to be moderate.

Port utilization: It is possible that Ports along the eastern seaboard within the geographic analysis area will be upgraded at some time in the future, which would affect offshore habitat. The Northeast Regional Planning Body anticipates that major vessel traffic routes will be relatively stable in the region for the foreseeable future; however, coastal developments and market demands that are unknown at this time could affect them (Northeast Regional Planning Body 2016). The general trend along the East Coast of the United States from Virginia to Maine indicates that port activity will increase modestly in the foreseeable future. These increases in port activity may require port modifications that could cause localized, minor impacts on finfish and EFH, likely resulting in temporary displacement of finfish. Existing ports within the geographic analysis area have already affected finfish, invertebrates, and EFH. It is anticipated that modifications of ports would cause temporary and localized impacts on finfish, invertebrates, and EFH, likely resulting in behavioral responses, such as avoiding the area during port modification activities. These impacts would be limited to the short term and would not be expected to affect finfish and invertebrate species at a population level; however, mortality at less-mobile life stages such as eggs and larvae could occur if individuals were present in the immediate vicinity of port modification activity. The overall impacts of port utilization on finfish, invertebrates, and EFH are likely to be negligible to minor, localized, and temporary or short term. As such, the impacts from offshore wind development would be expected to be minor.

Presence of structures: Presence of structures could lead to impacts on finfish, invertebrates, and EFH through entanglement, gear loss or damage, hydrodynamic disturbance, fish aggregation, habitat conversion, and migration disturbances. These impacts could occur through addition of buoys, meteorological towers, WTG foundations, scour/cable protection, and transmission cable infrastructure. Over the next 35 years, development is expected to continue within the geographic analysis area, providing additional structures on the seafloor. Based on assumptions of development for other offshore wind projects, 3,109 foundations would be developed in the geographic analysis area (Appendix F). BOEM assumes that offshore wind projects would include similar components for construction, i.e., WTGs, offshore and onshore cable systems, OSS, onshore O&M facilities, and onshore interconnection facilities, all of which would increase the total number of structures within the geographic analysis area over the next 35 years. In the geographic analysis area, structures are anticipated predominantly on sandy bottom, except for cable protection, which is more likely to be needed where cables pass through hard-bottom habitats. The potential locations of cable protection for planned activities have not been fully determined at this time; however, any addition of scour protection/hard-bottom habitat would represent substantial new hard-bottom habitat, as the geographic analysis area is predominantly composed of sand, mud, and gravel substrates.

Hydrodynamic disturbance is an emerging topic of concern because of potential effects on the Mid-Atlantic Bight cold pool, a seasonal oceanographic feature that influences regional biological oceanography. Changes in the size and seasonal duration of the cold pool over the past five decades have been associated with shifts in the fish community composition of the Mid-Atlantic Bight. The cold pool is a mass of relatively cool water that forms in the spring and is maintained through the summer by stratification. It supports a diversity of fish and other marine species that are usually farther north but thrive in the cooler waters it provides (Chen 2018; Lentz 2017). Structures may reduce wind-forced mixing of surface waters, whereas water flowing around the foundations may increase vertical mixing (Carpenter et al. 2016). During summer, when water is more stratified, increased mixing could increase pelagic primary productivity near the structure, increasing the algal food source for zooplankton and filter feeders. Increased mixing may also result in warmer bottom temperatures, increasing stress on some shellfish and fish at the southern or inshore extent of the range of suitable temperatures. Changes in cold pool dynamics resulting from future activities, should they occur, could conceivably result in changes in habitat suitability and fish community structure, but the extent and significance of these potential effects are unknown. Changes to the cold pool size, distribution, and timing may negatively affect thermal habitats preferred by some species (e.g., Atlantic mackerel, Illex squid) and may affect the availability of nearshore spawning habitats for some species (longfin squid) and sources of prey for other species. For example, a northward expansion of the longfin squid population may be related to warming Newfoundland nearshore waters (Dawe et al. 2007).

The presence of WTGs is likely to create localized hydrodynamic effects that could have localized impacts on food web productivity and pelagic eggs and larvae. Addition of vertical structure that spans the water column could alter vertical and horizontal water velocity and circulation. The geographic analysis area is considered seasonally stratified, with warmer waters and high salinity leading to strong stratification in the late summer and early fall. Presence of the monopiles in the water column can introduce small-scale mixing and turbulence that also results in some loss of stratification (Carpenter et al. 2016; Floeter et al. 2017; Schultze et al. 2020). In strongly stratified locations, the mixing seen at monopiles is often masked by processes forcing toward stratification (Schultze et al. 2020), but the introduction of nutrients from depth into the surface mixed layer can lead to a local increase in primary production (Floeter et al. 2017).

Monopiles can also influence current speed and direction. Monopile wakes have been observed and modeled at the kilometer scale (Cazenave et al. 2016; Vanhellemont and Ruddick 2014). While impacts on current speed and direction decrease rapidly around monopiles, there is evidence of hydrodynamic effects out to a kilometer from a monopile (Li et al. 2014). However, other work suggests the influence of a monopile is primarily limited to within 328 to 656 feet (100 to 200 meters) of the pile (Schultze et al. 2020). The discrepancy is likely related to local conditions, wind farm scale, and sensitivity of the analysis. NOAA consensus on other projects in the region is that effects would be limited to within a few hundred meters of the monopile (NOAA 2019).

Hydrodynamic effects could have localized effects on food web productivity and pelagic eggs and larvae. Given the planktonic nature of pelagic eggs and larvae, altered circulation patterns could transport pelagic eggs and larvae out of suitable habitat, altering their survivability. Additionally, pelagic juveniles and adults utilizing water column habitat may experience localized hydrodynamic effects down-current of each monopile. These effects may be limited to decreased current speeds but could also include minor changes to seasonal stratification regimes. Adults and juveniles are expected to exhibit an avoidance behavioral response away from potential unsuitable habitat due to hydrodynamic effects from monopiles.

No future activities were specifically identified within the geographic analysis area specific to entanglement and gear loss and damage; however, it is reasonable to assume that fishing activities (both commercial and recreational) may increase over time in the vicinity of structures due to the likelihood of fish and crustacean aggregation. Damaged and lost fishing gear caught on structures may result in ghost fishing[3] or other disturbances, potentially leading to finfish mortality. Impacts from fishing gear would be localized; however, the risk of occurrence would remain as long as the structures are present. The presence of structures in an otherwise primarily sandy benthic environment would provide a more complex environment, likely to attract finfish and invertebrates such as mobile crustaceans of commercial value. As such, entanglement and gear loss may cause increased impacts on finfish, including mortality and alteration of habitats. These impacts would be localized and short term; however, they would likely persist intermittently as long as structures remain in place.

The presence of structures results in the addition of new hard surfaces and structures to a mostly sandy seafloor, including WTG foundations, scour protection, and hard protection on top of cables, which would create a more complex habitat. Structure-oriented finfish species such as black sea bass, striped bass, and Atlantic cod (among others) would be attracted to these more complex structures. The structures would create an "artificial reef effect," whereby more sessile and benthic organisms would likely colonize the structures over time (e.g., sponges, algae, mussels, shellfish, sea anemones). Higher densities of filter feeders, such as mussels that colonize the structure surfaces, could consume much of the increased primary productivity but also provide a food source and habitat to crustaceans such as crabs (Dannheim et al. 2020). Mussels have been found to be the preferred food source of Jonah crabs in the Gulf of Maine by Donahue et al. (2009). These impacts would likely be permanent or remain as long as the structure remains. It is important to note that increases in biomass to any specific region due to presence of hard substrates (WTGs in this case) are not necessarily ecosystem benefits; rather, the long-term impacts of the

[3] "Ghost fishing" refers to entrapment, entanglement, or mortality of marine life in discarded, lost, or abandoned fishing gear, which can also smother habitat and act as a hazard to navigation.

artificial reef effect are unknown. Moreover, increased fish aggregation could result in increased regulated fishing, potentially leading to higher biomass removal if the artificial reef effect results in greater fish aggregation without a related increase in fish production.

In contrast to the potential beneficial effects of WTG foundations creating an artificial reef effect, these structures could also facilitate introduction and spread of nonnative species through the stepping-stone effect. New hard substrate structures in the environment could provide opportunity for nonnative species to colonize in an area that would otherwise be unable to settle due to lack of hard substrate habitat or structures. If established, new networks of hard substrate structures (WTG foundations in this case) could serve as new environments on which nonnative species could propagate and expand. Studies of WTGs in the North Sea of Scotland found that nonnative species were thriving on offshore structures, confirming that the stepping-stone effect can occur in offshore environments if nonnative species are present and introduced (Mesel et al. 2015). Expansion of nonnative species in offshore environments can cause ecological impacts on an area if allowed to propagate and expand.

Finfish aggregation around structures could be perceived as beneficial, adverse, or neutral for finfish and invertebrates. Aggregation and colonization would likely lead to increased fishing pressure at structures and may result in adverse predation pressures; however, complex structures generally provide protection and potential habitat for egg laying and larvae recruitment, which would be considered beneficial to finfish species and some invertebrate species. On the other hand, species that rely on soft-bottom habitat, such as surfclams and longfin squid, would experience a reduction in habitat, but not to the extent that population-level impacts would be expected (Guida et al. 2017). The addition of structures in the geographic analysis area would not be expected to impede migratory fish or invertebrate movement through these areas.

Considering the above information, BOEM anticipates that the cumulative impacts associated with the presence of structures may be negligible to moderate and long term. The impacts on finfish, invertebrates, and EFH resulting from the presence of structures would persist for the duration for which the structures remain.

Gear utilization: Impacts from gear utilization would likely be negligible, because impacts from Project fisheries surveys are expected to be localized and finfish are highly mobile and would be expected to avoid capture by active survey gear. However, capture of Atlantic sturgeon in trawl gear has the potential to result in injury and mortality, reduced fecundity, and delayed or aborted spawning migration. The time period for recovery would depend on the mobility and life stage of each species, with sessile organisms less able to avoid impacts and mobile organisms more able to avoid impacts. The effects of gear utilization are expected to contribute an undetectable increment to the cumulative impacts (disturbance, displacement, injury, and mortality) on invertebrates and EFH, which would likely be negligible and short term, as impacts from surveys are expected to be localized and would often occur along transects already included in fisheries surveys.

Vessel traffic: The presence of vessels introduces the risk of vessel collision with marine life, and vessel collisions with marine life are an ongoing threat in the Project area due to vessels from numerous industries such as trade, tourism, resource development, and offshore wind development. An increase in vessel traffic would be expected due to industries such as aquaculture, fishing, wind farms, power cables, tourism, and oil or gas pipelines, as well as increasing ship traffic in general. Marine species that spend a significant time near the water surface or in areas where vessel routes overlap with migration, feeding, or breeding grounds have the potential to be struck by vessels (SEER 2022). Vessel collisions may result in blunt force and sharp force trauma, both of which can result in death, but are likely to be underrepresented due to a lack of reporting awareness and because not all struck marine animals are recoverable for documentation. Vessel speed reductions and route restrictions have shown to be effective mitigation measures for reducing the probability of injury and mortality related to vessel collisions.

Impacts of vessel collisions can result in injury or mortality and may affect populations in some ESA-listed species such as the Atlantic sturgeon. However, the risk of vessel strikes to sturgeon would be limited to shallower nearshore areas during sturgeon migration into rivers. While Atlantic sturgeon are known to be struck and killed by vessels in rivers and estuaries, there are no reports of vessel strikes in the marine environment, likely due to the space between bottom-oriented sturgeon and the propellers and hulls of vessels (BOEM 2021). Dunton et al. (2010) reported that approximately 95 percent of all Atlantic sturgeon captured in sampling off New Jersey occurred in depths less than 66 feet (20 meters), with the highest catch per unit of effort at depths of 33 to 49 feet (10 to 15 meters). At these depths in open coastal and marine environments, which would not constrain the distribution or movement of Atlantic sturgeon, they are not likely to be struck by Project-related vessels. Atlantic sturgeon would rarely occur within the Offshore Project area (Stein et al. 2004; Eyler et al. 2009; Dunton et al. 2010; Erickson et al. 2011) and are unlikely to be affected by seabed disturbance. Effects of displacement of Atlantic sturgeon and their prey from physical disturbance of sediment are anticipated to be negligible and are further addressed in the BA (BOEM 2022b). Cumulative impacts of vessel traffic are expected to be minor.

Discharges: There would be increased potential for discharges from vessels during construction, O&M, and decommissioning. Offshore permitted discharges would include uncontaminated bilge water and treated liquid wastes. There would be an increase in discharges, particularly during construction and decommissioning, with localized discharges staggered over time. There does not appear to be evidence that the volumes and extents anticipated would have additional water-quality impacts on finfish or invertebrates, above what they would experience without offshore wind development, and cumulative impacts would be expected to be negligible.

3.13.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, finfish and invertebrates would continue to follow current regional trends throughout the geographic analysis area. Finfish and invertebrate populations are expected to respond to ongoing activities, including regulated fishing and climate change. Ongoing non-offshore wind activities would likely have minor to moderate impacts on finfish and invertebrates. Ongoing offshore wind activities are anticipated to affect finfish, invertebrates, and EFH through primary IPFs that include cable emplacement and maintenance, noise (specifically, pile-driving activities), and presence of structures. Under the No Action Alternative, fisheries monitoring proposed by Ocean Wind would not be implemented and these efforts to increase the understanding of the effects of offshore wind development that would otherwise benefit future management of finfish and inform planning of other offshore developments would not occur. Other ongoing and future monitoring would not be affected. Ongoing activities, especially continued fishing, dredging, and climate change, would result in moderate impacts on finfish, invertebrates, and EFH. The No Action Alternative would result in **moderate** impacts on finfish, invertebrates, and EFH.

Cumulative Impacts of the No Action Alternative. Planned non-offshore wind activities would affect finfish, invertebrates, and EFH through both temporary and permanent impacts. Other reasonably foreseeable activities such as increased vessel traffic, new subsea cables and pipelines, onshore construction (including ports), channel maintenance, and installation of permanent non-offshore wind-related structures would be expected to affect finfish and invertebrate populations, as well as EFH. Impacts of planned activities (e.g., increased vessel traffic) other than offshore wind would be minor and result primarily from ongoing fishing activities. Impacts of planned offshore wind activities are expected primarily from the presence of structures due to foundations and scour/cable protection. However, regardless of offshore wind-related activities within the geographic analysis area, it is anticipated that the greatest impact on finfish and invertebrates would be caused by regulated fishing activity and climate change. BOEM anticipates that cumulative impacts of the No Action Alternative would be **moderate** for finfish, invertebrates, and EFH.

3.13.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of impacts on finfish, invertebrates, and EFH.

- The number, size, and locations of WTGs;
- Total length of inter-array cables;
- Total length of offshore export cables;
- Number and locations of OSS;
- Total length of OSS interconnector cable; and
- The time of year during which construction occurs.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances for impacts:

- WTG number and locations: The level of hazard related to WTGs is proportional to the number of WTGs installed, with fewer WTGs requiring fewer foundations resulting in fewer construction-related impacts on finfish, invertebrates, and EFH.
- Offshore cable routes and OSS footprints: The route chosen (including variants within the general route) and OSS footprints would determine the type and amount of seafloor habitat impacts.
- Season of construction: Finfish vary in their migration movements, meaning that certain species may be present at different times of year, and their chosen depth in the water column may also be influenced by time of year and water temperature. Some mobile invertebrates also vary in their migration movements, and sensitive life stages are present at certain times of the year. Any construction window would affect finfish species; however, certain windows may avoid larger migratory movements and potential impacts on sensitive fish species such as Atlantic sturgeon and cusk, both of which may occur within the Project area and are either listed, or candidates for listing, under the ESA.

Although some variation is expected in the design parameters, the assessment of impacts on finfish, invertebrates and EFH in this section considers the maximum-case scenario.

Ocean Wind has committed to measures to minimize impacts on finfish, invertebrates, and EFH by conducting and evaluating G&G surveys to identify sensitive habitats (FISH-01), as well as coordinating with NJDEP, NMFS, and USACE regarding time-of-year restrictions (FISH-02) (COP Volume II, Table 1.1-2; Ocean Wind 2023). Applicant-committed measures in the COP Protected Species Mitigation and Monitoring Plan (COP Appendix AA; Ocean Wind 2023) would further minimize impacts on ESA-listed fish species, including establishing vessel speed restrictions, noise mitigation systems and soft starts during pile driving, and varied species monitoring and reporting (refer to Table H-1 in Appendix H).

Ocean Wind has developed a Submerged Aquatic Vegetation Monitoring Plan (Inspire 2022b) to conduct baseline delineations and document conditions of SAV beds, assess potential impacts on these SAV beds as a result of the construction and operation of the inshore export cable(s) associated with the Project, and track recovery of these SAV beds over time to inform potential mitigation strategies. SAV impacts from construction and installation of the Oyster Creek inshore export cables will be restored or mitigated to the greatest extent practicable, as described in the Ocean Wind 1 Submerged Aquatic Vegetation Preliminary

Mitigation Plan (Ocean Wind 2022). Additional detail regarding the Submerged Aquatic Vegetation Preliminary Mitigation Plan (Ocean Wind 2022) is provided in Section 3.6, *Benthic Resources.*

3.13.5 Impacts of the Proposed Action on Finfish, Invertebrates, and Essential Fish Habitat

3.13.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.13.6, *Impacts of Alternatives B, C, D, and E on Finfish, Invertebrates, and Essential Fish Habitat*.

The following sections summarize potential impacts of the Proposed Action on finfish, invertebrates, and EFH during construction and installation, O&M, and conceptual decommissioning of the Project, as described in Chapter 2, *Alternatives*.

Accidental releases: As discussed in Section 3.13.3.2, non-routine events such as accidental oil or chemical spills can have adverse or lethal effects on marine life; however, APMs such as a spill prevention and a response plan would be developed and implemented during all phases of the Proposed Action. The risk of any type of accidental release would be increased, primarily during construction, but also during O&M and decommissioning of offshore wind facilities (Section A.8.2 in Appendix A discusses the nature of releases anticipated). Modeling by Bejarano et al. (2013) predicted that the impact of smaller spills on benthic invertebrates would be low, and any accidental releases from the Project are expected to be localized. Larger spills are unlikely but could have a larger impact on benthic fauna due to adverse effects on water quality (see Section 3.21, *Water Quality*). Studies conducted by Almeda et al. (2014) indicate that chemical dispersants as well as petroleum-based products such as crude oil are highly toxic to marine zooplankton in low concentrations and the synergistic effects of these chemicals increase the toxicity to marine zooplankton (Almeda et al. 2014; Rico-Martinez et al. 2013). Compliance with USCG regulations would minimize the risk of accidental release of trash or debris. Another potential impact related to vessels and vessel traffic is the accidental release of invasive species, especially during ballast water and bilge water discharges from marine vessels. Vessels are required to adhere to existing state and federal regulations related to ballast and bilge water discharge, including USCG ballast discharge regulations (33 CFR 151.2025) and USEPA National Pollutant Discharge Elimination System Vessel General Permit standards, both of which aim at least in part to prevent the release and movement of invasive species. Adherence to these regulations would reduce the likelihood of discharge of ballast or bilge water contaminated with invasive species. The risk of accidental releases would be increased by the additional vessel traffic associated with the Proposed Action, especially traffic from foreign ports, primarily during construction. The potential impacts on benthic resources are described in Section 3.6. Releases may occur from anti-fouling paints and anti-corrosives that may leach into surface waters. Anti-corrosion and anti-biofouling contamination substances necessary to maintain offshore infrastructures can result in contamination due to galvanic anodes emitting substantial amounts of metals and organic coatings may release organic substances due to weathering or leaching (Kirchgeorg et al. 2018). Contaminations from chemical emissions may include organic compounds such as bisphenol A and metals such as aluminum, zinc, and indium from corrosion and biofouling protection measures and sacrificial anodes (Lloret et al. 2022). Lloret et al. (2022) report that these substances are presently considered to have a low environmental impact but monitoring data are not sufficient to assess the environmental impact of this new source. Impacts would be negligible because there does not appear to be evidence that the volumes and extents anticipated would have any impact on benthic resources.

Accidental releases of substances such as fuel, hazardous materials, and trash are a risk during the construction, operation, and maintenance of the Proposed Action. Some substances may persist in the environment and result in injury to individual animals but are not expected to have population impacts. Adverse impacts on finfish, including the Atlantic sturgeon, and invertebrates and EFH are expected to be short term and negligible.

Discharges: There would be increased potential for discharges from vessels during construction, O&M, and decommissioning of the Proposed Action. Offshore permitted discharges would include uncontaminated bilge water and treated liquid wastes. There would be an increase in discharges, particularly during construction and decommissioning, with localized discharges staggered over time. The volumes of anticipated discharges would be unlikely to have additional water-quality impacts on finfish or invertebrates above what they would experience without the Proposed Action, and impacts would be expected to be negligible.

Anchoring: Vessel anchoring would cause short-term impacts on finfish and invertebrates in the immediate area where anchors and chains meet the seafloor in offshore sandy environments. Impacts would include turbidity affecting finfish and invertebrates, and injury, mortality, and habitat degradation, primarily of invertebrates. All impacts would be localized, turbidity would be temporary, and displacement and mortality from physical contact would be recovered in the short term. Impacts may be higher within sensitive habitats (e.g., eelgrass beds, hard-bottom habitats) and other EFH. Degradation of EFH and other sensitive habitats such as SAV or hard-bottom habitats, if it occurs, could be long term to permanent. As of early 2023, Ocean Wind is developing an anchoring plan, potentially in combination with additional habitat characterization. Such a plan could reduce the area of sensitive habitats affected by anchoring, but avoidance of all sensitive habitats is not likely feasible. During installation of array and substation interconnection cables, Ocean Wind anticipates a maximum of 20 vessels operating during a typical workday in the Wind Farm Area. For offshore export cable installation, Ocean Wind anticipates a maximum of 26 vessels operating during a typical workday. Additional impact discussion related to anchoring is provided in the EFH Assessment (BOEM 2022a).

Atlantic sturgeon would likely depart or avoid unfavorable water quality conditions they may encounter. Suspended sediment and turbidity could result in some temporary avoidance of turbid areas. Any effects from elevated levels of turbidity from the project on Atlantic sturgeon or their prey are considered so small that they could not be measured, detected, or evaluated and are therefore short term and negligible**.**

EMF: During operation, powered transmission cables would produce EMF (Taormina et al. 2018). To minimize EMF generated by cables, all cabling under the Proposed Action would include electric shielding (BENTH-02; COP Volume II Table 1.1-2; Ocean Wind 2023). The strength of the EMF rapidly decreases with distance from the cable (Taormina et al. 2018). Ocean Wind proposes to bury cables to a target burial depth of up to 4 to 6 feet (1.2 to 1.8 meters) below the surface, well below the aerobic sediment layer where most benthic infauna live. Final burial depths will be determined following detailed design and the CBRA (COP Volume I, Section 6.1.1.6; Ocean Wind 2023).

The scientific literature provides some evidence of responses to EMF by fish and mobile invertebrate species (BOEM 2018; Taormina et al. 2018; Normandeau et al. 2011), although recent reviews (CSA Ocean Sciences, Inc. and Exponent 2019; Gill and Desender 2020; Albert et al. 2020) indicate the relatively low intensity of EMF associated with marine renewable projects would not result in impacts. Effects of EMF may include interference with navigation that relies on natural magnetic fields, predator/prey interactions, avoidance or attraction behaviors, and physiological and developmental effects (Taormina et al. 2018).

Atlantic sturgeon are electrosensitive but appear to have relatively low sensitivity to magnetic fields based on studies of other sturgeon species. Magnetic fields associated with the operation of the transmission line could affect benthic organisms that serve as sturgeon prey. Effects on forage fish, jellyfish, copepods, and krill are extremely unlikely to occur given the limited distance into the water column that any magnetic field associated with the transmission line is detectable.

The evidence for magnetic field sensitivity in sharks and rays is more variable. Orr (2016) exposed the benthic draughts board shark (*Cephaloscyllium isabellum*) to a 50-Hz magnetic field operating at 14,300 milligauss and found no observable effects on foraging behavior. In contrast, BOEM (2018) and Hutchison et al. (2020) observed behavioral responses in little skate to induced magnetic fields on the order of 650 milligauss. The available research indicates that while the minimum magnet sensitivity of elasmobranchs is unknown, some species have exhibited observable behavioral responses to anthropogenic EMF at field strengths ranging between 250 and 1,000 milligauss (BOEM 2018; Hutchison et al. 2020; Normandeau et al. 2011). The induced electrical fields generated in even the largest individuals potentially exposed to these effects are less than those generated by muscular and nervous activity in living animals (approximately 10 megavolts per meter) and are therefore likely indetectable (Adair 1998). It is reasonable to conclude that the EMF effects of the inter-array cable on EFH used by epibenthic and demersal pelagic skates and sharks would be insignificant. The 60-Hz electrical fields generated by the cable are above the known detection frequency limit of 20 Hz, while the maximum induced magnetic field and induced electrical field effects are orders of magnitude below the known or probable detection limits of these species. Further detail can be found in the EFH Assessment. CSA Ocean Sciences, Inc. and Exponent (2019) found that offshore wind energy development as currently proposed would have negligible effects, if any, on bottom-dwelling finfish and invertebrates residing within the southern New England area. Although demersal biota would be most likely to be exposed to EMF from power cables, potential exposure would be minimized because EMF quickly decays with distance from the cable source (CSA Ocean Sciences, Inc. and Exponent 2019). In the case of mobile species, an individual exposed to EMF would cease to be affected when it leaves the affected area. An individual may be affected more than once during long-distance movements; however, there is no information on whether previous exposure to EMF would influence the impacts of future exposure. For pelagic species within the southern New England area, no negative effects were expected from offshore wind energy development as currently proposed because of their preference for habitats located at a distance from the seabed. Therefore, BOEM expects localized and long-term, though not measurable, impacts on finfish, invertebrates, and EFH from EMF from the Proposed Action. Section 5.1.4.1 of the EFH Assessment provides a detailed discussion of EMF impacts on EFH and EFH-designated species from the Proposed Action (BOEM 2022a).

Species that use bottom or near-bottom habitats along the potential cable paths during one or more life stages may be exposed to EMF effects. The significance of these potential effects is dependent on habitat use (i.e., likelihood of exposure) and species-specific sensitivity to magnetic and electrical fields and heating effects. Species-specific data on finfish egg and larval sensitivity to EMF effects are lacking. However, general research on fish sensitivity to magnetic and electrical fields suggests that the effects of EMF from the inter-array cable on benthic egg and larval EFH would be insignificant. For example, Cameron et al. (1985) determined that magnetic fields on the order of 1,000 milligauss are required to produce observable developmental delay on the eggs of euryhaline Japanese rice fish. Brouard et al. (1996) exposed rainbow trout embryos to electrical fields ranging as high as 5,000 megavolts per meter and observed no evident effects on development or subsequent survival. These test exposures are orders of magnitude higher than the largest potential EMF effect on benthic habitats likely to result from inter-array cable operation. These findings indicate that the EMF effects of the Project component on benthic EFH for the eggs and larvae of the following species would be insignificant.

Available data for a variety of fish species (e.g., Armstrong et al. 2015; Bevelhimer et al. 2013; Orpwood et al. 2015) indicate that the minimum magnetic field exposure threshold for observable effects on behavior exceeds 1,000 milligauss for most fish species. The minimum threshold for observable detection of electrical fields in electrosensitive fish species is on the order of 20 megavolts per meter (Basov 1999). Each of these thresholds is an order of magnitude or greater than the maximum potential EMF effect likely to result from inter-array cable operation. In a review of EMF effects produced by offshore wind energy, Copping et al. (2016) concluded that induced electrical fields on the order of those generated in fish in close proximity to the inter-array cable would have no observable effects on physiology or behavior.

On this basis, the EMF effects of inter-array cable operation on benthic and epibenthic habitats used by finfish species and finfish prey organisms would be insignificant.

Lighting: Activities associated with the Proposed Action that could cause impacts from lighting on finfish and invertebrates include presence of vessels throughout construction, operation, and decommissioning. Transiting and working vessels associated with construction would use artificial lighting during any operations outside of daylight hours. Light is generally considered an attractant to finfish (Marchesan et al. 2005); therefore, it would be expected that areas where artificial light strikes and penetrates the ocean surface would experience increased fish activity. Lighting may result in impacts on normal behavior of fish and pelagic eggs and larvae by altering their movement and potentially causing temporary increases in predation pressure and disruption of normal swimming behavior, where light may be an attractant to finfish. Light sources from the Proposed Action would involve obstruction lights on the nacelle and mid-mast, which are characterized by intermittent flashes of red hues, and marine navigational lights, which are characterized by intermittent flashes of yellow hues, neither of which present a continuous light source. Artificial light would be minimized to the extent practicable through use of BMPs. No impacts on Atlantic sturgeon from lighting are anticipated.

Cable emplacement and maintenance: The Proposed Action would entail approximately 384 miles of new cable installation, which includes inter-array cables (194 miles) and offshore export cables (190 miles) and impacts (disturbance, displacement, injury, and mortality) of cable emplacement and maintenance under the Proposed Action are estimated to affect up to 172 acres (0.7 km^2) of seafloor within the export cable route corridors and 221 acres (0.9 km^2) in the Wind Farm Area. The primary impact on finfish, invertebrates, and EFH associated with cable emplacement is related to sediment resuspension during burial of cables and cable placement. Nearshore/inshore environments such as back bays where cable installation would occur would likely cause temporary displacement of finfish and mobile invertebrates due to sediment resuspension in the water column. In general, nearshore environments have finer sediments that take longer to settle back to the seafloor, thus potentially causing impacts on EFH.

Sediment within the Wind Farm Area is generally medium to coarse grained with areas of gravelly sand and gravel deposits near the Wind Farm Area (COP Volume II, Section 2.1.2.2.1; Ocean Wind 2023). Based on the grain sizes evaluated for similar projects in Massachusetts, Rhode Island, and Virginia, the medium- to coarse-grained sand deposits near the Wind Farm Area are likely to settle to the bottom of the water column quickly and sand re-deposition would be minimal and close, estimated within 525 feet (160 meters) of the trench centerline (COP Volume II, Section 2.1.2.2.1; Ocean Wind 2023). Based on USACE dredging projects in New York Harbor, dredging sediment with a high percentage of fine-grained particles dissipates quickly over distance within 656 feet (200 meters) to levels that are not detectable against background conditions. Furthermore, modeling for a similar project (BOEM 2015) indicated maximum deposition would still be anticipated nearest the disturbance and within 328 feet (100 meters) of the trench deposition and would not be expected to exceed 0.04 inch (1 millimeter). Even though invertebrates have a range of susceptibility to sedimentation based on life stage, mobility, and feeding mechanisms, invertebrates in this area would be expected to recover in the short term, resulting in minor impacts. Based on Wilber and Clarke (2007), full recovery of the benthic faunal assemblage may take several years. Mechanical trenching, used in more-resistant sediment (e.g., gravel, cobble), causes seabed profile alterations during use, although the seabed is typically restored to its original profile after utility line installation in the trench. Sand and gravel substrates typically take longer to recover to pre-disturbance conditions than habitats with finer grain sizes (Wilber and Clarke 2007). Sediment plumes in the water column would likely cause temporary displacement of finfish and mobile invertebrates, but they would be expected to return following settlement of sediments.

Sand wave clearance may be required in order to install cables at a sufficient depth that they would not be uncovered as a result of sand wave mobility. Cable emplacement and maintenance activities may flatten depressions and small sand waves, temporarily reducing benthic habitat suitability for species such as red and silver hake within the cable footprint. Prey organisms that use these habitats would also be displaced, potentially affecting habitat suitability for fish species. Trenching may leave behind temporary depressions. The extent of these natural features is difficult to quantify, as they are continually reshaped by natural sediment transport processes. Natural recovery from anthropogenic disturbance is likely to occur within several months of the disturbance, depending on timing relative to winter storm events. Due to their mobility, it is expected that the sand wave profiles would rapidly return after cable installation. Although it is anticipated that hydrodynamics would be altered by the presence of structures, it is not expected that this would be to a degree that prevents the processes of sand wave formation and migration.

Larger-scale ridge and trough morphology present in the Wind Farm Area is considered to be more stable and permanent when compared with sand waves, with associated slopes generally less than 1 degree, although vertical relief may be as much as 49 feet (15 meters). During construction, seabed alterations resulting from the Proposed Action could lead to short-term impacts for invertebrates, including habitat alteration, injury, and mortality. Under the Proposed Action, the impacts on benthic resources from seabed alteration, including injury, mortality, and short-term habitat disturbance, would be negligible to minor. Ridges and troughs, sand waves, and boulders are all features present in the Wind Farm Area and export cable route corridors; however, disturbance for cable emplacement would be temporary and short term.

Despite unavoidable mortality, damage, or displacement of invertebrate organisms during sand wave and boulder clearance, the area affected by the construction footprint within the Wind Farm Area and export cable route corridor (393 acres [1.6 km^2] total of export and inter-array cables, substation connector cables, and export cables) would be a fraction of available benthic habitat. Contractors and engineers for Ocean Wind would perform additional surveys and evaluation of geological conditions in the surface and shallow subsurface layers as a part of the CBRA (COP Volume I, Section 6.1.1.6; Ocean Wind 2023) prior to developing the precise route. This process would minimize impacts on complex bottom and maximize the likelihood of sufficient cable burial. BOEM does not expect population-level impacts on benthic invertebrates (i.e., generally accepted ecological and fisheries methods would be unable to detect a change in population, which is the number of individuals of a particular species that live within the geographic analysis area) as a result of the Proposed Action. Invertebrates would recolonize disturbed areas that have not been displaced by new structures, as discussed in Section 3.6, *Benthic Resources*.

Prey species consumed by EFH fish and invertebrate species are also a component of EFH and include forage fish such as Atlantic menhaden, bay anchovy (*Anchoa mitchilli*), and sand eel/sand lance (*Ammodytes americanus*) and invertebrates such as clams, crabs, and worms. Impacts on prey species may lead to indirect impacts on EFH and EFH species and life stages due to lost foraging opportunities. Adverse impacts on these species may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. The EFH final rule also states that the loss of prey may have an adverse effect on EFH and managed species. As a result, actions that reduce the availability of prey species, either through direct harm or capture or through adverse impacts on the prey species' habitat, may also be considered adverse effects on EFH. Adverse effects on EFH may result from actions occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions. For example, a prey species such as the sand lance may be affected by cable placement activities; loss of sand habitat due to scour protection and potential entrainment from hydraulic dredging of the ocean bottom are both likely to have localized and temporary impacts on the species. However, suitable habitat is present throughout the New Jersey continental shelf outside the Project area and the population would not be affected. Additional information on the sand lance can be found in the EFH Assessment (BOEM 2022a).

Array cables would be installed via hydroplow where possible, with alternative methods to include surface lay, trenching, jetting, plowing and pre-plowing, vertical injection, and controlled-flow excavation as necessary. Several of these methods use water withdrawals that can entrain invertebrate larvae (MMS 2009; USEPA 2003). Minor impacts would result from the unavoidable entrainment of benthic organisms or their planktonic larvae during cable installation. Due to the limited time and area involved, BOEM does not expect population-level impacts. The consequences of increased turbidity caused by this IPF are discussed in Section 3.13.3.2.

Impacts on SAV would be minimized during export cable installation, where practicable, using trenchless (e.g., HDD) cable installation. During HDD, there is the potential for inadvertent returns of drilling muds and subsequent impacts on benthic resources. An Inadvertent Return Plan would be implemented to prevent and minimize impacts (COP, Volume II, Table 1.1-2; Ocean Wind 2023). Open-cut trenching is being considered for landfalls not under the USACE beach nourishment program, including the west side of Island Beach State Park (Prior Channel Route) and the west side of Barnegat Bay at the Farm/Holtec landfall due to elevated risks of inadvertent returns of drilling mud occurring during HDD. HDD installation at the southern cable option at Island Beach State Park would be limited by engineering constraints to a length of approximately 1,181 feet (360 meters) into Barnegat Bay. As a result, the HDD exit pits would be within intact SAV beds. Open-cut trenching for the northern cable option allows for reduced cable separation (66 feet [20 meters]), which minimizes impacts on the intact SAV beds to the north and south of the prior channel (Ocean Wind 2023). Table 3.13-2 presents a comparison of short-term SAV impacts for HDD and open-cut trenching for Oyster Creek landfall options. Ocean Wind has committed to restoration of SAV at a ratio of 3:1 for affected SAV if the Project is approved, consisting of mapping efforts, monitoring activities, restoration of documented impacts at an in-situ 1:1 ratio, as well as additional research to improve SAV mitigation in the future. A 4-year monitoring program (2023–2027) would implement surveys to quantify the actual impacts of construction activities to better identify the extent of area required for mitigation.

Impacts from seabed disturbance due to open-cut trenching and HDD are anticipated to be localized and short term due to their temporary nature. Mobile life stages would move out of the area to avoid potential impacts. However, demersal non-mobile life stages would be affected due to removal of the sediment on which they occur. Most juvenile and adult finfish would actively avoid all construction activities. Immobile finfish life stages such as demersal eggs and larvae and sessile organisms may also experience mortality as a result of being crushed or buried during trenching or HDD.

Applicable to construction, O&M, and decommissioning impacts, Ocean Wind has committed to a benthic monitoring plan (APM Gen-06) and submerged aquatic vegetation monitoring plan. Monitoring would be implemented so that environmental conditions are monitored during construction, O&M, and decommissioning phases.

Dredging may also be required in the shallow areas of Barnegat Bay to allow vessel access for export cable installation. Locations include the prior channel (west side of Island Beach State Park/east side of Barnegat Bay), the west side of Barnegat Bay at the export cable landfall, and the Oyster Creek section of the federal channel in Barnegat Bay if USACE is unable to conduct dredging in this area as part of the federal channel dredging that is currently under contract. In 2020, USACE completed an environmental assessment, Section 7 ESA consultation, and EFH Assessment for maintenance dredging of the Barnegat

Inlet Federal Navigation Project and use of maintenance material for shoreline protection and habitat creation/restoration in Barnegat Bay. This analysis concluded that dredging Oyster Creek channel and beneficial use placement operations were not anticipated to result in significant direct, indirect, or cumulative adverse impacts on federally or state-listed threatened or endangered species (USACE 2020). NMFS concurred that the action was not likely to adversely affect listed species or critical habitat.

As discussed in Section 3.13.3.2, dredging activities associated with cable installation could affect the Atlantic sturgeon through impingement, entrainment, and capture associated with mechanical and hydraulic dredging techniques. The risk of interactions between sturgeon and mechanical dredges is thought to be highest in areas where large numbers of sturgeon are known to aggregate; however, there are no known areas of sturgeon aggregations within the proposed areas for dredging for the Project. The likelihood of an Atlantic sturgeon becoming entrained and entrapped in a mechanical dredge associated with the Proposed Action is considered extremely low due to the rarity of sturgeon in the area to be dredged and the lack of attraction observed between Atlantic sturgeon and dredges.

Juvenile Atlantic sturgeon are known to inhabit estuarine environments for up to a year before migrating out into the ocean (ASMFC 2012). Although the presence of SAV has been recorded in Barnegat Bay, no known strong association has been documented between juvenile Atlantic sturgeon and SAV (ASMFC 1997). Additionally, no juvenile or adult Atlantic sturgeon were recorded during a 3-year trawl survey of Barnegat Bay that spanned all four seasons (Valenti et al. 2017). It is not anticipated that dredging in Barnegat Bay due to inshore export cable installation would affect juvenile Atlantic sturgeon.

Dredging in sand waves to allow for cable installation is anticipated to result in the entrainment and mortality of some sand lances, as discussed in Section 3.13.3.2. However, given the opportunistic feeding nature of Atlantic sturgeon, the size of the area where dredging would occur, and the short duration of the dredging, the loss of benthic invertebrates and sand lance would be small, temporary, and localized. It is expected any impact of the loss of Atlantic sturgeon prey items to be so small that it cannot be meaningfully measured, evaluated, or detected.

Ocean Wind’s conservative estimate of detonation in place of up to 10 UXOs would result in habitat loss, reduced water quality, and physical disturbance, harm, and mortality in fish and marine invertebrates as described in Section 3.13.3.2. UXO detonations would occur on different days, such that only one UXO would be detonated within a 24-hour period. If demolition is necessary, APMs including a dual noise-mitigation system with 10-dB attenuation, seasonal restrictions between January and April, and post-detonation monitoring for injured or dead fish would be implemented. Impacts on finfish are expected to be adverse, but localized and short term, and therefore negligible. Atlantic sturgeons are unlikely to be affected by seabed disturbance in offshore areas or in Barnegat Bay. Effects of displacement of Atlantic sturgeon and its prey from physical disturbance of sediment are anticipated to be negligible and are further addressed in the BA (BOEM 2022b).

Table 3.13-2 Short-Term SAV Impacts by Installation Method for Oyster Creek Inshore Export Cable Route Corridor Landfall Options[1]

Data	Island Beach State Park – Base Case (Acres		Island Beach State Park – Prior Channel (Acres)		Holtec/The Farm (Acres)		Bay Parkway One Shot (Acres)		Bay Parkway (Acres)		Nautilus (Acres)		Lighthouse (Acres)		Marina (Acres)	
	HDD[2]	Open Cut[3]	HDD[4]	Open Cut	HDD	Open Cut	HDD	Open Cut	HDD	Open Cut	HDD	Open Cut	HDD	Open Cut	HDD	Open Cut
1979 Data	15.25	-	-	0.89	0	1.49	0.09	1.19	0	1.49	0	0.20	0	1.19	0	2.09
1985–1987 Data	13.17	-	-	14.01	0	0	0.87	1.99	0.57	2.39	0	1.29	0.25	1.49	0.15	2.98
2009 Data	11.78	-	-	1.80	0	1.59	1.86	2.98	0.22	2.09	0	0.99	0	0.80	0	0.50
Ocean Wind Survey Data	13.86	-	-	8.35	0	1.89	0.32	0.89	0	0.99	0	0.70	0	0.90	0	0.30

[1] Assumes 82-foot disturbance corridor width for open-cut trenching installation method and cable installation and seafloor preparation.
[2] HDD area calculated using boundary of HDD pit trench.
[3] Open-cut trenching installation not proposed for Island Beach State Park southern cable route option.
[4] HDD installation not proposed for Island Beach State Park northern cable route option.

Noise: Activities associated with the Proposed Action that could cause underwater noise effects on finfish and invertebrates are pile driving, drilling, vessel traffic, aircraft, geophysical surveys (HRG surveys and geotechnical drilling surveys), WTG operation, jet-plowing/cable installation, and seabed preparation activities. Pile driving would produce the most-intense underwater noise impacts with the greatest potential to cause injury-level and behavioral effects on finfish and invertebrates and operational WTG noise would occur over the longest duration; therefore, these effects are the focus of the Proposed Action assessment below. Further discussion of impacts from noise on finfish and invertebrates from Project-related activities is provided in the EFH Assessment and BA (BOEM 2022a and 2022b, respectively). Additionally, discussion specific to G&G-related noise impacts is presented in the BA (BOEM 2022b) and Appendix C of the acoustic modeling report (Küsel et al. 2021).

Impacts from sound vary based on the intensity of the noise and the method of sound detection used by the animal. However, severe impacts could include physiological reactions such as ruptured capillaries in fins, hemorrhaging of major organs, or burst swim bladders (Popper et al. 2014), which could lead to mortality or behavioral reactions such as temporary displacement or temporary disruption of normal activities such as feeding or movement. Assessment of the potential for underwater noise to injure or disturb a fish or invertebrate requires acoustic thresholds against which received sound levels can be compared. The most conservative available injury thresholds for fish were developed by the Fisheries Hydroacoustic Working Group (2008) and Popper et al. (2014) and are provided in Table 3.13-3. The current threshold classification considers effects on fish mainly through sound pressure without taking into consideration the effect of particle motion. Popper et al. (2014) and Popper and Hawkins (2018) suggest that extreme levels of particle motion induced by various impulsive sources may also have the potential to affect fish tissues and that proper attention needs to be paid to particle motion as a stimulus when evaluating the effects of sound on aquatic life. However, lack of evidence for any source due to extreme difficulty of measuring particle motion and determining fish sensitivity to particle motion currently renders establishing guidelines or thresholds for particle motion exposure not possible (Popper et al. 2014, 2022; Popper and Hawkins 2018).

Table 3.13-3 Acoustic Metrics and Thresholds for Fish Currently Used by NMFS and BOEM for Impulsive Pile Driving

Faunal Group	Injury		Impairment		Behavior
	Physical Injury		TTS		L_p
	L_{pk}	$L_{E,\ 24hr}$	L_{pk}	$L_{E,\ 24hr}$	
Fish equal to or greater than 2 grams	206	187	--	--	150
Fish less than 2 grams		183	--	--	
Fish without swim bladder	213	216	--	--	--
Fish with swim bladder not involved in hearing	207	203	--	--	--
Fish with swim bladder involved in hearing	207	203	--	--	--

Source: Küsel et al. 2021; FHWG 2008; Popper et al. 2014.
L_E = sound exposure level (decibel re 1 micropascal square second); L_p = root-mean-square sound pressure (decibel re 1 micropascal); L_{pk} = peak sound pressure (decibel re 1 micropascal); PTS = permanent threshold shift

Very few studies have measured the underwater particle motion of turbines. The results of Sigray and Andersson (2011) suggested that the effects of wind turbine underwater noise are restricted to the immediate vicinity of the wind turbine; they also identified the correlation between the mechanical vibrations of the turbine tower and the sound pressure between the vibrations and the particle motion in the water column. Results of laboratory studies provide evidence of the negative effects of offshore wind facility construction sounds on the common cuttlefish (*Sepia officinalis*), the most abundant cephalopod in the northeast Atlantic (Sole et al. 2022). The severity of the effects was dependent on distance from the sound source and was considered acute only in the very vicinity of the sound source where they have the potential to affect cephalopod populations and their offspring.

There is no available information on the hearing capabilities of Atlantic sturgeon specifically, although the hearing of other species of sturgeon have been studied. Meyer et al. (2010) and Lovell et al. (2005) studied the auditory system morphology and hearing ability of lake sturgeon (*Acipenser fulvescens*), a closely related species. The Acipenseridae (sturgeon family) have a well-developed inner ear that is independent of the swim bladder and therefore it appears that sturgeon rely directly on their ears to hear. The results of these studies indicate a generalized hearing range from 50 to approximately 700 Hz, with greatest sensitivity between 100 and 300 Hz. Popper (2005) summarized studies measuring the physiological responses of the ear of European sturgeon (*Acipenser sturio*). These results suggest sturgeon are likely capable of detecting sounds from below 100 Hz to about 1 kilohertz. Noise impacts may occur due to impact pile driving for WTGs and OSS foundations and effects of exposure that may result in physiological injury and behavior disturbance; UXO detonations, which generate high pressure levels that could kill, injure, or disturb Atlantic sturgeon; and non-impulsive noise from vibratory pile driving associated with HRG surveys, vessels, aircraft, cable laying and trenching, dredging, and WTG operations that may result in injury or behavioral changes. The Programmatic BA prepared to evaluate impacts from geotechnical and HRG surveys on the OCS (NMFS 2021d) concluded that no impacts on ESA-listed species, including the Atlantic sturgeon, from these activities are likely to occur.

Currently, there are no underwater noise thresholds for invertebrates. Marine invertebrates lack internal air spaces and gas-filled organs needed to detect sound pressure and so are considered less likely to experience injury from over-expansion or rupturing of internal organs, the typical cause of lethal noise-related injury in vertebrates (Popper et al. 2001). Noise thresholds for adult invertebrates have not been developed because of a lack of available data, but some invertebrates are responsive to particle motion and are therefore capable of vibration reception (e.g., crustaceans, squid) (Mooney et al. 2020). This is supported by other studies that found American lobster and shore crabs (*Carcinus maenas*) to have some capability to detect and respond to sound (Jézéquel et al. 2021; Aimon et al. 2021). Noise has also been shown to affect bivalves based on reactions where bivalves close their valves and burrow deeper when subjected to noise and vibration stimuli (Roberts and Elliott 2017). Prolonged valve closure could result in reduced respiration and growth in bivalves, prevent expulsion of wastes, and lead to mortality at a local level. These studies provide evidence to suggest that vibrations from pile driving adversely affect benthic invertebrates. A recent study (Roberts and Elliott 2017) demonstrated that blue mussels exhibited behavioral and physiological changes compared to control animals, including variation in valve gape and oxygen demand. Vibration may be used by marine species for the detection of biotic and abiotic cues and, consequently, exposure to additional vibration may elicit behavioral or physiological change, or even physical damage at high amplitudes or particular frequencies.

The longfin squid has been found to exhibit an initial startle response, comparable to that of a predation threat, to pile-driving impulses recorded from a wind farm installation but, upon exposure to additional impulses, the squid's startle response diminished quickly, indicating potential habituation to the noise stimulus (Jones et al. 2020, 2021; Mooney et al. 2020). After a 24-hour period, the squid seem to re-sensitize to the noise, which is an expected response to natural stimuli, as well. Squid schooling and shoaling behavior could be interrupted when exposed to pile-driving impulse noises, which could affect predation risk. Feeding behavior in longfin squid was disrupted by exposure to playbacks of pile-driving noise, resulting in increased failure of predation attempts on killfish. Regardless of whether they were hunting, squids exhibited comparable alarm responses to noise. Hearing measurements confirmed the noise was detected by the squid (Jones et al. 2021).

Fish communicate acoustically and are therefore subject to external, potentially masking, noise arising from abiotic sources including wind, rain, and waves, as well as biotic noise such as chorusing from conspecifics or heterospecifics (Mooney et al. 2020). Radford et al. (2014) report that acoustic communication in fish, including during territorial disputes and competition for food, predatory attacks, courtship interactions, and spawning aggregation, demonstrate the importance of communication and the potential impacts on survival and reproductive success of fish. However, acoustic masking is an environmental stressor that ceases as soon as the noise source stops; unlike other stressors, there is no lingering effect. The highest levels of noise from offshore wind occur during construction and are associated with pile driving for fixed-bottom turbine installation; noise produced during operation of the wind farm is expected to be lower than during construction (SEER 2022). However, several studies have reported negative environmental impacts associated with both the construction and operational stages of offshore wind farms (Siddagangaiah et al. 2021). The long-term effects of noise from offshore wind facility operation may be inferred from other long-term noise sources such as shipping, boat, and aquaculture noise, which include stress and corresponding physiological impacts, avoidance, and masking effects in fish; however physical injury due to turbine noise is unlikely (Mooney et al. 2020). Noise from UXO detonations also has the potential to kill, injure, or disturb Atlantic sturgeon (the only ESA-listed fish anticipated, as described in Section 3.13.1), but impacts on the sturgeon would effectively be eliminated by seasonal restriction of UXO detonations from January through April (described later in this section). The primary impacts of noise on finfish and invertebrates are therefore expected to occur during offshore construction activities associated with the Proposed Action. Research has shown that finfish can suffer behavioral and physiological effects based on received sound levels, distance from the noise, and variables related to the noise-producing impact (e.g., materials, size of hammer). Results from studies that examined the potential negative effects of exposure to pile driving on various marine species reviewed by Mooney et al. (2020) show diverse impacts on a range of taxa that indicate physical damage of barotrauma in striped bass, hogchoker, lake sturgeon, Chinook salmon, and Nile tilapia; loss of auditory hair cell loss in hybrid striped bass exposed to pile-driving noise; increased oxygen consumption in response to pile-driving noise; and behavioral escape and predator avoidance in longfin squid. Recent studies of the impacts of noise on black sea bass indicate its auditory detection bandwidth, and the most sensitive frequencies, directly overlap with high-amplitude noise such as underwater construction and suggest the most sensitive range of this species' sound detection capabilities directly overlaps with the highest sound energy created from pile-driving activity (Stanley et al. 2020). A study of the impacts of both pile driving and wind turbine operation in Taiwan waters (Siddagangaiah et al. 2021) found changes in fish chorusing due to both pile driving and operations.

As explained above, any response from invertebrates would be of lower magnitude than that of fish because they tend to be less sensitive to noise exposure. Noise from impact pile driving for the installation of WTGs and OSS foundations would occur intermittently during the installation of offshore structures. A total of 98 WTGs are anticipated for the Proposed Action. Each WTG requires one monopile and each pile requires 4 to 6 hours of driving to install. This would occur over a maximum-case scenario of a total of 98 days over 2 years. Acoustic propagation modeling of the impact pile-driving activities for the Proposed Action was undertaken by JASCO Applied Sciences to determine distances to the established injury and disturbance thresholds for fish (Küsel et al. 2021). Two types of piles were considered: 8- and 11-meter tapered monopiles (26 feet [8 meters] at the waterline and 36 feet [11 meters] at the mudline) and 2.44-meter pin piles. The tapered monopiles for WTG foundations under the Proposed Action would be 11 meters (37 feet) in diameter at the seabed and 8 meters (26 feet) in diameter at the sea surface (Ocean Wind 2023); however, Project development has carried forward a monopile with a maximum outer diameter of 11 meters (37 feet) (Ocean Wind 2023). Impact hammer installation of the monopile foundations would produce the most-intense underwater noise impacts with the greatest potential to cause injury-level effects on fish; therefore, these effects are the focus of the assessment below. Sound fields from 8- and 11-meter monopiles were modeled at one representative location in the Offshore Project area using IHC S-4000 and IHC S-2500 impact hammers. The modeling also used a 10-dB-per-hammer-strike noise attenuation to incorporate the use of a single noise-abatement system[4] (e.g., one or multiple bubble curtain[s]). This attenuation is considered achievable with currently available technologies (Bellmann et al. 2020). The resulting values represent a radius extending around each pile where potential injurious-level or behavioral effects could occur and are presented in Table 3.13-4. Soft start during impact pile driving is a mitigation technique that involves the gradual increase in hammer blow energy to allow marine life to leave the area. Soft starts would be employed prior to commencement of any impact pile driving. Soft starts would include at least 20 minutes of four to six strikes per minute at 10 to 20 percent of the maximum hammer energy (COP Volume III, Appendix AA; Ocean Wind 2023). Additional discussion related to impacts on finfish and invertebrate species is provided in the BA and the EFH Assessment (BOEM 2022a, 2022b).

Table 3.13-4 Summary of Acoustic Radial Distances (R_{max} in kilometers) for Fish during Monopile Impact Pile Installation

Threshold Type	Threshold Level	Acoustic radial distances (R_{max} in km) during summer	Acoustic radial distances (R_{max} in km) during winter
Behavioral (all fish)	150 dB re 1 μPa SPL_{RMS}	5.18	7.54
Injury (all fish)	206 dB re 1 μPa SPL_{peak}	0.07	0.07
Injury (fish over 2 grams)	187 dB re 1 $μPa^2s$ SEL_{cum}	4.93	6.85
Injury (fish under 2 grams)	183 dB re 1 $μPa^2s$ SEL_{cum}	6.06	9.35

Source: Küsel et al. 2021.
Notes: Cumulative sound exposure level values were calculated for a 24-hour period for the installation of a single 8- and 11-meter tapered monopile using a IHC S-4000 hammer.
dB re 1 μPa SPL_{peak} = decibel re 1 micropascal peak sound pressure level; dB re 1 μPa SPL_{RMS} = decibels re 1 micropascal root-mean-square sound pressure level; dB re 1 $μPa^2s$ SEL_{cum} = decibel re 1 micropascal squared second cumulative sound exposure level; km = kilometers; R_{max} = maximum range

The single-strike (or peak sound pressure level [SPL_{peak}]) injury distances represent how close a fish would have to be to the source to be instantly injured by a single pile strike. The cumulative injury distances consider total estimated daily exposure, meaning a fish would have to remain within that threshold distance over an entire day of exposure to experience injury. The exposure distances for behavioral effects are instantaneous values, meaning that any animal within the effect radius is assumed to have experienced behavioral effects.

The likelihood of injury from monopile installation depends on proximity to the noise source, intensity of the source, effectiveness of noise-attenuation measures, and duration of noise exposure. Results from the modeling show that injury from a single strike is limited to 70 meters from the pile for both winter and summer seasons and injury from prolonged cumulative exposure (over 24 hours) extends as far as 9.35 kilometers from the pile during the winter water profile. Modeling indicates that behavioral effects on fish could occur up to 7.54 kilometers from the pile source during the winter and 5.18 kilometers from the pile source during the summer. Within this area, it is likely that some level of behavioral reaction is expected and could include startle responses or migration out of areas exposed to underwater noise (Hastings and Popper 2005). Behavioral disturbance to fish from pile driving noise is therefore considered temporary for the duration of the activity. To mitigate impacts to the extent practicable, the Project would employ either a double big bubble curtain or a single big bubble curtain in combination with a hydrodamper to achieve a minimum of 10 dB of noise reduction. Additionally, the Project would employ soft starts during impact pile driving, allowing a gradual increase of hammer blow energy, thus allowing mobile marine life to

[4] Note that the noise-abatement system implemented must be chosen, tailored, and optimized for site-specific conditions.

leave the area. Soft starts would be employed on the Project such that, prior to the commencement of any impact pile driving (and any time following a cessation of 30 minutes or more), soft-start techniques would be implemented and would include at least 20 minutes of four to six strikes per minute at between 10 and 20 percent of the maximum hammer energy.

Fish response would be highest near impact pile driving (within tens of meters), moderate at intermediate distances (within hundreds of meters), and low at farther distances (within thousands of meters) (Küsel et al. 2022). During active pile-driving activities, highly mobile finfish likely would be displaced from the area, most likely showing a behavioral response; however, fish in the immediate area of pile-driving activities could suffer injury or mortality. The soft-start mitigation measure would minimize impacts by inducing fish to leave the immediate vicinity of the pile-driving activity. Affected areas would likely be recolonized by finfish in the short term following completion of pile-driving activity. Early sessile life stages of finfish, including eggs and larvae, could experience mortality or developmental issues as a result of noise; however, thresholds of exposure for these life stages are not well studied (Weilgart 2018).

Species occurring in the Wind Farm Area most sensitive to noise associated with pile-driving activities would be fishes that have a swim bladder involved with hearing such as the Atlantic herring (Küsel et al. 2022). Previous studies have demonstrated both mortality and no mortality in this group of fish due to pile driving. The least-affected species with designated EFH in the Lease Area include invertebrates, sharks, rays, flounders, and some tunas. These species do not have an air bladder and rely on particle motion for hearing, reducing any damage induced by sound pressure (Popper et al. 2014). This group also includes sessile species (Atlantic surfclam and ocean quahog). Although these species are less sensitive to sound pressure, they are similar to eggs and larvae in that they cannot avoid or retreat from potentially damaging sound pressure and would be subject to injury and mortality when sound pressure occurs within a certain radial distance from pile driving. A dual noise-mitigation system would be deployed for all impact pile-driving events, which would be a combination of two devices (e.g., bubble curtain, hydro-damper) to achieve 10 dB noise attenuation, to reduce noise propagation during monopile foundation pile driving (COP Appendix AA; Ocean Wind 2023). The soft-start mitigation measure would minimize impacts by inducing fish to leave the immediate vicinity of the pile-driving activity, while the noise mitigation system would minimize behavioral and physical impacts resulting from pile driving on any fish that remain in the area.

Pile driving during site preparation activities is anticipated to adversely affect habitat for both pelagic and demersal life stages; however, this impact would be short term and habitat is expected to return to pre-pile driving conditions, allowing fish and invertebrates to return. It is important to note that there is potential that concurrent pile-driving activities are possible from the nearby Atlantic Shores South offshore wind lease area. If pile-driving activities occur within 9.35 kilometers (the maximum distance where injury to finfish could occur if the pile driving occurs for a period of over 24 hours), it is possible that finfish could experience continuous cumulative exposure to noise exceeding 24 hours, which could potentially result in injury to finfish. The pile-driving plan and timing for pile-driving activities for the Atlantic Shores South offshore wind lease area are unknown, thus this impact can be considered; however, a determination regarding cumulative exposure cannot be made.

Other studies have concluded that operational noise from WTGs is detected by and affects behavior in finfish. For example, the particle motion generated at a WTG foundation from the turbine operation was found to generate relatively strong broadband sounds as well as tones likely to induce behavioral responses by fishes such as cod and plaice in the Baltic Sea (Hawkins 2020). As reported by Mooney et al. (2020), there was increased catchability of cod and roach (*Rutilus rutilus*) within 100 meters of a stopped WTG (i.e., no noise) compared to an operating WTG, and delayed metamorphosis of crab megalopae (larval stage) in response to operating turbine noise. WTG noise frequency and level were found to overlap with the auditory sensitivity of the marbled rockfish (*Sebastiscus marmoratus*), indicating the turbine noise could be detected by fish and may have a masking effect on their acoustic communication (Zhang et al. 2021).

Offshore WTGs produce continuous, non-impulsive underwater noise during operation, mostly in lower-frequency bands below 8 kilohertz. Operation of the Project would include continuous noise from 98 WTGs over 30 years. There are several recent studies that present sound properties of similar turbines in environments comparable to that of the Proposed Action. These are presented in detail in the marine mammal section (Section 3.15). Studies indicate that operating turbines (e.g., both older-generation, geared turbine designs and quieter, modern, direct-drive systems like those proposed for the Wind Farm Area) produce underwater noise on the order of 110 to 125 dB re 1 µPa root-mean-square sound pressure level (SPL_{RMS}) at a reference distance of 50 meters, occasionally reaching as high as 128 dB re 1 µPa SPL_{RMS}, in the 10-Hz to 8-kilohertz range (Tougaard et al. 2020). It is important to note that the Tougaard et al. (2020) study assumed that the largest monopile-based WTG was 3.6 MW, which is smaller than those being considered for the Project, which are likely to range from 12.4 MW to 14.7 MW. Larger turbines are also taller, and the distance from the noise source in the nacelle to the water is greater in the larger turbines. Statistical models were developed by Tougaard et al. (2020) that showed the increase in SPL from WTGs with increased turbine size (approximately 5 SPL per MW) and the decline in SPL with distance from the WTG. The underwater noise from individual wind turbines is still low compared to the noise radiated from cargo ships despite turbines now being larger and more measurements (for models) being available (Tougaard et al. 2020). When compared[5] to injury thresholds for fish, no physiological effects on fish as a result of WTG operational noise is anticipated. In addition, WTG operational noise is not expected to exceed fish behavioral thresholds. More recently, Stöber and Thomsen (2021) attempted to estimate operational noise from larger current-generation, direct-drive WTGs. They found that these designs could generate higher operational noise levels than those reported in earlier research; however, these findings have not yet been validated. Tougaard et al. (2020) report that noise from operating WTGs is lower than noise from passing ships despite their larger size, but remains static, while ship noise does not. Moreover, if ambient noise in the area is high, such as with wind farms near shipping lanes, noise from operating WTGs would only be detectable above ambient noise very close to the WTGs (Tougaard et al. 2020). van der Molen et al. (2014) also predicted changes would be most concentrated within the wind turbine array and smaller changes can occur up to several tens of kilometers outside the array, based on acoustic model results. However, the combined contribution of multiple turbines and the scale at which they occur means that the cumulative effects must also be considered.

Collectively, noise from the WTG operations could have limited adverse effects on habitat suitability for finfish, invertebrates, and EFH within a certain distance of each monopile foundation. The extent of these effects is difficult to quantify, as they will vary depending on wind speed, water temperature, ambient noise conditions, and other factors. Applying the sensitivity thresholds detailed in Section 5.1.1.2 of the EFH Assessment, potential adverse effects on habitat suitability for squid and fish belonging to the hearing specialist group are estimated to extend up to 164 feet (50 meters) from each foundation. This equates to adverse effects on habitat suitability over 46 acres (18.6 hectares) for the 37-foot (11-meter) monopile.

Several reports have noted that offshore wind farms attract fish and invertebrate species as a result of providing an artificial reef effect (Russel et al. 2014; Degraer et al. 2020). As a result, adverse behavioral effects from operation of WTGs are not considered likely for some species. Ship noise, such as from transport or survey boats, is intermittent but can mask the communication signals of haddock (*Melanogrammus aeglefinus*), cod, and other taxa, which may also induce physiological stress and impair foraging and predator responses in both fish and invertebrates. However, acoustic masking is an

[5] To compare source levels in dB re 1 µPa SPL_{RMS} with thresholds in dB re 1 µPa SPL_{peak}, 10 dB must be subtracted from peak values in dB re 1 µPa (WSDOT 2020).

environmental stressor that ceases as soon as the noise source stops; unlike other stressors, there is no lingering effect.

In addition to operational noises described above, there is a potential for interactions with UXO as well as the corrosion of UXO in the Project area. Ocean Wind may encounter UXOs on the seabed in the Lease Area and along export cable routes. While non-explosive methods may be employed to lift and move these objects, some may need to be removed by explosive detonation. Underwater explosions of this type generate high pressure levels that could kill, injure, or disturb Atlantic sturgeon (the only ESA-listed fish anticipated, as described in Section 3.13.1). However, the APM seasonal restriction of UXO detonations from January through April would effectively eliminate the likelihood of any exposures for Atlantic sturgeon. Should a sturgeon be exposed to noises above behavioral thresholds, the effects would likely be brief (e.g., Atlantic sturgeon may be startled and divert away from the area), and any effects would be so small that they could not be measured, detected, or evaluated.

Geotechnical surveys (drilling, cone penetration testing, and vibracores) related to offshore activities are typically numerous but very brief sampling activities that introduce relatively low levels of sound into the environment. The geotechnical surveys would take place prior to construction and no geotechnical surveys are planned for the construction or post-construction phases. The HRG and geotechnical surveys would help identify sensitive habitats (e.g., shellfish, SAV beds) and allow these areas to be avoided to the extent practicable for siting of the WTGs, OSS, and cable routes. BOEM’s regulations and guidance under 30 CFR 585.626 and 585.627 require the lessee to submit detailed G&G data and analysis, among other data requirements to establish engineering and other construction parameters, and the G&G activities are therefore mandatory.

Surveys would include equipment operating at less than 180 kilohertz and consist of multibeam depth sounding, seafloor imaging, and shallow- and medium-penetration sub-bottom profiling within the Project area. General vessel noise is produced from vessel engines and dynamic positioning to keep the vessel stationary while equipment is deployed and sampling is conducted for these surveys. The Atlantic sturgeon is the only ESA-listed fish species in the Project area that may be affected by these surveys (BOEM 2018). Impacts on the Atlantic sturgeon from these activities are summarized in Section 3.13.1.

Adverse effects on benthic habitat and communities are expected to be reversible; no impacts on hard-bottom communities would be anticipated from G&G surveys (for example, see BOEM 2014). In addition, a Programmatic BA was prepared to evaluate impacts from geotechnical and HRG surveys on the OCS (NMFS 2021d). The BA concluded that no adverse effects on ESA-listed species in the Project area are likely to occur. Impacts on species that are not ESA-listed would be similar.

No population-level impacts on finfish, invertebrate, and EFH resources from noise associated with the Proposed Action are anticipated. Overall impacts of noise on finfish are anticipated to be short term, temporary, and negligible to minor.

Presence of structures: Various impacts on finfish resulting from the presence of new structures associated with the Proposed Action are described in detail in Section 3.13.3.2 and include beneficial impacts as a result of the artificial reef effect associated with WTGs. The Proposed Action would include up to 98 WTGs. The primary impact would be from 98 WTG foundations, which would be constructed in mostly sandy seafloor. New structures could affect finfish migration through the area by providing unique complex features (relative to the primarily sandy seafloor) and altering water currents; this could lead to retention of those species and possibly affect spawning opportunities. Impacts on fish migration as a result of structures associated with offshore wind are unknown, as studies related to this potential impact are not available. New complex structures could result in additional impacts such as aggregation of fish, entanglement, gear loss, and habitat conversion. These impacts would largely be driven by changes to recreational and commercial fishing because foundations could provide areas of fish aggregation, leading to increased recreational and commercial fishing pressure. These impacts would be highly localized but could be long term for those structures that are not removed. Additionally, new structures could be beneficial to finfish and invertebrate species, providing potential feeding grounds and areas of protection from predators. The structures would create an "artificial reef effect," whereby more sessile and benthic organisms would likely colonize these structures over time (e.g., sponges, algae, mussels, shellfish, sea anemones). Higher densities of invertebrate colonizers would provide a food source and habitat to other invertebrates such as mobile crustaceans.

The presence of WTGs and corresponding scour protection would alter the ridge and trough habitat in the Project area. In the Mid-Atlantic Bight, infaunal assemblages and productivity differ between ridges and troughs (Byrnes et al. 2000; Slacum et al. 2010). For example, sand dollars and filter-feeding epibenthos are more prevalent on shoal crests than in troughs (VIMS 2000). In addition, the trough portions (or flat bottom) of the habitat generally have greater abundance, species richness, and species diversity, as well as greater abundance of benthic finfish, pelagic finfish, and pelagic invertebrates than ridges (or shoals); ridges with steeper elevation gradients had greater abundance than those with more gradual elevation changes (Slacum et al. 2010). The Wind Farm Area is dominated by sand and muddy sand interspersed with small to large patches of coarse sediment and small to large patches of coarse substrate such as pebbles or cobbles. Smaller areas of low-density boulders were also documented. Based on the 2022 benthic survey (Inspire 2022a), the vast majority of the impacts would be on soft-bottom habitat, with a small portion of impacts on complex (inclusive of coarse) habitats.

Structures may also reduce wind-forced mixing of surface waters, whereas water flowing around the foundations may increase vertical mixing. During summer, when water is more stratified, increased mixing could increase pelagic primary productivity near the structure, increasing the algal food source for zooplankton and filter feeders. Increased vertical mixing may also prevent or alter cold pool formation. Such alteration may cause finfish and invertebrates to avoid the area for the duration of the Project. Species that rely on soft-bottom habitat, such as surfclams and longfin squid, would experience a permanent reduction in habitat, which would no longer support these species, but not to the extent that population-level impacts would be expected. Therefore, potential impacts would be moderate.

The presence of WTGs is expected to result in wind-wake alterations in and around the Wind Farm Area due to downstream wind deficits that may result in changes to ocean stratification (mixing) and can reduce nutrient supplies to the ocean surface ocean and subsequently alter net primary productivity (Daewel et al. 2022; Christiansen et al. 2022). Turbulent processes near the sea surface boundary determine vertical fluxes between atmosphere and ocean and impacts can cascade downward into deeper layers. Resulting fluctuations of the mixed layer depth can alter nutrient availability, which, in turn, may affect local primary production and the nutrient balance (Christiansen et al. 2022; Daewel et al. 2022). Direct impacts of wind wake on fish include disturbance of fish larvae transport pathways (van Berkel et al. 2020).

Numerical modeling by Daewel et al. (2022) shows the offshore wind turbine–induced wind wakes in the North Sea result in large-scale changes in annual primary production with local changes of up to ±10 percent at offshore wind farm clusters and over a wider region; Christiansen et al. (2022) also report large-scale wake effects and subsequent changes to stratification in the southern North Sea. There are few empirical data showing the impact of WTGs on ocean stratification (Tagliabue et al. 2021), although recent models have demonstrated ocean mixing as a result of the wind-wake effect of WTGs in the North Sea (Carpenter et al. 2016; Floeter et al. 2017; Dorrell et al. 2022).

Importantly, net primary productivity is driven by photosynthesis in marine phytoplankton and accounts for half of global-scale photosynthesis and supporting major ocean ecosystem services (Field et al. 1998). However, interannual changes in net primary productivity in the North Atlantic are poorly correlated with parallel changes to stratification and emphasize the importance of other physical mechanisms, especially the Gulf Stream (Tagliabue et al. 2021). Wake-related changes are reportedly one order of magnitude smaller than the average perturbations due to climatic changes and account for a maximum of 10 percent of the annual and interannual variability of surface temperature in the southern North Sea (Christiansen et al. 2022). Potential impacts on net primary productivity in the north Atlantic from the Proposed Action are anticipated due to wind wake but, without additional data, impacts are considered negligible when compared with the effects of the Gulf Stream.

Large offshore wind farm clusters in the North Sea have been shown to result in large-scale changes in annual primary production with local changes (increase/decrease) of up to 10 percent, while region-wide averages in estimated annual primary production remain almost unchanged (Daewel et al. 2022). In the North Sea, the extent of wind wakes has been documented from 15 kilometers to 70 kilometers downstream of the wind farm and an average distance of 32 kilometers was reported by Christiansen et al. (2022), with highest deficits in the first kilometers behind the wind farm and a decrease over the downstream distance; wind wakes are highly dependent on ambient atmospheric conditions and subsequent changes in stratification are minor in shallow, mixed waters when compared with deeper waters.

Wake impacts would likely be permanent but variable, and because of the relatively low offshore wind blocking effect, impacts would be expected to be minor when compared to natural variability (Floeter et al. 2017). The greatest concern for Atlantic sturgeon with respect to placement of structures would be the changes in oceanographic and hydrologic conditions resulting from structures in the open ocean and the subsequent impacts on prey sources. However, Atlantic sturgeon consume prey not as closely affected by physical oceanographic features, such as the sand lance, mollusks, polychaete worms, amphipods, isopods, and shrimp, as other species discussed in the BA. Potential impacts on larval dispersion and survival of Atlantic sturgeon prey species from changes in hydrologic conditions are unlikely and impacts are expected to be negligible.

Concentration of recreational fishing around the foundations would potentially increase the risk of Atlantic sturgeon entanglement in vertical and horizontal fishing lines and subsequent injury and mortality due to infection and starvation. If there is an increase in recreational fishing in the Project area, it would likely represent a shift in fishing effort from areas outside the Wind Farm Area to within the Wind Farm Area or an increase in overall effort. Vessel safety concerns over proximity to foundations and other vessels limit the likelihood of recreational aggregations at the WTGs. Due to their benthic foraging strategy, Atlantic sturgeon have a reduced chance of being exposed to recreational fishing lines in the pelagic WTG area. Therefore, the potential impacts of fishing on the Atlantic sturgeon are expected to be short to long term and negligible to minor.

Gear utilization: Ocean Wind has committed to a Fisheries Monitoring Plan to assess fisheries status in the Project area and at a nearby control site throughout the pre-, during, and post-construction phases. Survey types include trawl surveys, environmental DNA surveys, structure-associated fishes surveys, clam surveys, pelagic fish surveys, and acoustic telemetry monitoring. Gear restrictions, closures, and other regulations set forth by take reduction plans would be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury to ESA-listed species.

The trawl surveys would be conducted using the Fishing Vessel Darana R, a 90-foot commercial dragger, and occur once per season, or four times per year. The trawls are designed to capture a representative sample of demersal fish species present in the impact and reference areas, emphasizing EFH and other species of commercial and recreational interest. This activity would directly affect EFH species and their prey through mortality of most or all of the trawled individuals. In addition to these direct impacts, bottom-disturbing trawls can alter the composition and complexity of soft-bottom benthic habitats. For example, when trawl gear contacts the seabed it can flatten sand ripples, remove epifaunal organisms and biogenic structures like worm tubes, and expose anaerobic sediments (BOEM 2022a). In this case, the survey tracks have been pre-selected by commercial fishermen based on their known suitability for bottom trawling. This indicates that the associated seabed is subjected to regular disturbance by commercial fishing activity, and that this type of disturbance has already and would continue to occur regardless of whether the Fisheries Research Monitoring Plan is implemented. Impacts on EFH species through capture during the trawl survey would not result in population-level impacts. Trawl surveys are not likely to significantly alter the rate and extent of disturbance of soft-bottom benthic habitat relative to the environmental baseline. BOEM therefore concludes that beam trawl surveys would not change the effects determination for EFH for any species in the EFH Assessment (BOEM 2022a). Mitigation measures for species protected under the ESA species that would be enacted during the trawl surveys include a short tow duration of 20 minutes; sampling during daylight only; marine mammal monitoring by the captain or other scientific crew member before, during, and after haul back; trawl operations commencing as soon as possible once the vessel arrives on station; and opening of codend[6] during haul back as quickly and carefully as possible to avoid damaging any protected species that may have been incidentally captured.

The environmental DNA sampling would occur synoptically with the trawl survey, enabling a more holistic understanding of the relative abundance and composition of the species assemblage at the Wind Farm Area. Environmental DNA sampling is non-invasive and can be conducted without causing damage to any individuals or the benthic habitat. BOEM therefore concludes that environmental DNA sampling would not change the effects determination for EFH for any species in the EFH Assessment (BOEM 2022a).

The multi-method survey for structure-associated fish would also be conducted concurrently with the trawl survey. Methods employed in the multi-method survey include chevron traps, rod-and-reel fishing, and baited remote underwater video. The equipment used for baited remote underwater video would include a weighted line attached to surface and subsurface buoys that would hold a stereo-camera system in the water column and a system at the seafloor. Fishing activity of the type described can damage benthic invertebrates on hard-bottom benthic habitat, resulting in long-term effects on community composition and complexity (Tamsett et al. 2010). However, hard-bottom benthic habitats within the Wind Farm Area, including the survey area, are regularly targeted by commercial trap and pot fisheries. This indicates that habitat disturbance from trap and pot placement is routine within the Wind Farm Area and would continue to occur regardless of whether the Fisheries Research Monitoring Plan is implemented. Moreover, the commercial fishing vessels contracted for the Fisheries Research Monitoring Plan would likely be engaged in trap and pot fishing if not engaged in research. As such, trap and pot survey activities under the Fisheries Research Monitoring Plan are not likely to measurably alter the extent or frequency of benthic habitat disturbance in the affected areas. Therefore, this activity is not likely to adversely alter the composition and complexity of EFH relative to the environmental baseline and any associated effects would be insignificant relative to those likely to result from the effects of Project construction and operation. BOEM therefore concludes that these surveys would not change the effects determination for EFH for any species in the EFH Assessment (BOEM 2022a). Mitigation measures for ESA-listed species that would be enacted during the structure-associated fishes surveys include a limited soak duration for chevron traps of less than 90 minutes, the vessel remaining on site during equipment deployment, lines used in the multi-method survey with a breaking strength of less than 1,700 pounds and weak links to reduce potential for moderate or significant NARW entanglement risk, labeled buoys with scientific permit numbers, immediate reports of any missing lines, and ensuring that deployment does not occur if any ESA-listed species are observed.

The clam survey would occur once yearly in the Project area and two control sites in August over at least 6 years. A towed, modified sampling dredge would be pulled by the Fishing Vessel Joey D at ten stations

[6] The terminal section of a trawl net in which captured fish may accumulate.

within the Project area and five stations at each of the two control sites. A robust commercial ocean quahog and surfclam fishery currently exists within the Wind Farm Area; therefore, similar dredging activities already regularly occur. The towed sampling dredge would cause localized and direct impacts on benthic EFH on both hard- and soft-bottom habitat, resulting in potentially long-term effects on community composition. Soft-bottom impacts would be short term and expected to recover quickly. BOEM therefore concludes that these surveys would not change the effects determination for EFH for any species in the EFH Assessment (BOEM 2022a).

The pelagic fish survey would employ two methods: towed, baited remote underwater video stations and autonomous gliders. The second survey method in the pelagic fish survey would occur while all survey vessels of opportunity (e.g., trawl survey vessel, clam survey vessel, glider deployment vessel, structure-associated habitat survey vessel) are underway. This survey would not result in additional vessel traffic. The survey techniques themselves would not cause any impacts on EFH or EFH-designated species. BOEM therefore concludes that these surveys would not change the effects determination for EFH for any species in the EFH Assessment (BOEM 2022a).

The acoustic telemetry survey would cover the Lease Area and adjacent inshore areas. Tagging efforts would not increase vessel transits, as they would occur aboard the trawl, trap, or hook-and-line sampling vessels. The sole increase to vessel traffic for this survey component would be the towing of the omni-directional hydrophone during the four trips per year by the 25-foot Research Vessel Resilience. BOEM has concluded that these surveys would not change the effects determination for EFH for any species in the EFH Assessment (BOEM 2022a).

Monitoring survey trawls are likely to adversely affect the Atlantic sturgeon. Capture of Atlantic sturgeon in trawl gear has the potential to result in injury and mortality, reduced fecundity, and delayed or aborted spawning migrations (Moser and Ross 1995; Collins et al. 2000; Moser et al. 2000). However, the use of trawl gear has been employed as a safe and reliable method to capture sturgeon, provided that the tow time is limited (NMFS 2014).

Negative impacts on sturgeon resulting from trawling capture are related to tow speed and duration (Moser et al. 2000). Northeast Fisheries Observer Program data from Miller and Shepherd (2011) indicate that mortality rates of Atlantic sturgeon caught in otter trawl gear is approximately 5 percent. Short tow durations and careful handling of individuals once on deck are likely to result in a very low risk of mortality of captured individuals (NMFS 2014, 2016). The equipment and methods used for the Project’s trawl surveys are the same as are used for Northeast Area Monitoring and Assessment Program (NEAMAP) surveys. Northeast Fisheries Observer Program data calculate mortality rates of Atlantic sturgeon caught in otter trawl gear as approximately 5 percent (Miller and Shepherd 2011).

Atlantic sturgeon are captured incidentally in trawls used for scientific studies, including the standard NEFSC bottom-trawl surveys and both the spring and fall NEAMAP bottom-trawl surveys. However, the shorter tow durations and careful handling of any sturgeon once on deck during fisheries research surveys are likely to result in lower potential for mortality of captured individuals, as commercial fishing trawls tend to be significantly longer in duration. None of the hundreds of Atlantic and shortnose sturgeon captured in past state ocean, estuary, and inshore trawl surveys have had any evidence of serious injury and there have been no recorded mortalities. Both the NEFSC and NEAMAP surveys have recorded the capture of hundreds of Atlantic sturgeon since the inception of each. To date, there have been no recorded serious injuries or mortalities. In the Hudson River, a trawl survey that incidentally captures shortnose and Atlantic sturgeon has been ongoing since the late 1970s (NMFS 2016). To date, no serious injuries or mortalities of any sturgeon have been recorded in those surveys. A single capture of Atlantic sturgeon has occurred in trawl surveys currently being conducted for the South Fork Wind offshore wind project.

Given the dispersed nature of Atlantic sturgeon, the limited number of trawl tows that will be conducted, the short tow times of 20 minutes for the Project, and evidence that fisheries research surveys are associated with a low risk of mortality, BOEM does not anticipate serious injury or mortality of Atlantic sturgeon captured during Project trawl surveys. Therefore, the effects of trawl surveys from Project monitoring activities leading to potential capture or minor injury are anticipated to have minor to moderate impacts on small numbers of ESA-listed Atlantic sturgeon.

Vessel traffic: Project-related vessels used in pre-construction, construction, O&M, and decommissioning may pose a potential collision risk to finfish, including the Atlantic sturgeon. Construction activities (including offshore installation of WTGs, OSS, array cables, interconnection cable, and export cable) would require several vessel types transiting between the various ports and the Project area and result in an estimated total of 2,859 vessel trips over the 20-month construction period, or approximately 143 trips per month (COP Volume I, Section 6.1; Ocean Wind 2023). Vessels used and number of trips for decommissioning would be similar to those used in construction. Potential impacts on sturgeon from vessel traffic are detailed in the BA for the Project (BOEM 2022b).

While Atlantic sturgeon are known to be struck and killed by vessels in rivers and estuaries, there are no reports of vessel strikes in the marine environment, likely due to the space between bottom-oriented sturgeon and the propellers and hulls of vessels (BOEM 2021). Dunton et al. (2010) reported approximately 95 percent of all Atlantic sturgeon captured in sampling off New Jersey occurred in depths less than 66 feet (20 meters) with the highest catch per unit of effort at depths of 33 to 49 feet (10 to 15 meters). At these depths in open coastal and marine environments, Atlantic sturgeon are not likely to be struck by Project-related vessels. The dispersed nature of vessel traffic and individual sturgeons reduces the potential for co-occurrence of individual sturgeon and individual vessels throughout most of the Project area.

The majority of vessel-related Atlantic sturgeon mortality is likely caused by large transoceanic vessels in river channels (Brown and Murphy 2010; Balazik et al. 2012). Atlantic sturgeon strikes are most likely to occur in areas with abundant boat traffic such as large ports or areas with relatively narrow waterways (ASSRT 2007). Vessel transits for the Project through the critical habitat of the Delaware River during spawning periods when sturgeon aggregate in the spring pose an increased risk of vessel strikes with Atlantic sturgeon. However, the infrequent nature of these transits and the existing vessel traffic in the Delaware River resulting from the Project are not expected to have a significant or measurable effect on Atlantic sturgeon in the Delaware River (NMFS 2021b). In offshore areas, the risk of a vessel strike is likely to be minimal due to overall lower densities of sturgeon and available space for sturgeon to avoid vessels in these areas. Therefore, the potential for vessel strikes to ESA-listed Atlantic sturgeon is considered extremely unlikely to occur and discountable.

3.13.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action reflect the impacts of the Proposed Action in combination with other ongoing and planned activities.

Accidental releases: The Proposed Action would contribute a noticeable increment to the cumulative impacts of accidental releases, which would likely be negligible and short term. Most of the risk of accidental releases of invasive species comes from ongoing activities, and the impacts (mortality, decreased fitness, disease) due to other types of accidental releases are expected to be negligible.

Anchoring: The Proposed Action would contribute an undetectable increment to the cumulative impacts of anchoring on finfish and invertebrates, which would likely be minor and short term, with localized impacts only occurring in the immediate vicinity of anchors. Anchoring would affect 19 acres under the Proposed Action and ongoing and planned activities, including the Proposed Action, could collectively affect up to 3.076 acres (12.4 km^2) (although some of this may occur after the resource has recovered from the earlier impacts). If anchoring occurs in sensitive SAV habitat, impacts would likely be moderate and long term within that specific habitat.

EMF: The Proposed Action would contribute an undetectable increment to the cumulative impacts because the Proposed Action would slightly increase the impacts of EMF in the geographic analysis area beyond those described under the No Action Alternative. The cumulative impact on finfish, invertebrates, and EFH would likely be negligible and localized but long term.

Lighting: The Proposed Action would contribute a undetectable to noticeable increment to the cumulative impacts. The Proposed Action would slightly increase the impacts of artificial lighting in the geographic analysis area beyond those described under the No Action Alternative. The cumulative impacts on finfish, invertebrates, and EFH would likely be minor and highly localized but long term.

Noise: The Proposed Action would contribute a noticeable increment to the cumulative noise impacts on finfish and invertebrates, which would likely be moderate, localized, and short term.

Presence of structures: The Proposed Action would contribute a noticeable increment to the cumulative impacts on finfish and invertebrates from the presence of structures , which would likely be minor to moderate, potentially beneficial, and long term, given that hard-structure surfaces could provide benefits to finfish and invertebrates while they are in place.

Cable emplacement and maintenance: Although cable routes and lengths for other offshore wind projects are not known at this time, using the assumptions in Appendix F, the total seafloor disturbance from new cable emplacement under the Proposed Action and other offshore wind projects is estimated to be 183,868 acres (744 km^2). In most locations, the affected areas are expected to recover naturally, and impacts would be short term because seabed scars associated with jet plow cable installation are expected to recover in a matter of weeks, allowing for recolonization (MMS 2009). Mechanical trenching, which could be used in coarser sediments, could result in more-intense disturbances and a greater width of the impact corridor, and is also expected to recover naturally. Other cable installation techniques would be expected to result in similar impacts. The Proposed Action would contribute a noticeable increment to the cumulative impacts on finfish from sediment resuspension during new cable emplacement, which would likely be negligible, as finfish would be expected to experience short-term and temporary behavioral impacts, resulting in displacement from the immediate vicinity of cable locations. The Proposed Action would contribute a noticeable increment to the cumulative impacts on invertebrates (disturbance, displacement, injury, and mortality) during new cable emplacement, which would likely be negligible to minor. However, the time period for recovery would depend on the mobility and life stage of the invertebrate species, with sessile organisms less able to avoid impacts and mobile organisms more able to avoid impacts. Similarly, the cumulative impacts on EFH would likely be long term but negligible to minor.

Gear utilization: The Proposed Action would contribute an undetectable increment to the cumulative impacts on finfish, which would likely be negligible, as impacts from fisheries surveys are expected to be localized and finfish are highly mobile and would be expected to experience short-term, temporary, and localized behavioral impacts where finfish may be displaced or captured by active survey gear. The Proposed Action would contribute an undetectable increment to the cumulative impacts (disturbance, displacement, injury, and mortality) on invertebrates and EFH, which would likely be negligible and short term, as impacts from surveys are expected to be localized and would often occur along transects already included in fisheries surveys. However, the time period for recovery would depend on the mobility and life stage of each species, with sessile organisms less able to avoid impacts and mobile organisms more able to avoid impacts.

Vessel traffic: The Proposed Action would contribute a noticeable incremental increase to the cumulative impacts of vessel traffic, which would likely be negligible and short term and minor with respect to the ESA-listed Atlantic sturgeon. Most of the risk of vessel traffic is due to ongoing and planned activities, and the impacts (mortality, decreased fitness, disease) due to additional vessel traffic are expected to be negligible to minor.

Discharges: The Proposed Action would contribute an undetectable increment to the cumulative impacts on finfish, which would be negligible because impacts on species or habitat would be so small as to be unmeasurable.

3.13.5.3. Conclusions

Impacts of the Proposed Action. Construction and installation, O&M, and decommissioning of the Proposed Action would have short- and long-term, permanent, and therefore **negligible** to **moderate** impacts on finfish, with the primary impacts on finfish occurring as a result of noise during construction and operation of the proposed Project. Short-term adverse effects include construction-related underwater noise impacts, crushing and burial effects, and disturbance of bottom substrates resulting in increased turbidity and sedimentation. O&M of the Wind Farm Area and offshore export cable route corridor (e.g., alteration of water column and benthic habitats, habitat conversion, operational noise, EMF and heat effects, hydrodynamic effects, food web effects) would result in long-term and permanent adverse effects on EFH for some life stages of EFH-designated species. Monopile foundations, scour protection, cable protection, and operational maintenance and improvements would alter or convert habitat, resulting in permanent habitat conversion. BOEM expects long-term impacts on EFH from construction and installation of the Proposed Action to be moderate, as habitat conversion is expected to occur over the life of the Project and would not recover naturally over time. Primary impacts on EFH would result from new cable emplacement, the presence of structures, and anchoring. Activities associated with construction and installation, O&M, and decommissioning of the Proposed Action alone would have **negligible** to **moderate** impacts on invertebrates through temporary disturbance and displacement, habitat conversion, and behavioral changes, injury, and mortality of sedentary fauna. For example, soft-bottom habitats that support Atlantic surfclam, ocean quahog, sea scallop, and others would be permanently converted to steel pile (foundation) and rock riprap and would not support these species, thereby reducing colonization and reproductive potential or recruitment.

The presence of structures may have a minor beneficial effect on invertebrates through an “artificial reef effect.” Despite invertebrate mortality and varying extents of habitat alteration, BOEM expects the long-term impact on invertebrates from construction and installation of the Proposed Action to be minor, as the resources would likely recover naturally over time. In general, the impacts are likely to be local on the scale of the benthic invertebrate geographic analysis area, and thus would not be expected to extend to the far larger geographic analysis area (New Jersey LME). The larger invertebrate geographic analysis area was selected to account for migratory movement of mobile species that are predicted to experience negligible impacts with respect to the Proposed Action’s contribution to the impacts of individual IPFs resulting from ongoing and planned activities. The primary impacts on invertebrates would be expected to occur as a result of new cable emplacement, the presence of structures, noise from pile driving, and anchoring.

Cumulative Impacts of the Proposed Action. The impacts resulting from individual IPFs would be negligible to moderate for finfish, invertebrates, and EFH. BOEM anticipates that the cumulative impacts on finfish, invertebrates, and EFH in the geographic analysis area associated with the Proposed Action would be **negligible** to **moderate**.

3.13.6 Impacts of Alternatives B, C, D, and E on Finfish, Invertebrates, and Essential Fish Habitat

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternatives B, C, D, and E. The impacts resulting from many of the individual IPFs associated with construction, O&M, and conceptual decommissioning of the Project under all action alternatives would be similar to those described under the Proposed Action. The number of WTGs would be reduced under Alternative B; the number of WTGs under Alternative C would be the same as under the Proposed Action, but structures would be compressed in a smaller area. Consequently, impacts associated with WTG construction, O&M, and decommissioning would be reduced under Alternative B but not under Alternative C in comparison to the Proposed Action, although the types of impacts and habitats affected would remain the same as for the Proposed Action. Under Alternatives D and E, specific areas of ridge and trough and SAV habitat, respectively, would be avoided and impacts on these habitats would be reduced when compared with the other action alternatives. Alternative D would remove up to 15 WTGs from the most sensitive area of ridge and sand habitat in the Project area. Under Alternative E, impacts on SAV would be reduced compared to the Proposed Action, as shown in Table 3.13-5.

The IPFs can be grouped under general evaluation of those with the potential to cause sedimentation and habitat alteration (e.g., cable emplacement, structures, anchoring), those that would generate noise (e.g., pile driving, construction noise, trenching, vessels), accidental releases (e.g., spills, debris, invasive species), EMF, the presence of structures (hydrodynamic disturbance, fish/invertebrate aggregation, migration disturbance), and climate change. The impacts expected to differ most among alternatives are from the presence of structures and cable installation and maintenance, while impacts of most IPFs (i.e., discharges, EMF, lighting, accidental releases, and anchoring) are expected to remain similar among the alternatives. These were considered in the following assessment of Alternatives B, C, D, and E on finfish, invertebrates, and EFH.

BOEM expects the decreased number of WTGs under Alternatives B-1 (up to nine WTGs), B-2 (up to 19 WTGs), and D (up to 15 WTGs) to have a slightly reduced impact on finfish, invertebrates, and EFH compared to the Proposed Action, given that there would be fewer foundations developed and therefore lower noise impact duration associated with pile driving and permanent loss of habitat. The most substantial difference would be relative to the presence of structures, which would be reduced by as many as 19 foundations for Alternative B-2 and up to 15 foundations for Alternative D (as described further in Section 3.6, *Benthic Resources* [Sections 3.6.6 and 3.6.7]).

The removal of WTGs in Alternative D would avoid impacts on the northeastern corner of the Lease Area, which has steeper and more biologically valuable sand ridge and trough features than other portions of the Project area. Ridges, and ridge and trough complexes, provide much of the large-scale physical relief and complexity on the OCS and represent macroscale habitats for finfish and invertebrates. These structures are also considered ecotones or habitat transition zones that enhance biological productivity and concentrate organisms at several trophic levels. Under Alternative D, impacts would be reduced compared to the Proposed Action by removal of up to 15 foundations and fewer miles of inter-array cable, resulting in an estimated 728 fewer acres of bottom impacts. Permanent impacts on complex habitat (NOAA habitat complexity category) would be reduced by 1.8 acres and soft-bottom habitat impacts would increase by 11.3 acres under Alternative D (refer to Table 3.6-4 in Section 3.6, *Benthic Resources*). Overall impacts (both adverse and beneficial) would be reduced associated with the presence of structures and conversion of habitat from existing bottom to scour protection.

Impacts from noise would be similar to those described in Section 3.13.5; however, the duration of impacts would be shorter due to the reduced number of foundations. A summary and comparison of changes to impact pile-driving requirements among these alternatives is provided in Table 3.15-2 in Section 3.15, *Marine Mammals*. Similarly, due to fewer WTG foundations, there would be a decrease in permanent benthic habitat loss and decreased impacts on hydrodynamics, which are discussed in Section 3.13.5.

Under Alternative E, the Oyster Creek export cable route would be limited to the option aimed at avoiding impacts on SAV in Barnegat Bay (as described in Section 3.6, *Benthic Resources*). Alternative E could result in significantly lower impacts on SAV; however, it would require additional trenching or HDD to avoid the SAV. It would be expected that impacts under Alternative E would result in greater benthic disturbance due to increased trenching and cable laying; therefore, impacts associated with increased turbidity, sedimentation, and burial would be greater under Alternative E. However, significantly less SAV would be affected under Alternative E relative to the southern route in the Proposed Action, which would be beneficial to numerous fish and invertebrate species that utilize this important inshore habitat. Impacts of HDD and dredging for cable landings in Barnegat Bay were listed previously in Table 3.13-2.

BOEM does not expect relocation of the eight WTGs and compression of the 98 WTGs under Alternatives C-1 and C-2, respectively, to significantly change the potential impacts compared to the Proposed Action, as the number of WTGs would remain the same and the overall footprint would remain the same or slightly less.

Given the assumed ubiquitous use of the water column throughout the OCS by finfish; smaller footprints under Alternatives B-1, B-2, C-1, and C-2; and the cable route under Alternative E, BOEM does not anticipate impacts to be significantly different than those described under the Proposed Action. Compared with the Proposed Action, Alternatives D and E would have reduced EFH impacts, specifically on ridge and trough habitat (Alternative D) and SAV habitat (Alternative E).

Table 3.13-5 SAV Impacts of Alternative E Compared to the Proposed Action

Data	Proposed Action Southern Route (Acres)	Proposed Action Northern Route/Alternative E (Acres)
1979 Data	15.25	0.89
1985–1987 Data	13.17	14.01
2003 Data	11.78	1.8
2009 Data	13.86	8.35
Ocean Wind Survey Data	15.25	0.89

Cumulative Impacts of Alternatives B, C, D, and E. The incremental impacts contributed by the action alternatives to the overall impacts from ongoing and planned activities would be similar to or slightly less than the impacts described under the Proposed Action.

3.13.6.1. Conclusions

Impacts of Alternatives B, C, D, and E. As discussed in the above sections, the anticipated impacts associated with the Proposed Action alone would not change substantially under all action alternatives considered. While the action alternatives could slightly change the impacts on finfish, invertebrates, and EFH, ultimately the same construction and installation, O&M, and decommissioning impacts would still occur, with the most pronounced being related to the addition of new structures and to noise. Alternatives

B-1, B-2, and D may result in slightly less, but not significantly different, **negligible** to **moderate** impacts on finfish, invertebrates, and EFH relative to those described under the Proposed Action. Alternative C-1 would have the same number of WTGs and overall footprint as the Proposed Action and would therefore have similar negligible to moderate impacts on fish and invertebrates. Alternative C-2 would have the same number of WTGs as the Proposed Action, but compressed into a smaller footprint, and would therefore have similar negligible to moderate impacts on finfish, invertebrates, and EFH.

Alternative E would have a slightly different cable route across Island Beach State Park to avoid SAV but would still require trenching activities. The anticipated impacts associated with Alternative E would be similar to those of the Proposed Action, although impacts on SAV within Barnegat Bay would be greatly reduced. The overall noticeable impacts would be similar across all action alternatives, although direct impacts on SAV would be reduced under Alternative E. Greater detail on impacts on, and avoidance of, SAV is provided in the EFH Assessment and Section 3.6, *Benthic Resources*.

Cumulative Impacts of Alternatives B, C, D, and E. The incremental impacts contributed by the action alternatives to the impacts from ongoing and planned activities would be undetectable to noticeable for finfish, invertebrates, and EFH. However, the differences in impacts among the action alternatives should still be considered alongside the impacts of other factors. Therefore, impacts on finfish, invertebrates, and EFH would be slightly less due to fewer WTGs, a smaller footprint, and avoidance of SAV and ridge and trough habitat but not significantly different for the geographic analysis area under all action alternatives. Considering all the IPFs together, BOEM anticipates that the overall impacts on finfish, invertebrates, and EFH associated with the action alternatives when each is combined with the impacts from ongoing and planned activities including offshore wind would be **negligible** to **moderate**.

3.13.7 Proposed Mitigation Measures

Several measures are proposed to minimize impacts on finfish (including ESA-listed fish), invertebrates, and EFH (Appendix H, Table H-2 and H-3). In the Draft EIS, BOEM analyzed a proposed winter flounder time-of-year restriction to minimize impacts on finfish. After publication of the Draft EIS, BOEM conducted consultation with NMFS pursuant to Section 305(b) of the MSA (i.e., EFH consultation), which resulted in NMFS issuing EFH Conservation Recommendations that replace the winter flounder time-of-year restriction measure analyzed in the Draft EIS. EFH Conservation Recommendations are analyzed collectively in Table 3.13-6. If one or more of the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced.

Table 3.13-6 Measures Resulting from Consultations (Also Identified in Appendix H, Table H-2): Finfish, Invertebrates, and Essential Fish Habitat

Measure	Description	Effect
PAM Plan	BOEM, BSEE, and USACE would ensure that Ocean Wind prepares a PAM Plan that describes all proposed equipment, deployment locations, detection review methodology and other procedures, and protocols related to the required use of PAM for monitoring. This plan would be submitted to NMFS, BOEM and BSEE (at OSWsubmittals@bsee.gov) for review and concurrence at least 120 days prior to the planned start of pile driving.	Ocean Wind has committed to implementing passive acoustic monitoring as part of the Proposed Action. Requiring that Ocean Wind submit a Passive Acoustic Monitoring Plan for agency approval further defines how the APM would be enforced. Because analysis of the Proposed Action already accounts for implementation of a Passive Acoustic Monitoring Plan, this measure would not further reduce the impact on finfish from underwater noise.

Measure	Description	Effect
Sound field verification	BOEM, BSEE, and USACE would ensure that if the clearance and/or shutdown zones are expanded, PSO coverage is sufficient to reliably monitor the expanded clearance and/or shutdown zones. Additional observers would be deployed on additional platforms for every 1,500 m that a clearance or shutdown zone is expanded beyond the distances modeled prior to verification.	Sound field verification would increase the accountability of underwater noise mitigation during pile driving but would not alter the impact determination of negligible for gear utilization. While these measures would reduce risk and improve accountability under the Proposed Action, they would not alter the impact determination of negligible to minor for noise from WTG pile driving.
UXO detonations – Atlantic sturgeon	Ocean Wind would extend the APM seasonal restriction of UXO detonations (January to April) to include months of increased Atlantic sturgeon presence in the offshore wind area. No UXOs can be detonated from November to April in the offshore areas greater than 3 nautical miles (state waters). UXO surveys are expected in Fall of 2022 which defines the exact location and size of UXO.	The APM seasonal restriction of UXO detonations from January through April would effectively eliminate the likelihood of any exposures for Atlantic sturgeon. Should a sturgeon be exposed to noises above behavioral thresholds, the effects would likely be brief (e.g., Atlantic sturgeon may be startled and divert away from the area), and any effects would be so small that they could not be measured, detected, or evaluated
Procedures for regular gear haul out, gear identification, and recovery of lost survey gear	All sampling gear would be hauled at least once every 30 days, and all gear would be removed from the water and stored on land between survey seasons to minimize risk of entanglement. To facilitate identification of gear on any entangled animals, all trap/pot gear used in the surveys would be uniquely marked to distinguish it from other commercial or recreational gear. All reasonable efforts would be undertaken to recover lost gear and lost gear would be reported to NMFS and BSEE within 24 hours.	The regular hauling of sampling gear and recovery of lost survey gear would reduce risk of entanglement in fisheries survey gear. Gear identification would improve accountability in the case of gear loss. While adoption of these measures would reduce risk and improve accountability under the Proposed Action, it would not alter the impact determination of negligible for gear utilization. Monthly haul-out of gear will assist in decreasing the likelihood of gear being lost. Lost gear can result in fish and invertebrate mortality and affect sensitive habitats. Adherence to this mitigation measure is a proactive approach to minimize potential long-term impacts of lost gear on finfish, invertebrates, and sensitive habitats, including EFH.
Marine debris awareness training	The Lessee would ensure that vessel operators, employees, and contractors engaged in offshore activities pursuant to the approved COP complete marine trash and debris awareness training annually.	Training would improve management of trash and debris and reduce the potential for interactions and impacts on finfish, invertebrates, and EFH. This measure is not expected to change the overall impact determination for marine debris impacts.

Measure	Description	Effect
Training	At least one of the survey staff onboard the trawl surveys and ventless trap surveys would have completed NEFOP observer training (within the last 5 years) or other training in protected species identification and safe handling (inclusive of taking genetic samples from Atlantic sturgeon). Reference materials for identification, disentanglement, safe handling, and genetic sampling procedures would be available on board each survey vessel. BOEM and BSEE would ensure that Ocean Wind prepares a training plan that addresses how this requirement would be met and that the plan is submitted to NMFS in advance of any trawl or trap surveys. This requirement is in place for any trips where gear is set or hauled.	Training would improve the potential for identification, safe handling, and disentanglement of finfish from any activities that include trawls, traps, or gear setting or hauling, and reduce the potential for harm to the ESA-listed Atlantic sturgeon. This measure is not expected to change the overall impact determination for gear impacts on finfish, invertebrates, and EFH.
Atlantic sturgeon identification and data collection	Any Atlantic sturgeon caught and/or retrieved in any fisheries survey gear will be identified to species or species group. Each ESA-listed species caught and/or retrieved would then be properly documented using appropriate equipment and data collection forms. Biological data, samples, and tagging would occur as outlined below. Live, uninjured animals should be returned to the water as quickly as possible after completing the required handling and documentation.	Identification and documentation of Atlantic sturgeon and subsequent return to the water of any tagged or captured fish would reduce the potential for harm to the fish and inform population trends for the species. While adoption of these measures would reduce risk and improve accountability under the Proposed Action, it would not alter the impact determination of negligible for gear utilization.
Atlantic sturgeon handling and resuscitation guidelines	Any Atlantic sturgeon caught and retrieved in gear used in fisheries surveys would be handled and resuscitated (if unresponsive) according to established protocols and whenever at-sea conditions are safe for those handling and resuscitating the animal(s) to do so.	Training would improve the potential for identification, safe handling, and disentanglement of finfish from any activities that include trawls, traps, or gear setting or hauling, and reduce the potential for harm to the ESA-listed Atlantic sturgeon. However, these measures would not alter the impact determination of negligible for gear utilization
Take notification	GARFO PRD would be notified as soon as possible of all observed takes of Atlantic sturgeon occurring as a result of any fisheries survey. At the end of each survey season, a report would be sent to NMFS that compiles all information on any observations and interactions with ESA-listed species.	Take notification would improve accountability for documenting Atlantic sturgeon take associated with the Proposed Action to inform the impacts of proposed and similar activities on population trends in the Atlantic sturgeon and other ESA-listed species. However, this would not alter the overall impact determination for the Proposed Action.

Measure	Description	Effect
Monthly/annual reporting requirements	BOEM and BSEE would ensure that Ocean Wind submits regular reports (in consultation with NMFS and USFWS) necessary to document the amount or extent of take that occurs during all phases of the proposed action.	Reporting requirements to document take would improve accountability for documenting take associated with the Proposed Action. While adoption of these measures would improve accountability, it would not alter the overall impact determination for the Proposed Action.
Data Collection BA BMPs	BOEM would ensure that all Project Design Criteria and BMPs incorporated in the Atlantic Data Collection consultation for Offshore Wind Activities (June 2021) shall be applied to activities associated with the construction, maintenance, and operations of the Project as applicable. Project Design Criteria and BMPs aim to minimize potential impacts on natural resources.	Adherence to these practices will assist in minimizing impacts on finfish, invertebrates, and EFH. However, this measure would not change the overall impact determination for impacts from the proposed activities.
Periodic Underwater Surveys, Reporting of Monofilament and other fishing gear around WTG foundations	The Lessee must monitor indirect impacts associated with charter and recreational fishing gear lost from expected increases in fishing around WTG foundations by surveying at least 10 of the WTGs located closest to shore in the Ocean Wind 1 Lease Area (OCS-A 0498) annually. The Lessee must report the results of the surveys to BOEM and BSEE in an annual report.	Periodic underwater surveys and reporting of monofilament and other fishing gear around WTG foundations would reduce the risk of entanglement associated with the presence of structures. Implementation of this measure would reduce risk to finfish and their prey under the Proposed Action but would not alter the impact determination associated with the presence of structures and fishing gear.
Project design criteria (PDC) minimize vessel interactions with listed species	All vessels associated with survey activities (transiting [i.e., travelling between a port and the survey site] or actively surveying) must comply with the vessel strike avoidance measures specified below. The only exception is when the safety of the vessel or crew necessitates deviation from these requirements.	Compliance with project design criteria to minimize vessel interactions with listed species and vessel speed restrictions would reduce risk of vessel strikes to Atlantic sturgeon. While adoption of these measures would reduce risk to the Atlantic sturgeon under the Proposed Action, it would not alter the potential for vessel strikes to Atlantic sturgeon, which is considered extremely unlikely to occur and discountable.
Operational sound field verification	BOEM would require the Lessee to develop an operational sound field verification plan to determine the operational noises emitted from the Offshore Wind Area.	Operational sound field verification would allow BOEM to confirm that impacts of operating WTG noise does not exceed predicted impacts based on existing monitoring data and modeling efforts. While adoption of this measure would improve accountability of WTG operational noise under the Proposed Action, it would not alter the impact determination for WTG noise.

Measure	Description	Effect
EFH Conservation Recommendations	EFH Conservation Recommendations from NMFS were transmitted by letter dated February 24, 2023, which is included in its entirety in Attachment H-1 of Appendix H. EFH Conservation Recommendations for activities under BOEM's jurisdiction were provided for WTG and cable removal and relocation (micrositing), habitat alteration minimization, noise mitigation, contents of the Benthic Habitat and Fisheries Monitoring Plans. EFH Conservation Recommendations for activities under USACE's jurisdiction were provided for offshore impact minimization, inshore/ estuarine habitat impact minimization, and compensatory mitigation.	Implementation of Conservation Recommendations, including micro-siting WTGs, scour protection avoidance, anchoring avoidance, reduced distance in boulder/cobble relocation, and cable re-routing, would minimize known or reasonably foreseeable adverse impacts on EFH, including high-relief/high-heterogeneity and ridge/trough areas, NOAA Complex Category habitats, and fishing grounds such as "The Ham" and "Atlantic City Bluefish Lump," thereby minimizing the potential for the elimination/conversion of existing habitats and EFH. Conservation Recommendations for noise during construction, such as soft starts, use of noise-dampening equipment, and noise mitigation protocols in consultation with resource agencies prior to construction activities, would avoid and minimize potential noise impacts on EFH species and habitat. Implementation of Conservation Recommendations to revise the Benthic Habitat and Fisheries Monitoring Plans would benefit EFH and species by ensuring robust experimental design, methods, and data collection/analysis to assess changes in the benthic and fisheries communities in the Project area(s). Although implementation of the Conservation Recommendations would provide incremental reductions in impacts on the most unique and spatially limited components of the ridge and trough features and complex habitats and associated EFH, reductions in the overall impact rating are not anticipated for any of the Proposed Action's IPFs.

Measure	Description	Effect
Biological Opinion Reasonable and Prudent Measures (RPMs) and Terms and Conditions	RPMs and Terms and Conditions to minimize the impact of incidental take of ESA-listed species were documented in the NMFS Biological Opinion dated April 3, 2023. These measures include adherence to mitigation measures specified in the final MMPA ITA to minimize impacts during pile driving and UXO detonation; compliance with requirements for vessel operations within the Delaware River and Delaware Bay included in the Incidental Take Statements provided with the Paulsboro Marine Terminal Biological Opinion (dated July 19, 2022) and the New Jersey Wind Port Biological Opinion (dated February 25, 2022); reporting requirements related to effects to, or interactions with, ESA-listed species; submittal of required plans (e.g., PSO Training Plan for Trawl Surveys, Passive Acoustic Monitoring Plan, Marine Mammal and Sea Turtle Monitoring Plan, Cofferdam Installation and Removal Monitoring Plan, Alternative Monitoring Plan/Night Time Pile Driving Monitoring Plan, Sound Field Verification Plan, North Atlantic Right Whale Vessel Strike Avoidance Plan) to NMFS GARFO with sufficient time for review, comment and approval; and conducting on-site observation and inspection to gather information on the effectiveness and implementation of measures to minimize and monitor incidental take.	These RPMs and Terms and Conditions would minimize the exposure of ESA-listed species to pile-driving noise and the effects of UXO detonation. These RPMs and Terms and Conditions would also ensure that all incidental take that occurs is documented and reported to NMFS in a timely manner and that any incidentally taken individual specimens are properly handled, resuscitated if necessary, transported for additional care or reporting, or returned to the sea. Reporting requirements to document take would improve accountability for documenting take associated with the Proposed Action. In some cases, these PRMs and Terms and Conditions provide additional detail or clarification of measures that are included as part of the Proposed Action. Implementation of these RPMs and Terms and Conditions would provide incremental reductions in impacts on finfish, invertebrates, and sensitive habitats, including EFH, and would improve accountability, but would not alter the overall impact determination of the Proposed Action.

ft/sec = foot per second; GARFO = Greater Atlantic Regional Fisheries office; ITA = incidental take authorization; m = meter; NEFOP = Northeast Fisheries Observer Program; OSW = offshore wind; PAM = passive acoustic monitoring; PRD = Protected Resources Division; PSO = protected species observer; RPM = Reasonable and Prudent Measure

Table 3.13-7 Additional Proposed Measures (Also Identified in Appendix H, Table H-3): Finfish, Invertebrates, and Essential Fish Habitat

Measure	Description	Effect
Anadromous fish time of year restriction	Avoid construction activities during anadromous fish migration and spawning activity from March 1 through June 30 of each year within Barnegat Bay.	Avoidance of construction activities in Barnegat Bay during this sensitive time period will avoid potential disruption and mortality of anadromous species, including American shad, river herring (alewife and blueback herring), and striped bass. Avoiding impacts on migration during this time period is important to avoid affecting local populations.
Live and Hard Bottom Habitat Mapping and Avoidance	Vessel operators would be provided with maps of sensitive hard-bottom habitat in OSW Project area, as well as a proposed anchoring plan that would avoid or minimize impacts on the hard-bottom habitat to the greatest extent practicable. These plans would be provided for all anchoring activity, including construction, maintenance, and decommissioning.	The live and hard-bottom mapping would document presence of sensitive habitats in the Project area and inform avoidance and minimization of these habitats; this would reduce the extent of potential impacts on live and hard-bottom habitats from the proposed activities.
Live and Hard Bottom Impact Monitoring	The Lessee would develop and implement a monitoring plan for live and hard-bottom features that may be affected by proposed activities. The monitoring plan would also include assessing the recovery time for these sensitive habitats. BOEM recommends that all monitoring reports classify substrate conditions following the Coastal and Marine Ecological Classification Standards (CMECS), including live bottoms (e.g., submerged aquatic vegetation and corals and topographic features. The plan would also include a means of recording observations of any increased coverage of invasive species in the affected hard-bottom areas.	The live and hard-bottom monitoring plan would document conditions of live and hard-bottom habitats during construction and operational activities and assess potential impacts on these habitats, including extent of invasive species, to inform potential mitigation strategies and reduce potential impacts on these habitats.
Intake Screens on Pump Intakes for In-shore Hydraulic Dredges	All hydraulic dredge intakes should be covered with a mesh screen or screening device that is properly installed and maintained to minimize potential for impingement or entrainment of fish species. The screening device on the dredge intake should prevent the passage of any material greater than 1.25” in diameter, with a maximum opening of 1.25” x 6”. Water intakes should be positioned at an appropriate depth to avoid or minimize the entrainment of eggs and larvae. Intake velocity should be limited to less than 0.5 ft/sec.	Intake screens would reduce the potential entrainment of fish during hydraulic dredging; appropriate positioning of screens would reduce the entrainment of early life stages such as eggs and larvae. However, this would not alter the determination of negligible impact for Atlantic sturgeon from entrainment under the Proposed Action.

Measure	Description	Effect
Scour and Cable Protection	To the extent technically and economically feasible, the Lessee must ensure that all materials used for scour and cable protection consist of natural or engineered stone that does not inhibit epibenthic growth. The materials selected for protective purposes should mirror the natural environment and provide similar habitat functions.	The use of natural or engineered stone would not inhibit epibenthic growth and would provide three-dimensional complexity. This type of scour protection would most nearly replicate natural habitat features. This measure would reduce impacts on benthic habitat composition and structural complexity and, in the case of cable protection, reduce the time required for colonization by habitat-forming organisms. While long-term impacts from these structures would remain, the time required to achieve beneficial effects would decrease.

ft/sec = foot per second; OSW = offshore wind

3.13.7.1. Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.13-6 and Table H-2 in Appendix H, *Mitigation and Monitoring*, are incorporated in the Preferred Alternative. BOEM has identified the following additional measures in Table 3.13-7 as incorporated in the Preferred Alternative: EFH Conservation Recommendations for WTG and cable removal and relocation (micrositing), habitat alteration minimization, noise mitigation, contents of the Benthic Habitat and Fisheries Monitoring Plans, and anadromous fish time-of-year restriction. These measures, if adopted, would further ensure the effectiveness and compliance of APMs by requiring the submittal of plans for approval by the enforcing agency(ies) and by defining reporting requirements. Time-of-year restrictions would have the overall effect of avoiding interactions with sensitive species and their habitat during spawning and migration periods in nearshore waters. While the impact determination for finfish or EFH, described in Section 3.13.2, would not change, these measures ensure the effectiveness and compliance with APMs already analyzed as part of the Proposed Action.

3.14. Land Use and Coastal Infrastructure (see Appendix G)

The reader is referred to Appendix G for a discussion of current conditions and potential impacts on land use and coastal infrastructure from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.15. Marine Mammals

This section discusses potential impacts on marine mammal resources from the proposed Project, alternatives, and ongoing and planned activities in the marine mammal geographic analysis area. The marine mammal geographic analysis area, as shown on Figure 3.15-1, includes the Canadian Scotian Shelf, Northeast U.S. Continental Shelf, and Southeast Continental Shelf LMEs. This area is intended to capture the movement range for marine mammal species that could be affected by the Project. Due to the size of the geographic analysis area, the analysis for this EIS focuses on marine mammals that would likely occur in the Project area (see Figure 1-1, Section 1.2) and have the potential to be affected by Project-related activities, while providing context within the larger geographic analysis area.

3.15.1 Description of the Affected Environment for Marine Mammals

The Project area is used by a variety of species for a range of life-sustaining activities, migration, foraging, mating, and giving birth, which directly affect species distribution (Madsen et al. 2006; Weilgart 2007). Some species occur in all seasons (e.g., NARW, Risso's dolphins; Appendix I, Section I.4, Table I-8) while others are seasonally present in the area (e.g., harbor seal, harbor porpoise, blue whale, sperm whale). There are several species that have been considered seasonally occurring in the offshore area in the past; however, year-round occurrence near the Project area may also be possible (e.g., fin whale). Prey distribution can influence the distribution of marine mammals and is highly dependent on oceanographic properties and processes. Therefore, impacts on prey items must also be considered when assessing impacts on marine mammals. Impacts on availability of prey are addressed in Section 3.15.2 under the IPFs of climate change, noise, presence of structures, accidental releases, and lighting.

Marine mammal composition in the marine mammal geographic analysis area (see Figure 3.15-1) includes 38 species, comprising six mysticetes (baleen whales), 28 odontocetes (toothed whales), and four pinnipeds (BOEM 2014). Seventeen of those species (18 stocks[1]) have the potential to be affected by the Project, as they are likely to have regular or common occurrences in the Project area.

[1] The MMPA defines a marine mammal stock as a group of individuals "of the same species or smaller taxa in a common spatial arrangement that interbreed when mature."

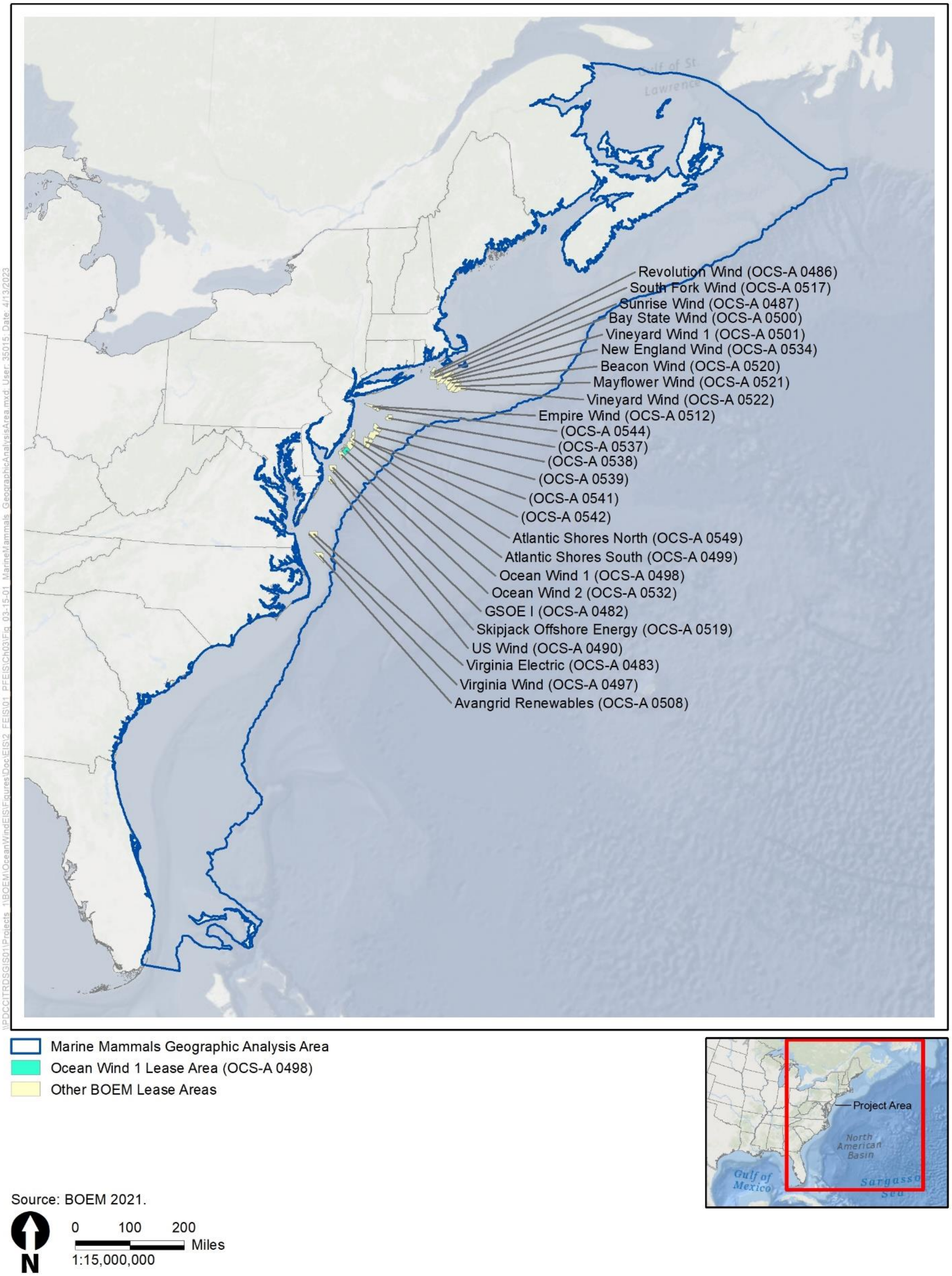

Figure 3.15-1 Marine Mammals Geographic Analysis Area

The analysis of the Proposed Action includes 17 species (18 stocks) of marine mammals that have been documented or are considered likely to occur in the Project area and have the potential to be affected by Project-related activities, as described in Section I.4 in Appendix I. Species occurrence, seasonality, habitat use, and density were determined based on the most current available aerial and vessel survey data, which are routinely collected near the Project area, as well as other available data including passive acoustic monitoring data and habitat-based modeling efforts conducted using multiple years of visual survey data. Several studies of marine mammal occurrence and distribution have been conducted in or near the Project area. NJDEP funded the New Jersey Ecological Baseline Studies (EBS) from January 2008 through December 2009 and used visual line-transect (aerial and shipboard) methods and passive acoustic monitoring to estimate the abundance and density of marine mammals from the shoreline to around 20 nm (37 kilometers) off the coast of New Jersey between Stone Harbor and Seaside Park (NJDEP 2010). Ship surveys were conducted once per month between January 2008 and December 2009. Aerial surveys were conducted once per month between February and May 2008, and twice monthly (when possible) between January and June 2009 (NJDEP 2010).

In addition, the Atlantic Marine Assessment Program for Protected Species (AMAPPS) coordinates data collection and analysis to assess the abundance, distribution, ecology, and behavior of marine mammals in the U.S. Atlantic. These include both ship and aerial surveys conducted between 2011 and 2019. Although the majority of AMAPPS survey effort has been focused on offshore areas outside the Project area, a portion were relevant to the assessment of the Proposed Action (NEFSC and SEFSC 2011, 2012, 2013, 2014, 2015, 2016, 2018, 2020, 2022).

Habitat-based marine mammal density models for the U.S. Exclusive Economic Zone of the East Coast (eastern U.S.) and Gulf of Mexico were also developed by the Duke University Marine Geospatial Ecology Lab in 2016 (Roberts et al. 2016a). These models were recently updated in June 2022 (Roberts and Halpin 2022) and serve as a complete replacement for the Roberts et al. (2016a) models and subsequent updates and are based primarily on a collection of Roberts et al. (2016b, 2017, 2018, 2020, 2021a, 2021b) density estimates and data collected through September 2020. Collectively, these estimates are considered the best information currently available for marine mammal densities in the U.S. Atlantic; marine mammal densities used in this analysis are summarized in Attachment J-1 of Appendix J, *Underwater Sound and Acoustic Modeling Results*.

Threatened and Endangered Marine Mammals

The ESA (16 USC 1531 et seq.) classifies certain species as threatened or endangered based on their overall population status and health. Five marine mammals that are known to occur in the Project area (Figure 1-1, Section 1.2) are classified as endangered: the blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), NARW (*Eubalaena glacialis*), sei whale (*Balaenoptera borealis*), and sperm whale (*Physeter macrocephalus*) (35 *Federal Register* 18319, December 2, 1970). Of the marine mammal species listed under the ESA, critical habitat has only been designated for the NARW (81 CFR 4838, January 27, 2016). Critical habitat for the NARW within the marine mammal geographic analysis area comprises the feeding areas in Cape Cod Bay, Stellwagen Bank, and the Great South Channel, as well as the calving grounds that stretch from off Cape Canaveral, Florida to Cape Fear, North Carolina (Hayes et al. 2021). The closest designated NARW critical habitat area is approximately 260 miles north of the Project area. These critical habitat areas do not overlap with the Project area; however, the general region is an important migratory corridor for a number of ESA-listed large whales including the NARW (Hayes et al. 2020, 2021). The nearest biologically important areas (BIA)[2] for NARW feeding have been

[2] BIAs identify areas and times within which cetacean species or populations are known to concentrate for specific behaviors, or be range-limited, and consist of reproductive areas, feeding areas, migratory corridors, and small and resident populations. NOAA's Biologically Important Areas Map is available at https://cetsound.noaa.gov/biologically-important-area-map.

identified well north of the Project area near Georges Bank, Cape Cod Bay, and the Gulf of Maine between the months of April and July (Van Parjis et al. 2015). BIAs for NARW migration overlap with the Project area and surrounding waters for the months of March–April and November–December (Van Parjis et al. 2015). No other BIAs have been identified near the Project area.

In 2017, an Unusual Mortality Event (UME) began for NARW and in that year a total of 31 mortalities, serious injuries, and morbidities were documented. Between 2017 and April 2023, a total of 98 mortalities, serious injuries, and morbidities (sublethal injury and illness) of NARW were documented (NOAA Fisheries 2023a). Entanglement in fishing gear and vessel strikes are the preliminary causes of mortality, serious injury, and morbidity during the ongoing UME. The whales affected by the UME represent more than 20 percent of the population. The draft 2022 NMFS stock assessment report estimates the median population abundance (Nbest) is 338 NARWs (Hayes et al. 2022b).

Other endangered species that have the potential to occur near the Project area are the fin whale, blue whale, sei whale, and sperm whale. Fin whales are common/regular year-round residents of the areas near the Project area with peak abundances noted in the spring, summer, and fall (Hayes et al. 2021). BIAs for fin whale feeding have been identified to the north of the Project area, off Rhode Island Sound between March and October, and year-round for Georges Bank, Cape Cod Bay, and the Gulf of Maine (Van Parjis et al. 2015). Blue whales have been observed near the Project area in spring and summer but are considered rare visitors (Waring et al. 2011). BIAs have not been identified for blue whales on the East Coast (Van Parjis et al. 2015). Sei whales are also considered rare in the Project area but regular visitors to the offshore areas near the continental slope where they have been observed year-round. BIAs for sei whale feeding have been identified north of the Project area, stretching from the Gulf of Maine to the continental shelf off Georges Bank between the months of March and November (Van Parjis et al. 2015). Sperm whales generally prefer deeper waters off the continental slope and are found primarily in water 200 to 1,500 meters deep. They are considered uncommon year-round visitors near the Project area with peak abundances likely to occur in the spring, summer, and fall. Based upon the most recent NOAA Fisheries stock assessments (Hayes et al. 2020, 2021), the population estimates for these species are as follows: 6,802 fin whales in the western North Atlantic stock, 402 blue whales in the western North Atlantic stock, 6,292 sei whales in the Nova Scotia stock, and 4,349 sperm whales in the North Atlantic stock (as outlined in Appendix I).

Non-Endangered Marine Mammals

Pursuant to the MMPA (16 USC 1361 et seq.), all marine mammals are protected, and their populations are monitored by NOAA and USFWS. Mysticetes that are not endangered or threatened and regularly occur in the Project area include the humpback whale and minke whale. BIAs for humpback whale feeding have been identified near Georges Bank, Cape Cod Bay, and the Gulf of Maine between the months of March and December (Van Parjis et al. 2015), all of which are more than 450 kilometers north of the Project area. Humpback whales have a regular occurrence near the Project area in the spring, summer, and fall and may occur year-round (Hayes et al. 2021). A UME was declared for this species in January 2016, and since then, 28 humpback whales have stranded off New Jersey, with 191 coastwide (NOAA Fisheries 2022a). A potential leading cause of the ongoing UME is vessel strikes; however, more research is necessary to be definitive. Minke whales are also considered common in the waters near the Project area. BIAs for minke whale feeding have been identified on Georges Bank, in Cape Cod Bay, and the Gulf of Maine between the months of March and November (Van Parjis et al. 2015), all of which are more than 450 kilometers north of the Project area. A UME was also declared for the minke whale in January 2017 (NOAA Fisheries 2022b). A total of 142 individuals stranded from Maine to South Carolina, and preliminary results of necropsy examinations indicate evidence of human interactions or infectious disease; however, these results are not conclusive (NOAA Fisheries 2022b).

Odontocetes known to occur near the Project area include pilot whales (*Globicephala* spp.), Atlantic white-sided dolphins (*Lagenorhynchus acutus*), common dolphins (*Delphinus delphis*), bottlenose dolphins (*Tursiops truncatus*), Risso's dolphins (*Grampus griseus*), and harbor porpoise (Hayes et al. 2020, 2021). Two species of pilot whale (*Globicephalus* spp.) occur along the edge of the U.S. continental shelf in the winter and early spring: the long-finned pilot whale (*Globicephalus melas*) and the short-finned pilot whale (*Globicephalus macrorhynchus*). They move onto the Georges Bank and into the Gulf of Maine and more northern waters in late spring and remain there until late autumn (Hayes et al. 2020). Atlantic white-sided dolphins could potentially be observed in the Project area; their seasonal abundance estimates off New Jersey were highest in the spring, followed by fall with very low numbers in the fall to no estimate during the winter (Palka et al. 2017). Two distinct stocks of Western North Atlantic bottlenose dolphins can occur within the Project area: the migratory coastal stock and the offshore stock (Hayes et al. 2021). Although they can be difficult to identify from surveys, the two stocks exhibit slightly different ecotypes, with both morphological and genetic differences. During warmer months, the migratory coastal stock is found from the coastline out to the 20-meter isobath from Assateague, Virginia, north to Long Island, New York, and in the colder months this stock has been found to occupy coastal waters from Cape Lookout, North Carolina, north to the North Carolina/Virginia border (Hayes et al. 2021). Because the current assessment relies heavily on survey data, the two stocks are referred to collectively. Density models predicted that Risso's dolphins (which typically prefer deeper waters) occur at very low densities near the Project area even in offshore areas close to the shelf break (Roberts and Halpin 2022), but no sightings of Risso's dolphins in the Project area or coastal strandings were recorded. Harbor porpoises prefer coastal waters shallower than 150 meters but can also be found farther offshore and are considered regular visitors to the Project area particularly during the winter and possibly during spring and summer months (Hayes et al. 2020). Current population estimates for these species are included in Appendix I, Table I-8.

The most common pinniped species documented in the Project area are harbor and gray seals, with the former being the most dominant (Hayes et al. 2022a). Data on habitat use and foraging of harbor and gray seals in the mid-Atlantic are limited; however, there are three major harbor seal haul-out sites in New Jersey: (1) Great Bay, which is adjacent to the Project area (and the largest haul-out south of Long Island, New York), (2) Barnegat Inlet/Barnegat Lighthouse, and (3) Sandy Hook (Slocum et al. 2005; NJDEP 2010; CWF 2023). The population of harbor seals has increased in the mid-Atlantic states in recent years, with regular occurrences in North Carolina and consistent haul-outs of 40–60 individuals in Virginia and the Chesapeake Bay (Rees et al. 2016). In March 2019, 45 seals were detected via aerial surveys of the known haul-outs: six in the Sandy Hook area, five in the Barnegat Lighthouse area, and 34 in the Great Bay area (Ocean Wind 2019). Another ground-based survey recorded 145 seals at the Great Bay site. Since July 2018, increased numbers of gray seal and harbor seal mortalities have been recorded across Maine, New Hampshire, and Massachusetts (Hayes et al. 2021). This event has been declared a UME by NMFS and encompasses 3,152 seal strandings from Maine to Virginia (Hayes et al. 2021). Off New Jersey, 172 seals stranded between July 2018 and March 2020 (NOAA Fisheries 2020). The pathogen phocine distemper virus was found in the majority of deceased seals and, based on this finding, has been identified as the cause of the UME. This 2018–2022 UME is non-active with closure pending. Since June 2022, another UME for harbor and gray seals has been declared by NMFS off the southern and central coast of Maine, with 322 seal strandings between June and December 18, 2022 (NOAA Fisheries 2023b). Preliminary testing has found some of the harbor and gray seals affected by the June 2022 UME to be positive for highly pathogenic avian influenza H5N1. Current population estimates for these species are included in Appendix I, Table I-8.

Overview of Sound and Marine Mammal Hearing

Underwater noise can be described through a source-path-receiver model. An acoustic source emits sound energy that radiates outward and travels through the water and the seafloor as pressure waves, which is the most relevant component of sound to marine mammals. The sound level decreases with increasing distance from the acoustic source as the sound pressure waves spread out under the influence of the surrounding environment. The amount by which the sound levels decrease between a source and receiver is called transmission loss (Richardson et al. 1995). The amount of transmission loss that occurs depends on the source-receiver separation, frequency of the sound, properties of the water column, and properties of the seafloor layers. Underwater sound levels are expressed in dB, which is a logarithmic ratio relative to a fixed reference pressure of 1 μPa (equal to 10^{-6} Pa or 10^{-11} bar).

Underwater sound can be produced by biological and physical oceanographic sources, as well as anthropogenic sources. A brief overview of acoustic units and the propagation of underwater sound can be found in Appendix J, *Underwater Sound and Acoustic Modeling Results*. Biological sounds include vocalizations made by marine mammals and physical oceanographic sounds, including wind and wave activity, rain, sea ice, and undersea earthquakes. Anthropogenic (human-introduced) sounds include shipping and other vessel traffic, military activities, marine construction, oil and gas exploration, and more. Some of these natural and anthropogenic sounds are present everywhere in the ocean all of the time; therefore, background sound in the ocean is commonly referred to as “ambient noise” (DOSITS 2019). The efficiency of underwater sound propagation allows marine mammals to use underwater sound as a primary method of communication, navigation, prey detection (i.e., foraging), and predator avoidance (Richardson et al. 1995; Southall et al. 2007; OSPAR Commission 2009). Anthropogenic noise has gained recognition as an important stressor for marine mammals because of their reliance on underwater hearing for maintenance of these critical biological functions (Richardson et al. 1995; Ketten 1998). Underwater noise generated by human activities can often be detected by marine mammals many kilometers from the source. With decreasing distance from a noise source, potential acoustic impacts can result in mortality, non-auditory injury, permanent or temporary hearing loss, behavioral changes, and acoustic masking. All of these effects have the potential to induce impacts on marine mammals (OSPAR Commission 2009; Erbe 2013).

Auditory masking occurs when sound signals used or produced by marine mammals overlap in time, space, and frequency with another sound source (Richardson et al. 1995). Masking can reduce communication space, limit the detection of relevant biological cues, and reduce echolocation effectiveness. A growing body of literature is focused on improving the framework for assessing the potential for masking of animal communication by anthropogenic noise and understanding the resulting effects. More research is needed to understand the process of masking, the risk of masking by anthropogenic activities, the ecological significance of masking, and what anti-masking strategies are used by marine animals and their degree of effectiveness before masking can be incorporated into regulation strategies or mitigation approaches (Erbe et al. 2016). The potential for masking can be assessed qualitatively by comparing the frequencies of anthropogenic sources with the frequencies at which marine mammal vocalizations are made and the hearing ranges of marine mammal species.

Marine mammals are acoustically diverse, with wide variations in ear anatomy, hearing frequency range, and amplitude sensitivity (Ketten 1991). An animal’s sensitivity to sound likely depends on the presence and level of sound in certain frequency bands and the range of frequencies to which the animal is most sensitive (Richardson et al. 1995). In general, larger species, such as baleen whales, are believed to hear better at lower frequency ranges than smaller species, such as porpoises and dolphins. Hearing abilities are generally only well understood for smaller species for which audiograms (plots of hearing threshold at different sound frequencies) have been developed based on captive behavioral studies (reactions to sound or behavioral audiograms), and electrophysiological experiments (measuring auditory evoked potentials) on captive or stranded animals (Erbe et al. 2012). Audiograms have been obtained in some toothed whale (odontocetes) and pinniped species (Southall et al. 2007; Finneran 2015), while direct measurements of baleen whale (mysticetes) hearing are lacking (Ridgway and Carder 2001). Baleen whale hearing sensitivities have therefore been estimated based on anatomy, modeling, vocalizations, taxonomy, and behavioral response studies (Houser et al. 2001; Ketten and Mountain 2011, 2014 in Southall et al. 2019; Cranford and Krysl 2015; Richardson et al. 1995; Wartzok and Ketten 1999; Au and Hastings 2008; Dahlheim and Ljungblad 1990; Reichmuth 2007).

Auditory Criteria for Injury and Disturbance

Assessment of the potential effects of underwater noise on marine mammals requires acoustic thresholds against which received sound levels can be compared. Acoustic thresholds from underwater noise are expressed using two common metrics: SPL, measured in dB relative to 1 μPa (dB re 1 μPa), and sound exposure level (SEL), a measure of energy in decibels relative to 1 μPa squared second (dB re 1 $\mu Pa^2 s$). SPL is an instantaneous value represented as either root mean squared (RMS) SPL (also, SPL_{RMS}) or peak SPL (also, SPL_{peak}), whereas SEL is the total noise energy to which an organism is exposed over a given time period, typically 1 second for pulse sources. As such, the cumulative SEL (SEL_{cum}) metric is appropriate when assessing effects to marine mammals from cumulative exposure to multiple pulses.

For marine mammals, NMFS has developed Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NMFS 2018a). The technical guidance established acoustic criteria identifying the potential for onset of permanent threshold shift (PTS) and TTS (NMFS 2018a). NMFS developed dual metric thresholds that consider the peak SPL and cumulative SEL and marine mammal weighting functions. The thresholds are divided by hearing group to acknowledge that not all marine mammal species have identical hearing or susceptibility to noise-induced hearing loss (Table 3.15-1). NMFS has also established behavioral disturbance thresholds for marine mammals that utilize an RMS SPL of 160 dB re 1 μPa for impulsive/intermittent sounds and 120 dB re 1 μPa for continuous sounds for all marine mammal species (NOAA 2013). Unlike PTS and TTS thresholds, behavioral disturbance thresholds are not frequency weighted to account for different hearing abilities by the five marine mammal hearing groups.

Table 3.15-1 Marine Mammal Hearing Groups

Hearing Groups	Functional Hearing Groups	Taxonomic Group	Generalized Hearing Range*
Low-frequency cetaceans (LFC)	Low-frequency cetaceans	Baleen whales (e.g., humpback whale, blue whale)	7 Hz to 35 kHz
Mid-frequency cetaceans (MFC)	Mid-frequency cetaceans	Most dolphin species, beaked whales, sperm whale	150 Hz to 160 kHz
High-frequency cetaceans (HFC)	High-frequency cetaceans	True porpoise, river dolphins, *Cephalorhynchus* dolphins)	275 Hz to 160 kHz
Phocid pinnipeds in-water (PW)	Phocid pinnipeds in-water	Phocid or true seals (e.g., harbor seal)	50 Hz to 86 kHz
Otariid pinnipeds in-water (OW)	Otariid pinnipeds in-water	Otariid (e.g., sea lions and fur seals)	60 Hz to 39 kHz

Source: NMFS 2018a
kHz = kilohertz

Table 3.15-2 outlines the acoustic thresholds for onset of hearing impairment (PTS and TTS) for marine mammals for both impulsive and non-impulsive noise sources. For further detail about classification of underwater sounds, please see Appendix J, *Underwater Sound and Acoustic Modeling Results*. Impulsive noise sources considered in this assessment include impact pile driving, some HRG equipment, and UXO detonation. Non-impulsive noise sources include vibratory pile driving, vessel traffic, some HRG equipment, turbine operations, and dredging.

Table 3.15-2 NMFS PTS and TTS Thresholds (NMFS 2018a)

Marine Mammal Hearing Group	Effect	Impulsive Source		Non-Impulsive Source
		PK (dB re 1 µPa)	Weighted SEL_{24h} (dB re 1 µPa²s)	Weighted SEL_{24h} (dB re 1 µPa²s)
Low-frequency cetaceans (LFC)	PTS	219	183	199
	TTS	213	168	179
Mid-frequency cetaceans (MFC)	PTS	230	185	198
	TTS	224	170	178
High-frequency cetaceans (HFC)	PTS	202	155	173
	TTS	196	140	153
Phocid pinnipeds underwater (PW)	PTS	218	185	201
	TTS	212	170	181
Otariid pinnipeds underwater (OW)	PTS	232	203	219
	TTS	226	188	199

Note: Peak sound pressure (PK) values are flat weighted or unweighted within the generalized hearing range of marine mammals (i.e., 7 Hz to 160 kilohertz): Values presented for SEL_{cum} use a 24-hour cumulative analysis unless stated otherwise.
dB re 1 µPa = decibels relative to 1 micropascal; dB re 1 µPa^{2}s = decibels relative to 1 micropascal squared second

Mortality and Non-auditory Injury Criteria for Explosives (Unexploded Ordnance)

Shock waves associated with underwater detonations can induce non-auditory physiological effects, including direct tissue damage involving mortality (i.e., severe lung injury), slight lung injury, and gastrointestinal injury known as *primary blast injury*. The gas-containing organs (lungs and gastrointestinal tract) are most vulnerable to primary blast injury. The U.S. Navy established thresholds to identify to assess the potential for mortality, slight lung, and gastrointestinal injury from explosive sources; this assessment adopts and applies these thresholds. The magnitude of the acoustic impulse (which is the integral of the instantaneous sound pressure) of the underwater blast causes the most common injuries, and therefore its value is used to determine if there is potential for mortality and slight lung injuries. Gastrointestinal injury potential is identified using the peak SPL (Navy 2017). Mortality and slight lung injury threshold for each depends upon an animal's mass and depth. Table 3.15-3 provides an estimate of mass of the different marine mammal species considered in this assessment. Table 3.15-4 lists equations used to calculate thresholds based on effects observed in 1 percent of exposed animals.

Table 3.15-3 Representative Calf/Pup and Adult Mass Estimates Used for Assessing Impulse-based Onset of Lung Injury and Mortality Threshold Exceedance Distances

Impulse Animal Group	Representative Species	Calf/Pup Mass (kilograms)	Adult Mass (kilograms)
Baleen whales and sperm whale	Sei whale (*Balaenoptera borealis*) Sperm whale (*Physeter macrocephalus*)	650	16,000
Pilot and minke whales	Minke whale (*Balaenoptera acutorostrata*)	200	4,000
Beaked whales	Gervais' beaked whale (*Mesoplodon europaeus*)	49	366

Impulse Animal Group	Representative Species	Calf/Pup Mass (kilograms)	Adult Mass (kilograms)
Dolphins, kogia, pinnipeds, and sea turtles	Harbor seal (*Phoca vitulina*)	8	60
Porpoises	Harbor porpoise (*Phocoena phocoena*)	5	40

Table 3.15-4 Thresholds for Onset of Non-auditory Injury Based on Observed Effects on 1 Percent of Exposed Animals (Navy 2017)

Hearing Group	Mortality (Severe lung injury)*	Slight Lung Injury[1]	Gastrointestinal Tract Injury
All marine mammals	$103M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$ Pa·s	$47.5M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$ Pa·s	$L_{pk,flat}$: 237 dB

[1] Lung injury (severe and slight) thresholds are dependent on animal mass.
M animal (adult and/or calf/pup) mass (kilograms) (see Table C.9 in Navy 2017)
D animal depth (meters)

Auditory Explosive Thresholds

The supersonic shock wave from an explosion transitions to a normal pressure wave at a range determined by the weight and type of the explosive used. The ranges to the impulsive TTS and PTS thresholds (Table 3.15-2) are applicable for determining auditory injury impacts.

Behavioral Explosive Thresholds

Single blast events within a 24-hour period are not presently considered by NMFS to produce behavioral effects below the onset of TTS thresholds for frequency-weighted SEL and peak pressure level (Table 3.15-2). Therefore, the effective disturbance threshold for single events in each 24-hour period is the TTS onset.

3.15.2 Environmental Consequences

3.15.2.1. Impact Level Definitions for Marine Mammals

Definitions of potential impact levels for adverse effects from each alternative are provided in Table 3.15-5. Definitions for duration and significance criteria are provided in Section 3.3. Beneficial impacts are also described, as applicable, for each IPF. Beneficial impacts are those that result in a positive effect on marine mammals. Impact levels are intended to serve NEPA purposes only and they are not intended to incorporate similar terms of art used in other statutory or regulatory reviews. For example, the term “negligible” is used for NEPA purposes as defined here and is not necessarily intended to indicate a negligible impact or effect under the MMPA. Similarly, the use of “detectable” or “measurable” in the NEPA significance criteria is not necessarily intended to indicate whether an effect is “insignificant” or “adverse” for purposes of ESA Section 7 consultation.

Table 3.15-5 Impact Level Definitions for Marine Mammals

Impact Level	Impact Type	Definition
Negligible	Adverse	The impacts on individual marine mammals or their habitat, if any, would be at the lowest levels of detection and barely measurable, with no perceptible consequences to individuals or the population.
	Beneficial	Impacts on species or habitat would be beneficial but so small as to be unmeasurable.
Minor	Adverse	Impacts on individual marine mammals or their habitat would be detectable and measurable; however, they would be of low intensity, short term, and localized. Impacts on individuals or their habitat would not lead to population-level effects.
	Beneficial	If beneficial impacts occur, they may result in a benefit to some individuals and would be temporary to short term in nature.
Moderate	Adverse	Impacts on individual marine mammals or their habitat would be detectable and measurable; they would be of medium intensity, can be short term or long term, and can be localized or extensive. Impacts on individuals or their habitat could have population-level effects, but the population can sufficiently recover from the impacts or enough habitat remains functional to maintain the viability of the species both locally and throughout their range.
	Beneficial	Beneficial impacts on species would not result in population-level effects. Beneficial impacts on habitat may be short term, long term, or permanent but would not result in population-level benefits to species that rely on them.
Major	Adverse	Impacts on individual marine mammals or their habitat would be detectable and measurable; they would be of severe intensity, can be long lasting or permanent, and would be extensive. Impacts on individuals and their habitat would have severe population-level effects and compromise the viability of the species.
	Beneficial	Beneficial impacts would promote the viability of the affected population or increase population resiliency. Beneficial impacts on habitats would result in population-level benefits to species that rely on them.

3.15.3 Impacts of the No Action Alternative on Marine Mammals

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on marine mammals, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for marine mammals and how the No Action Alternative affects those baseline conditions. BOEM separately analyzes how resources will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.15.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, BOEM would not approve the COP. Various stressors associated with the construction, operations, and maintenance of the Project would not occur. However, baseline conditions for marine mammals described in Section 3.15.1, *Description of the Affected Environment for Marine Mammals*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. As such, this section primarily discusses the impacts from baseline conditions and separately makes conclusions on the incremental impact of not approving the COP.

Marine mammals in the geographic analysis area are currently subject to a variety of ongoing human-caused IPFs. The main known contributors to mortality events include collisions with vessels (ship strikes), entanglement with fishing gear, and fisheries bycatch. Other important IPFs considered include underwater noise from anthropogenic sources, pollution (accidental spills and waste discharge), and climate change. For example, impacts associated with climate change have the potential to reduce reproductive success and increase individual mortality and disease occurrence, which could have population-level effects. Many marine mammal migrations cover long distances, and these factors can have impacts on individuals over broad geographic and temporal scales.

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on marine mammals include:

- Continued O&M of the Block Island project (five WTGs) installed in state waters;
- Continued O&M of the Coastal Virginia Offshore Wind pilot project (two WTGs) installed in OCS-A 0497; and
- Construction and O&M of two offshore wind projects, the Vineyard Wind 1 project (62 WTGs and 1 OSS) in OCS-A 0501 and the South Fork project (12 WTGs and 1 OSS) in OCS-A 0517.

The effects of approved projects have been evaluated through previous NEPA review and are incorporated by reference. Ongoing O&M of the Block Island and pilot Coastal Virginia Offshore Wind projects and construction and O&M of the Vineyard Wind 1 and South Fork projects would affect marine mammals through the primary IPFs of noise and presence of structures. Ongoing offshore wind activities would have the same type of impacts from noise, presence of structures, cable emplacement and maintenance, port utilization, and lighting that are described in detail in Section 3.15.3.2 for planned offshore wind activities.

Ongoing non-offshore wind activities that may affect marine mammals include, but are not limited to, submarine cables and pipelines, tidal energy projects, oil and gas activities, dredging and port improvement, marine minerals extraction, military use (i.e., sonar, munitions training), marine transportation, research initiatives, and installation of new structures (such as artificial reefs) on the U.S. Continental Shelf (see Section F.2 in Appendix F for a description of ongoing activities). These activities could result in temporary or permanent displacement and injury or, to a lesser extent, mortality of individual marine mammals. See Table F1-13 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for marine mammals.

It is difficult to consider all potential impacts on marine mammals within the geographic analysis area while considering the interconnectedness of those impacts. The paragraphs below provide an overview of what is known regarding the IPFs affecting marine mammals.

Traffic (vessel strikes): Vessel collisions are a major source of mortality and injury for many marine mammal species (Hayes et al. 2021; Laist et al. 2001). Almost all sizes and classes of vessels have been involved in collisions with marine mammals around the world, including large container ships, ferries, cruise ships, military vessels, recreational vessels, commercial fishing boats, whale-watch vessels, research vessels, and even jet-skis (Dolman et al. 2006). Research into vessel strikes and marine mammals has focused largely on baleen whales given their higher susceptibility to a strike because of their larger size, slower maneuverability, larger proportion of time spent at the surface foraging, and inability to actively detect vessels using sound (i.e., echolocation). Focused research on vessels strikes on toothed whales is lacking. Factors that affect the probability of a marine mammal vessel strike and its severity include number, species, age, size, speed, health, and behavior of animal(s) (Martin et al. 2016; Vanderlaan and Taggart 2007); number, speed, and size of vessel(s) (Martin et al. 2016; Vanderlaan and Taggart 2007); habitat type characteristics (Gerstein et al. 2006; Vanderlaan and Taggart 2007); operator's ability to avoid collisions (Martin et al. 2016); vessel path (Martin et al. 2016; Vanderlaan and Taggart 2007); and the ability of a marine mammal to detect and locate the sound of an approaching vessel. Vessel strikes have been preliminarily determined as a leading cause of death for humpback whales during the current UME (NOAA Fisheries 2022a) and a primary contributor to the NARW UME (NOAA 2022).

North Atlantic cetaceans and pinnipeds including, but not limited to, the fin whale, humpback whale, NARW, sei whale, minke whale, sperm whale, long-finned pilot whale, Risso's dolphin, Atlantic white-sided dolphin, common bottlenose dolphin, harbor porpoise, harbor seal, and gray seal, are all common or regular visitors within the geographic analysis area and could be susceptible to vessel collisions. Most odontocetes (e.g., harbor porpoise) and pinnipeds (e.g., harbor seals) are considered to be at low risk for vessel strikes due to their swimming speed and agility in the water. Although data are limited, events of vessel collisions were recorded by Hayes et al. 2021 for the following species:

- Since 2017, there have been there have been 16 confirmed vessel strikes on NARWs; 14 of those resulted in mortality or serious injury. From 2016–2020, 29 percent of the observed mortality and serious cases were attributed to vessel strike (Hayes et al. 2022b). Applying this to the estimated mortality/serious injury cases (n= 156), it is estimated that 46 cases of mortality have occurred between the same time period (Hayes et al. 2022b). In 2020, 1.3 collisions occurred with U.S. vessels. Two cases of morbidity (a lesser impact than mortality/serious injury) are documented in the NARW UME. Although vessel strikes with NARW may not seriously injure or kill the animal, sustained injuries can be internal and affect reproductive success (van der Hoop et al. 2012; Corkeron et al. 2018).
- For data collected in 2020, the fin whale had an annual average rate of 0.8 U.S. vessel collision. Between 2014 and 2018, there were confirmed fin whale mortalities linked with vessel collisions: two in 2016 and one each in 2017 and 2018.
- Similar to the fin whale, the annual average rate of vessel collisions was 0.8 per year for the sei whale.
- The minke whale had between one and two confirmed cases of whale mortalities linked with vessel traffic in North Atlantic waters between 2014 and 2018, with the exception of the year 2016, which had no confirmed deaths. The average rate of vessel collisions is 1.2 in U.S. waters.
- Humpback whales: Of the 184 whales involved in the 2016–2023 humpback whale UME, 40 percent showed evidence of human interaction (either entanglement or vessel strike). The exact percentage attributable to vessel strike alone is not available; however, recent strandings in the New York/New Jersey area demonstrate that vessel strikes of humpback whales remain a serious threat.
- From 2014 to 2018, 692 common bottlenose dolphins of the Northern Migratory Coastal Stock stranded between North Carolina and New York; 11 percent (n = 80) had evidence of human interaction and of those 5 percent (n = 4) exhibited evidence of vessel strikes. Nineteen percent (n = 134) showed no evidence of human interaction and 69 percent (n = 478) could not be determined.
- Hayes et al. 2021 did not report any harbor porpoise strandings exhibiting evidence of vessel strikes for the Gulf of Maine/Bay of Fundy stock.

Vessel speed and size are important factors for determining the probability and severity of vessel strikes. The size and bulk of the large vessels inhibit the ability for crew to detect and react to marine mammals along the vessel's transit route. Two vessel types that carry AIS transponders were thought to be of the highest threat to humpback whales in the New York Bight apex: tug/tow vessels due to their ability to traverse shallower waters outside shipping channels where humpbacks are frequently found, and passenger vessels due to their high rate of speed (Brown et al. 2019).

Smaller vessels have also been involved in marine mammal collisions. Minke whales, humpback whales, fin whales, and NARWs have been killed or fatally wounded by whale-watching vessels around the world (Jensen et al. 2003; Pfleger et al. 2021). Strikes have occurred when whale-watching boats were actively watching whales as well as when they were transiting through an area (Laist et al. 2001; Jensen et al. 2003). Small vessels, other than whale watching vessels, are also potential sources of large whale vessel strikes; however, many go unreported and are a source of cryptic mortality (Pace et al. 2021). Vessel traffic in the vicinity of the Project area from March 2019 to February 2020 was composed of cargo/carriers (22.4 percent), fishing vessels (19.6 percent), pleasure craft (19.1 percent), tugs (11.4 percent), other/undefined (11.1 percent), cruise ships/large ships (10.5 percent), and tanker/oil tanker (5.8 percent) (COP Volume III, Appendix M; Ocean Wind 2023). Vessels more than 80 meters in length or longer, and therefore those more likely to cause lethal or severe injury to large whales (Laist et al. 2001), in this area account for up to 38.7 percent of vessel traffic.

In 93 percent of marine mammal collisions with large vessels reported in Laist et al. (2001), whales were either not seen beforehand or were seen too late to be avoided. Laist et al. 2001 reported that most lethal or severe injuries are caused by ships 80 meters or longer traveling at speeds greater than 13 knots. A more recent analysis conducted by Conn and Silber (2013) built upon collision data collected by Vanderlaan and Taggart (2007) and Pace and Silber (2005) included new observations of serious injury to marine mammals as a result of vessel strikes at lower speeds (e.g., 2 and 5.5 knots). The relationship between lethality and strike speed was still evident; however, the speeds at which 50 percent probability of lethality occurred was approximately 9 knots. Vanderlaan and Taggart (2007) reported that the probability of whale mortality increased with vessel speed, with greatest increases occurring between 8.6 and 15 knots, and that the probability of death declined by 50 percent at speeds less than 11.8 knots.

As a result of these findings, NMFS implemented a seasonal, mandatory vessel speed rule in certain areas along the U.S. East Coast in 2008 to reduce the risk of vessel collisions with NARW. These Seasonal Management Areas require vessel operators to maintain speeds of 10 knots or less and to avoid Seasonal Management Areas when possible. Effectiveness of the Seasonal Management Area program was reviewed by NMFS in 2020. Results indicated that while it was not possible to determine a direct causal link, the mortality and serious injury incidents on a per-capita basis suggest a downward trend in recent years (NOAA 2020a). NARW vessel strike mortalities decreased from 10 prior to the implementation of Seasonal Management Areas to 3, while serious injuries (defined as a 50-percent probability of leading to mortality) increased from 2 to 4 and injuries increased from 8 to 14 (potentially due to increased monitoring levels). Laist et al. 2014 and NMFS (2020) assessed the effectiveness of Seasonal Management Areas 5 years after their initiation by comparing the number of NARW and humpback whale carcasses attributed to ship strikes since 1990 to proximity to the Seasonal Management Areas. Prior to implementation of Seasonal Management Areas, they found that 87 percent of NARW and 46 percent of humpback whale ship-strike deaths were found either inside Seasonal Management Areas or within 52 miles (83 kilometers, 43 nm), and that no ship-struck carcasses were found within the same proximity during the first 5 years of Seasonal Management Areas.

NMFS also recognized that NARW may be present outside of established Seasonal Management Areas; therefore, temporal voluntary Dynamic Management Areas are established when a group of three or more NARWs are sighted; similarly, a NARW acoustic Slow Zone is triggered if an acoustic detection is made. Right Whale Slow Zones and Dynamic Management Areas are voluntary programs NOAA Fisheries uses to notify vessel operators to slow down to avoid right whales. Mariners are encouraged to avoid the Dynamic Management Area/Slow Zone or reduce speed to less than 10 knots when transiting through the area. NMFS establishes a Dynamic Management Area/Slow Zone boundary around the whales for 15 days and alerts mariners through radio and local notices.

In 2022, NMFS proposed changes to the 2008 NARW vessel speed rule to further reduce the likelihood of mortalities and serious injuries to NARW from vessel collisions. The proposed rule, if issued, would: (1) modify the spatial and temporal boundaries of current Seasonal Management Areas, (2) include most vessels greater than or equal to 35 feet (10.7 meters) and less than 65 feet (19.8 meters) in length in the size class subject to speed restriction, (3) create a Dynamic Speed Zone framework to implement mandatory speed restrictions when whales are known to be present outside active Seasonal Management Areas, and (4) update the speed rule’s safety deviation provision (NOAA Fisheries 2022c).

In general, large baleen whales are more susceptible to a vessel strike than smaller cetaceans and pinnipeds. While there are rare reports of toothed whales/delphinds being struck by ships (Van Waerebeek et al. 2007; Wells and Scott 1997), these animals are at relatively low risk due to their speed and agility (Richardson et al. 1995). However, the behavioral choice by small delphinds to bowride does expose them to the potential for vessel strike and has occurred seasonally in Florida (Wells and Scott 1997) as vessel traffic increases with recreational vessels. Pinnipeds are also fast and maneuverable in the water and have sensitive underwater hearing, potentially enabling them to avoid being struck by approaching vessels (Olson et al. 2021). Of the 3,633 stranded harbor seals in the Salish Sea (Canada/U.S.) from 2002–2019, 28 exhibited injuries consistent with propeller strike (Olson et al. 2021). There are very few documented cases of seal mortalities as a result of vessel strikes in the literature (Richardson et al. 1995). Large whales are more susceptible to vessel strikes than other marine mammals due to their large size, slower travel and maneuvering speeds, lower avoidance capability, and increased proportion of time they spend near the surface (Laist et al. 2001; Vanderlaan and Taggart 2007). In the marine mammal geographic analysis area, whales at risk of collision include NARW, humpback whales, blue whales, fin whales, sei whales, sperm whales, and, to a lesser extent, minke whales due to their smaller size (Hayes et al. 2020, 2021). The impacts of traffic (vessel strikes) on marine mammals, with the exception of NARW, from ongoing activities (from any vessel) would be moderate because it is likely to result in long-term consequences to individuals or populations that are detectable and measurable. Impacts of traffic (vessel strikes) on individual mysticetes could have population-level effects, but the population should sufficiently recover. BOEM notes that not all populations (e.g., minke whales, fin whales) are experiencing population-level consequences from vessel strikes; however, vessel strikes are a threat for all whales. The impacts of traffic (vessel strikes) on NARW from ongoing activities would be major and long term because vessel strikes have had and continue to have population level effects that compromise the viability of the species. The impacts of traffic (vessel strikes) on odontocetes and pinnipeds from ongoing activities would be minor to moderate because population-level effects are unlikely although consequences to individuals would be detectable and measurable.

The likelihood of an offshore wind vessel striking a marine mammal is negligible. BOEM concluded that vessel strikes were unlikely to occur from ongoing offshore wind projects because of the relatively low number of vessel trips and monitoring and mitigation activities to avoid vessel strikes (BOEM 2021a, 2021b). Therefore, ongoing offshore wind activities are anticipated to have no effect on marine mammals via the vessel traffic IPF, as vessel strikes from this industry are not likely to occur.

Gear utilization: Global demand for fish as a food source will likely increase; however, output of seafood from wild fish capture has plateaued (Costello et al. 2020). Although traditional fisheries’ gear utilization may not increase, there is potential for more aquaculture gear utilization to meet the growing demand (Costello et al. 2020). Fisheries interactions can have adverse effects on marine mammal species, with estimated global mortality exceeding hundreds of thousands of individuals each year (Read et al. 2006). Marine mammals can ingest or become entangled in marine debris (e.g., ropes, plastic) that is lost from fishing vessels and other offshore activities. The majority of recorded marine megafauna entanglements are directly or indirectly attributable to ropes and lines associated with fishing gear (Benjamins et al. 2014; Harnois et al. 2015; McIntosh et al. 2015). Depending on the severity of entanglement, this could lead to reduced foraging and swimming capacity and eventual mortality due to drowning.

Entanglement is listed as a threat to humpback whales, NARWs, blue whales, fin whales, sei whales, common bottlenose dolphins, and gray seals (Hayes et al. 2020, 2021). There is limited information regarding entanglements of blue, fin, sei, and minke whales; however, evidence of fishery interactions causing injury or mortality has been noted for each of these species in the Greater Atlantic Regional Fisheries Office/NMFS entanglement/stranding database (Hayes et al. 2021). Of the available information, there are considerable data on the potential for entanglement of humpback whales. A study of 134 individual humpback whales in the Gulf of Maine suggested that between 48 and 65 percent of the whales experienced entanglements (Robbins and Mattila 2001) and that 12 to 16 percent encounter gear annually (Robbins 2012). Along with vessel collisions (discussed above), entanglement of humpback whales could be limiting the recovery of the population (Hayes et al. 2020). Entanglement in fishing gear has also been identified as one of the leading causes of mortality in NARWs and may be a limiting factor in the species' recovery (Knowlton et al. 2012).

Limited information is available for sperm whale entanglement mortalities; however, from 1993 to 1998 there were documented three sperm whale entanglements, two of which were in the North Atlantic Ocean. Three additional sperm whale mortalities from entanglement were also documented in 2009–2010 in a similar region (Waring et al. 2015). There are no documented reports of fishery-related mortality or serious injury to this stock in the U.S. exclusive economic zone during 2013–2017 (Hayes et al. 2020).

Pinnipeds, including harbor seals and gray seals, are also at risk for entanglements (Hayes et al. 2020, 2021). Drowning or asphyxiation in gear, chronic secondary complications of injuries, and feeding impairment are all associated with entanglement mortalities in seals (Moore et al. 2013). A 2014 unoccupied aerial system survey of large populations of gray and harbor seals was used to assess the prevalence of entanglement within haul-out locations in the North Atlantic. The mean prevalence of entanglement within the haul-outs varied between 0.83 percent and 3.70 percent (Waring et al. 2015). However, observed serious injury rates are lower than would be expected from the anecdotally observed numbers of gray seals living with ongoing entanglements, as gray seals entangled in netting are common at haul-out sites in the Gulf of Maine and southeastern Massachusetts. This may be because the majority of observed animals are dead when they come aboard the vessel at bycatch (Josephson et al. 2021); therefore, rates do not reflect the number of live animals that may have broken free of the gear and are living with entanglements. Martins et al. 2019 estimated the mean prevalence of live entangled gray seals at haul-out sites in Massachusetts and Isle of Shoals to be between 1 and 4 percent.

Bycatch occurs in various commercial, recreational, and subsistence fisheries with hotspots driven by marine mammal density and fishing intensity (Lewiston et al. 2014). Small cetaceans and seals are at most risk of being caught as bycatch due to their small body size that allows them to be taken up in fishing gear. Of the species considered in this assessment, Risso's dolphins, short-finned pilot whales, harbor porpoises, white-sided dolphins, harbor seals, and gray seals have been documented in several fisheries' bycatch data. Several commercial fisheries have documented bycatch. The ones that most commonly report bycatch are pelagic longlining, bottom trawling, and sink gillnetting (Hayes et al. 2020, 2021). Purse seine fisheries, Atlantic blue crab trap/pot, North Carolina roe mullet stop net, and hook and line (rod and reel) have also noted instances of marine mammal bycatch.

Stranding data indicate that other marine mammal species may be affected by entanglements or bycatch; however, the contribution of fishery-related mortalities and serious injuries to these strandings is often difficult to determine. This is because not all of the marine mammals that die or are seriously injured wash ashore, and not all will show signs of entanglement or other fishery interaction (Hayes et al. 2020, 2021). As a result, the contribution of fisheries interactions to the annual mortality and injury of marine mammal species in the geographic analysis area and beyond is likely underestimated (Hayes et al. 2020, 2021). Although the duration of increased gear utilization is long term, the frequency of individual gear in any one location throughout the geographic analysis area is short term and localized. The impacts of gear utilization on mysticetes, odontocetes, and pinnipeds from ongoing non-offshore wind activities would be moderate because it is likely to result in long-term consequences to individuals or populations that are detectable and measurable, with the exception of NARW. Impacts on individual mysticetes, odontocetes, and pinnipeds could have population-level effects, but the population should sufficiently recover. Gear utilization from ongoing non-offshore wind activities would likely result in long-term major impacts for NARW because impacts on individual NARWs could have severe population-level effects and compromise the viability of the species.

BOEM does not anticipate that mysticete, odontocete, and pinniped entanglement with gear used for biological monitoring in ongoing offshore wind projects would occur. There are no documented cases associated with biological monitoring for the Block Island, Coastal Virginia Offshore Wind pilot project, and Vineyard Wind 1 wind farms. There are 13 documented seal deaths from South Fork Wind Farm biological monitoring; however, these occurred during gillnet surveys and South Fork Wind Farm has since ceased gillnet surveys. While impacts from gear utilization associated with biological resource monitoring on individual marine mammals could occur, monitoring plans will have sufficient mitigation procedures in place to reduce potential impacts so as to not result in population-level effects. Accordingly, impacts are expected to be minor to moderate (BOEM 2021a, 2021b).

Noise: Underwater sound is a pervasive issue throughout the world’s oceans and can adversely affect marine mammals. Vessel traffic, seismic surveys, and active naval sonars are the main anthropogenic contributors to low- and mid-frequency noises in oceanic waters (NMFS 2018a), with vessel traffic the dominant contributor to ambient sound levels in frequencies below 200 Hz (Arveson and Vendittis 2000; Veirs et al. 2016). In the marine mammal geographic analysis area, underwater noise from anthropogenic sources includes offshore marine construction activities (including pile driving), vessel traffic, seismic surveys, sonar and other military training activities. The long-term effects of multiple anthropogenic underwater noise stressors on marine mammals across their large geographical range are difficult to determine and relatively unknown. The potential for these stressors to have population-level consequences likely varies by species, among individuals, across situational contexts, and by geographic and temporal scales (Southall et al. 2021).

Noise generated from ongoing non-offshore wind activities includes impulsive (e.g., seismic surveys,[3] sonar, military training [sonar and munitions training]) and non-impulsive (e.g., vessels, aircraft, dredging) sources. Impact pile driving, seismic exploration, and sonar surveys can lead to PTS/injury-level effects in marine mammals. In addition, high-intensity tactical sonar activities have been linked to stranding events (Fernandez et al. 2005; Cox et al. 2006; Balcolmb and Claridge 2001; Jepson et al. 2003; Wang and Yang 2006; Parsons et al. 2008; D’Amico et al. 2009; Dolman et al. 2010). All noise sources that are audible by a given species have the potential to cause behavioral effects and some may also cause PTS and TTS when in closer proximity to the sound source. The frequency and number of noise-generating anthropogenic activities in the marine mammal geographic analysis area are relatively unknown. If marine mammal populations are subjected to multiple anthropogenic noise stressors throughout their lifetimes that disrupt critical life stages (e.g., feeding, breeding, calving) and throughout

[3] Seismic surveys used in oil and gas exploration create high-intensity impulsive noise to penetrate deep into the seabed, whereas site characterization surveys associated with offshore wind typically use sub-bottom profiler technologies, such as shallow penetrating high-resolution seismic systems, that generate less-intense sound waves more similar to common deep-water echosounders. Exploratory oil and gas surveys are anticipated to occur infrequently over the next 35 years.

their ranges, then impacts from noise from ongoing non-offshore wind activities could be major, particularly for listed species such as NARW, and have the potential to result in population-level effects through detectable and measurable impacts on the individual that could compromise the viability of the species.

BOEM previously determined that noise impacts on marine mammals from pile driving for Vineyard Wind 1 would be negligible for mid-frequency cetaceans (MFC) and high-frequency cetaceans (HFC) and pinnipeds. Minor impacts on NARW were determined due to avoidance of peak seasons of occurrence and the incorporation of extensive mitigation specific to the species. Impacts from pile driving were determined to be moderate for all other marine mammals in the low-frequency hearing group. Impacts of vessel noise during construction were determined to be moderate for all mysticetes because the lower frequency of sound emitted from vessels overlaps in the most sensitive hearing range of mysticetes. Potential temporary behavioral impacts on all other marine mammals from vessel traffic and temporary impacts on marine mammals from cable-laying noise were determined to be minor. Operation of WTGs was determined to result in negligible impacts on marine mammals (BOEM 2021a). No mortality or non-auditory injury of any marine mammal would occur.

For South Fork, BOEM’s analysis determined construction noise exposures associated with impact pile driving would have moderate effects on fin, minke, and humpback whales and harbor porpoises; minor effects on NARW and Atlantic spotted, Atlantic white-sided, common bottlenose, and common dolphins; and negligible effects on Risso’s dolphin and sei, sperm, and pilot whales. Construction vessel noise impacts on marine mammals was assessed to be minor. Dredging noise effects on marine mammals from O&M facility construction were expected to be negligible, while vibratory and impact pile-driving noise to install moorage improvements at the O&M facility would likely result in minor effects on seals and porpoises (BOEM 2021b).

BOEM reviewed underwater noise levels produced by the available types of HRG survey equipment as part of a programmatic BA for this and other activities associated with regional offshore wind energy development. NMFS concurred with BOEM’s determination that planned HRG survey activities using even the loudest available equipment types would be unlikely to injure or measurably affect the behavior of ESA-listed marine mammals. The rationale supporting this conclusion also applies to non-listed marine mammal species. Specifically, the noise levels produced by HRG survey equipment are relatively low, meaning that an individual marine mammal would have to remain close to the sound source for extended periods of time to experience injury. This type of exposure is unlikely, as the sound sources are continuously mobile and directional (i.e., pointed at the bottom) (BOEM 2021a).

Accidental releases and discharges: Marine mammals are particularly susceptible to the effects of contaminants from pollution and discharges as they accumulate through the food chain or are ingested with garbage. Polychlorinated biphenyls (PCBs) and chlorinated pesticides (e.g., DDT, DDE, dieldrin) are of most concern and can cause long-term chronic impacts. These contaminants can lead to issues in reproduction and survivorship, and other health concerns (e.g., Pierce et al. 2008; Jepson et al. 2016; Hall et al. 2018; Murphy et al. 2018); however, the population-level effects of these and other contaminants are unknown. Research on contaminant levels for many marine mammal species is lacking. Some information has been gathered from necropsies conducted from bycatch and therefore focus on smaller whale species and seals. Moderate levels of these contaminants have been found in pilot whale blubber (Taruski et al. 1975; Muir et al. 1988; Weisbrod et al. 2000). Weisbrod et al. (2000) examined PCBs and chlorinated pesticide concentrations in bycaught and stranded pilot whales in the western North Atlantic. Contaminant levels were similar to or lower than levels found in other toothed whales in the western North Atlantic, perhaps because they are feeding farther offshore than other species (Weisbrod et al. 2000). Dam and Bloch (2000) found very high PCB levels in long-finned pilot whales in the Faroe Islands. Also, high levels of toxic metals (e.g., mercury, lead, cadmium) and selenium were measured in pilot whales harvested in the Faroe Islands drive fishery (Nielsen et al. 2000).

Impacts from accidental releases and discharges associated with the ongoing construction and operation of offshore wind projects have been previously analyzed and were anticipated to result in negligible impacts (BOEM 2021a, 2021b). Offshore wind projects will comply with their Oil Spill Response Plan and USCG requirements for the prevention and control of oil and fuel spills. However, impacts from accidental releases and discharges from ongoing non-offshore wind activities would likely be minor for mysticetes, odontocetes, and pinnipeds and are unlikely to result in population-level effects, although consequences to individuals would be detectable and measurable, except for the NARW. Impacts from accidental releases and discharges from ongoing non-offshore wind activities would likely be moderate to major and long term for NARW and have the potential to result in population-level effects through detectable and measurable impacts on the individual that could compromise the viability of the species.

EMF: There are four in-service and six out-of-service submarine telecommunication cables present in the offshore export cable corridor and in the vicinity of the Project area. The four in-service cables would presumably continue to operate and generate EMF effects under the No Action Alternative. While the type and capacity of those cables is not specified, the associated baseline EMF effects can be inferred from available literature. Fiber-optic communications cables with optical repeaters would not produce EMF effects. Impacts from EMF from ongoing non-offshore wind activities would likely be negligible for mysticetes, odontocetes, and pinnipeds, of the lowest level of detection, and barely measurable, with no perceptible consequences to individuals or the population.

Exponent Engineering, P.C. (2018) modeled EMF levels that could be generated by the South Fork Wind Farm export cable and inter-array cable. The model estimated induced magnetic field levels ranging from 13.7 to 76.6 milligauss on the bed surface above the buried and exposed South Fork Wind Farm export cable and 9.1 to 65.3 milligauss above the inter-array cable, respectively. Induced field strength would decrease effectively to 0 milligauss within 25 feet (7.6 meters) of each cable. By comparison, Earth's natural magnetic field produces more than five times the maximum potential EMF effect from projects similar to the Project (BOEM 2021b, Appendix F, Figure F-8). Background magnetic field conditions would fluctuate by 1 to 10 milligauss from the natural field effects produced by waves and currents. The maximum induced electrical field experienced by any organism close to the exposed cable would be no greater than 0.48 millivolt per meter (Exponent Engineering, P.C. 2018). EMF effects on marine mammals from offshore wind activities would vary in extent and magnitude depending on overall cable length, the proportion of buried versus exposed cable segments, and project-specific transmission design (e.g., HVAC or HVDC, transmission voltage). However, measurable EMF effects are generally limited to within tens of feet of cable corridors. BOEM would require these future submarine cables to have appropriate shielding and burial depth to minimize potential EMF effects from cable operation. Impacts from EMF from the ongoing construction and operation of offshore wind projects have been previously analyzed and were anticipated to be negligible due to estimate low EMF levels, the localized nature of EMF along the cables near the seafloor, and appropriate shielding and burial depth (BOEM 2021a, 2021b).

Presence of structures: There are more than 130 artificial reefs in the Mid-Atlantic region, 15 of which are offshore New Jersey. Artificial reefs in the vicinity of the Project area are depicted in Section 3.6, *Benthic Resources*, Figure 3.6-2. Artificial reefs are made of a variety of materials including cars, trucks, subway cars, bridge rubble, barges, boats, and large cables (MAFMC 2023). Artificial reefs may have higher levels of recreational fishing, which increases the chances of marine mammals encountering lost fishing gear, resulting in possible ingestions, entanglement, injury, or death of individuals, if present where artificial reefs are located. Ongoing offshore wind projects will add a total of 81 WTGs and 2 OSS to the offshore environment. Hard bottom from scour and cable protection and vertical structures such as WTG foundations in a soft-bottom habitat can create artificial reefs, thus inducing the "reef" effect. The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans, providing a potential increase in available forage items and shelter for seals and small odontocetes compared to the surrounding soft bottoms (Appendix F, Table F1-13). Increased prey abundance would be localized at foundation and cable protection locations, and a substantial increase in use offshore wind project areas by foraging whales is not anticipated (NMFS 2021b). Impacts from presence of structures from the ongoing construction and operation of offshore wind projects have been previously analyzed and were anticipated to be negligible to minor as a result of the potential for increased interaction with active or ghost fishing gear. Minor beneficial impacts on pinniped and odontocete foraging and sheltering occur as a result of the monopiles and scour protection creating an artificial reef effect (BOEM 2021a, 2012b; Russell et al. 2016). These beneficial effects have the potential to be offset by risk of entanglement for derelict fishing gear or reduced feeding potential (prey concentrations) for some marine mammal species.

Cable emplacement and maintenance: Emplacement and maintenance of submarine cables and pipelines associated with non-offshore wind activities, and cable emplacement and maintenance for ongoing offshore wind activities, would disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances would be local and generally limited to the emplacement corridor. Data are not available regarding marine mammal avoidance of localized turbidity plumes; however, Todd et al. (Todd et al. 2015) suggest that because some marine mammals often live in turbid waters and some species of mysticetes and sirenians employ feeding methods that create sediment plumes, some species of marine mammals have a tolerance for increased turbidity. If elevated turbidity caused any behavioral responses such as avoiding the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any impacts would be temporary and short term. Turbidity associated with increased sedimentation may result in temporary, short-term impacts on marine mammal prey species (Appendix F, Table F1-13). Impacts from emplacement and maintenance of submarine cables and pipelines are anticipated to be negligible. Sediment resuspension during cable and pipeline emplacement and maintenance would be short term and localized and individual marine mammals, if present, would be expected to successfully forage in nearby areas not affected by increased turbidity.

Port utilization: Vineyard Wind 1 will use port facilities in Connecticut, Massachusetts, Rhode Island, and Canada during construction and O&M, and BOEM found that no changes to port utilization would occur (BOEM 2021a). South Fork will use existing port facilities in New York, Rhode Island, Massachusetts, Connecticut, New Jersey, Maryland, Virginia, or Nova Scotia for offshore construction, staging, fabrication, crew transfer, and logistics support, and BOEM found that although dredging or in-water work could be required for the Port of Montauk, these actions would occur within heavily modified habitats (BOEM 2021b). Impacts from port utilization from ongoing construction and operation of offshore wind projects are anticipated to be negligible. Port expansion activities are localized to nearshore habitats and are expected to result in temporary, short-term impacts, if any, on marine mammals. Vessel noise may affect marine mammals, but response would be expected to be temporary and short term. The impacts on water quality from sediment suspension during port expansion activities is temporary and short term, and would be similar to those described under the cable emplacement and maintenance IPF above.

Lighting: The addition of 81 WTGs and 2 OSS to the geographic analysis area with aviation and marine navigation lighting, as well as lighting associated with construction vessels, would increase artificial lighting in the offshore environment. Orr et al. (2013) concluded that the operational lighting effects from wind farm facilities on marine mammal distribution, behavior, and habitat use were uncertain but likely negligible if recommended design and operating practices are implemented. BOEM requires wind farm developers to comply with the current design guidance for avoiding and minimizing artificial lighting effects; however, artificial light could aggregate prey species at night. Impacts from lighting from ongoing offshore wind activities would likely be negligible for mysticetes, odontocetes, and pinnipeds and are likely to be of the lowest level of detection and barely measurable, with no perceptible consequences to individuals or the population (BOEM 2021a, 2021b).

Climate change: NMFS lists the long-term changes in climate as a threat for almost all marine mammal species (Hayes et al. 2020, 2021). Climate change is known to increase temperatures, alter ocean acidity, raise sea levels, and increase numbers and intensity of storms. Increased temperatures can alter habitat, modify species' use of existing habitats, change precipitation patterns, and increase storm intensity (USEPA 2016; NASA 2019; Love et al. 2013). Increase of the ocean's acidity has numerous effects on ecosystems including reducing available carbon that organisms use to build shells and causing a shift in food webs offshore (USEPA 2016; NASA 2019; Love et al. 2013). This has the potential to affect the distribution and abundance of marine mammal prey. For example, between 1982 and 2018 the average center of biomass for 140 marine fish and invertebrate species along U.S. coasts shifted approximately 20 miles north. These species also migrated an average of 21 feet deeper (USEPA 2016). Shifts in abundance of their zooplankton prey will affect baleen whales who travel over large distances to feed (Hayes et al. 2020). The extent of these impacts is unknown; however, it is likely that marine mammal populations already stressed by other factors (e.g., NARWs) will likely be the most affected by the repercussions of climate change.

Impacts from climate change would likely be moderate for mysticetes, odontocetes, and pinnipeds and are likely to result in long-term consequences to individuals or populations that are detectable and measurable, except for NARW. Impacts from climate change would likely be major for NARW and have the potential to result in population-level effects through detectable and measurable impacts on the individual that could compromise the viability of the species.

3.15.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative (i.e., not approving the COP) in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities that may affect marine mammals include new submarine cables and pipelines, tidal energy projects, oil and gas activities, dredging and port improvement, marine minerals extraction, military use (i.e., sonar, munitions training), marine transportation, research initiatives, and installation of new structures (such as artificial reefs) on the U.S. Continental Shelf (see Section F.2 in Appendix F for a description of planned activities). These activities could result in displacement and injury to or mortality of individual marine mammals. Planned non-offshore wind activities would have the same types of impacts from traffic (vessel strikes), gear utilization, noise, accidental releases and discharges, EMF that are described in detail in Section 3.15.3.1 for ongoing non-offshore wind activities. Additional detail regarding the analysis of impacts from planned non-offshore wind activities is provided in Appendix F, Table F1-12.

This EIS anticipates that planned offshore wind projects, exclusive of the Proposed Action, could affect marine mammals through the following primary IPFs: underwater noise, presence of structures, vessel traffic (vessel strikes), accidental releases, EMF, cable emplacement and maintenance, gear utilization, port utilization, lighting, and climate change. Details regarding planned offshore wind projects are provided in Appendix F.

The IPFs deemed to have impacts on marine mammals are summarized below for planned offshore wind activities on marine mammals during construction, O&M, and decommissioning of projects without the Proposed Action. This section provides a general description of these mechanisms, recognizing that the extent and significance of potential effects of planned offshore wind projects on conditions cannot be fully quantified for projects that are in the conceptual or proposal stage and have not been fully designed. Where appropriate, potential effects resulting from planned activities are generally characterized by comparison to effects resulting from approved projects that have been evaluated and are likely to be similar in nature. Planned activities with federal funding or approval would be subject to independent

NEPA analyses and regulatory approvals. The environmental effects of other offshore wind energy development activities would be fully considered before BOEM makes a decision on the respective COP.

Noise: In the geographic analysis area, offshore wind activities that could cause underwater noise are impact and vibratory pile driving (installation of WTGs and OSS, and installation and removal of piles to support cable landfall construction activities), G&G surveys (HRG surveys and geotechnical drilling activities), detonations of UXO, vessel traffic, aircraft, cable laying or trenching, and site preparation (boulder clearance, sandwave clearance, pre-lay grapnel run, and dredging) during construction, vessel traffic during O&M, and turbine operation. Each of these sub-IPFs are discussed under their own heading below. Decommissioning activities related to noise are likely similar to those outlined for construction activities.

Impact and vibratory pile-driving noise: Impact and vibratory pile driving are used for both the installation of WTG and OSS foundations and also at export cable landfalls for the installation and removal of sheet pile cofferdams and casing pipes. The installation of WTG foundations into the seabed involves impact or vibratory pile driving, which can produce high SPLs in the underwater environment and may affect marine mammals. In the planned activities scenario (see Appendix F), the construction of up to 3,101 new WTG and OSS foundations in the geographic analysis area would create underwater noise and may affect marine mammal species in the area (see Section I.5.1 of Appendix I). Construction of offshore wind facilities is expected to occur intermittently over an 8-year period in lease areas that are anticipated to be developed in the marine mammal geographic analysis area. Noise from pile driving would occur during installation of foundations for offshore structures. The sound generated during pile driving will vary depending on the piling method (impact or vibratory), pile material, size, hammer energy, water depth, and substrate type. A description of the physical qualities of pile-driving noise can be found in Appendix J, *Underwater Sound and Acoustic Modeling Results*. These impacts would vary in extent and intensity based on the scale and design of each project (which may include underwater noise attenuation), as well as the schedule of project activities. There are three potential exposure scenarios that marine mammals could experience:

- Concurrent exposure to noise from two or more impact or vibratory hammers operating simultaneously
- Non-concurrent exposure to noise from multiple pile-driving events within the same year
- Exposure to two or more concurrent or non-concurrent pile-driving events over multiple years

Concurrent pile-driving scenarios would increase the geographical extent and sound intensity to which a marine mammal is exposed at a given time when the piles are being driven but would decrease the total number of days of exposure (assuming the project is completed faster if they drive piles consecutively and thus they can install more piles per day than if pile driving is non-concurrent). Concurrent pile driving may be considered appropriate or desirable if scheduled to avoid critical periods when sensitive or particularly vulnerable populations (e.g., NARW) are present in highest densities and to complete project construction faster. However, this could result in greater potential for TTS and PTS to occur in marine mammals that are more likely to be present during concurrent pile driving. Because driving non-concurrently would likely extend the time over which construction would occur, this scenario could increase the total number of exposure days. Given that multiple planned activities are proposed for construction, it is likely that some individual marine mammals would experience two or more impact and vibratory pile-driving noise exposure days within the same year.

Pile-driving activities from planned offshore wind development projects have the potential to affect all marine mammal hearing groups within a certain radius around each project site. Depending on the hearing sensitivity of the species, exceedance of PTS thresholds may occur on the scale of several kilometers, whereas exceedance of TTS thresholds and behavioral effects may occur on the order of tens of kilometers from the center of pile-driving activity. However, based on the mobility of most marine mammals and the likelihood that they will avoid the area to a certain extent (e.g., Schakner and Blumstein 2013), certain marine mammal species (MFC, HFC, and pinnipeds) may not be exposed to underwater sound for sufficient duration to cause PTS or TTS. In addition, when mitigation measures are applied (e.g., bubble curtains, exclusion zones) all of these effects and exposure ranges can be reduced.

The most commonly reported behavioral effect of pile-driving activity on marine mammals has been short-term avoidance or displacement from the pile-driving site. This has been well documented for harbor porpoises, a species of high concern in European waters. Given that species like harbor porpoise produce echolocation clicks nearly constantly (Osiecka et al. 2020), strategically placed passive acoustic instruments can allow researchers to derive insights about the animals' presence and behavior around wind farms by listening for their clicks. A 2011 study of harbor porpoise acoustic activity in the North Sea at the Horns Rev II wind farm revealed that porpoise vocal activity was reduced as distant as 17.8 kilometers from the construction site during pile driving. At the closest measured distance of 2.5 kilometers, vocal activity completely ceased at the start of pile driving and did not recommence for up to 1 hour after pile driving ended, and remained below average levels for 24–72 hours (Brandt et al. 2011). Dahne et al. (2017) visually and acoustically monitored harbor porpoises during construction of the Alpha Ventus wind farm in German waters and found a decline in porpoise detections at distances up to 10.8 kilometers from pile driving, while an increase in porpoise detections occurred at points 25 and 50 kilometers away, suggesting displacement away from the pile-driving activity. During several construction phases of two Scottish windfarms, an 8–17 percent decline in porpoise acoustic presence was seen in the 25-kilometer by 25-kilometer block containing pile-driving activity in comparison to a control block. Displacement within the pile-driving monitored area was seen up to 12 kilometers away (Benhemma-Le Gall et al. 2021).

A more recent analysis in the North Sea looked at harbor porpoise density and acoustic occurrence relative to the timing and location of pile-driving activity, as well as the sound levels generated during the development of eight wind farms (Brandt et al. 2016). Using data from passive acoustic monitoring pooled across all projects, changes in porpoise detections across space and time were modeled. Compared to the 25–48-hour pre-piling baseline period, porpoise detections during construction declined by about 25 percent at SELs between 145–150 dB re 1 μPa^2s and 90 percent at SELs above 170 dB re 1 μPa^2s. Across the eight projects, a graded decline in porpoise detections was observed at different distances from pile-driving activities. The results revealed a 68-percent decline in detections within 5 kilometers of the noise source during construction, 33-percent decline 5–10 kilometers away, 26-percent decline 10–15 kilometers away, and a decline of less than 20 percent at greater distances, up to the 60-kilometer range modeled (note: the authors used a 20-percent decline to indicate an adverse effect had occurred). However, within 20–31 hours after pile driving porpoise detections increased in the 0- to 5-kilometer range, suggesting no long-term displacement of the animals. Little to no habituation was found, i.e., over the course of installation, porpoises stayed away from pile-driving activities. It is worth noting that there was substantial inter-project variability in the reactions of porpoises that were not all explained by differences in noise level. The authors hypothesized that the varying qualities of prey available across the sites may have led to a difference in motivation for the animals to remain in an area. Temporal patterns were observed as well: porpoise abundance was significantly reduced in advance of construction up to 10 kilometers around the wind farm area, likely due to the increase in vessel traffic activity. This study showed that although harbor porpoises actively avoid pile-driving activities during the construction phase, these short-term effects did not lead to population-level declines over the 5-year study period (Brandt et al. 2016).

A study conducted during wind farm construction in Cromarty Firth, Scotland compared the effect of impact and vibratory pile-driving on the vocal presence of both bottlenose dolphins and harbor porpoises in and outside the Cromarty Firth area (Graham et al. 2017). The researchers found a similar level of response, of both species to both impact and vibratory piling, likely due to the similarly low, received sound exposure levels from the two approaches (129 dB re 1 μPa^{2}s [vibratory] and 133 dB re 1 μPa^{2}s [impact], both at 812 meters from the pile). There were no statistically significant responses attributable to either type of pile-driving activity in the three metrics considered: daily presence/absence of a species, number of hours in which a species was detected, or duration of daytime (between 06:00–18:00) encounters of a species. The only exception was seen in bottlenose dolphins on days with impact pile driving. The duration of bottlenose dolphin acoustic encounters decreased by an average of approximately 4 minutes at sites within the Cromarty Firth (closest to pile-driving activity) in comparison to areas outside the Cromarty Firth. The authors hypothesized that the lack of a strong response was because the received levels were very low in this particularly shallow environment, despite similar size piles and hammer energy to other studies. This study underscores the important influence of environmental conditions on the propagation of sound and its subsequent impacts on marine mammals.

In addition to avoidance behavior, several studies have observed other behavioral responses in marine mammals. A playback study on two harbor porpoises revealed that high-amplitude sounds, like pile driving, may adversely affect foraging behavior in this species by decreasing catch success rate (Kastelein et al. 2019). In another playback study, trained dolphins were asked to perform a target detection exercise during increasing levels of vibratory pile driver playback sounds (up to 140 dB re 1 μPa) (Branstetter et al. 2018). Three of the five dolphins exhibited either a decrease in their ability to detect targets in the water or a near-complete cessation of echolocation activity, suggesting the animals became distracted from the task by the vibratory pile-driving sound.

In addition to bottlenose dolphins and harbor porpoises, the effects of pile driving have been studied on a limited set of additional species. Würsig et al. (2000) studied the response of Indo-Pacific hump-backed dolphins to impact pile driving in the seabed in water depths of 6–8 meters. No overt behavioral changes were observed in response to the pile-driving activities, but the animals' speed of travel increased, and some dolphins remained in the vicinity while others temporarily abandoned the area. Once pile driving ceased, dolphin abundance and behavioral activities returned to pre-pile-driving levels. A study using historical telemetry data collected before and during the construction and operation of a British wind farm showed that harbor seals may temporarily leave an area affected by pile-driving sound beginning at estimated received peak-to-peak pressure levels between 166 and 178 dB re 1 μPa (Russell et al. 2016). Seal abundance was reduced by 19 to 83 percent during individual piling events (i.e., the installation of a single pile) within 25 kilometers of the center of the pile. Displacement lasted no longer than 2 hours after the cessation of pile-driving activities, and the study found no substantial displacement during construction as a whole. The study also showed that seal usage in the wind farm area increased during the operational phase of the wind farm, although this may have been due to another factor, as seal density increased outside the wind farm area as well.

Because there are no studies that have directly examined the behavioral responses of baleen whales to pile driving, studies using other impulsive sound sources such as seismic airguns serve as the best available proxies. With seismic airguns, the distance at which responses occur depends on many factors, including the volume of the airgun (and consequently source level), as well as the hearing sensitivity, behavioral state, and even life stage of the animal (Southall et al. 2021). In a 1986 study, researchers observed the responses of feeding gray whales to a 100-cubic-inch airgun, and found that there was a 50-percent probability that the whales would stop feeding and move away from the area when the received levels reached 173 dB re 1 μPa SPL (Malme et al. 1986). Other studies have documented baleen whales initiating avoidance behaviors to full-scale seismic surveys at distances of less than 10 kilometers (Johnson et al. 2007; Ljungblad et al. 1988; McCauley 1998; Richardson et al. 1986) and as far away as 20 kilometers (Richardson et al. 1999). Bowhead whales have exhibited other behavioral changes, including increased calling rates when airgun pulses are detectable, which level off at a received cumulative SEL around 94 dB re 1 μPa^{2}s and decrease once the 10-minute cumulative SEL exceeds 127 dB re 1 μPa²s (Blackwell et al. 2015). A more recent study by Dunlop et al. (2017) compared the migratory behavior of humpback whales exposed to a 3,130-cubic-inch airgun array with those that were not. There was no gross change in behavior observed (including respiration rates), although whales exposed to the seismic survey made a slower progression southward along their migratory route compared to the control group. This was largely seen in female-calf groups, suggesting there may be differences in vulnerability to underwater sound based on life stage (Dunlop et al. 2017). The researchers produced a dose-response model that suggested behavioral change was most likely to occur within 4 kilometers of the ship at SELs over 135 dB re 1 μPa²s (Dunlop et al. 2017).

Acoustic masking can occur if the frequencies of the sound source overlap with the frequencies of sound used by marine species. Given that most of the acoustic energy from pile driving is below 1 kilohertz, low-frequency cetaceans (LFC) and pinnipeds are more likely to experience acoustic masking from pile driving than MFC or HFC. In addition, low-frequency sound can propagate greater distances than higher frequencies, meaning masking may occur over larger distances than masking related to higher-frequency noise. There is evidence that some marine mammals can avoid acoustic masking by changing their vocalization rates (e.g., bowhead whale [Blackwell et al. 2013], blue whale [Di Iorio and Clark 2010], humpback whale [Cerchio et al. 2014]), increasing call amplitude (e.g., beluga whale [Scheifele et al. 2004], killer whales [Holt et al. 2009]), or shifting dominant frequencies (Lesage et al. 1999; Parks et al. 2007). When masking cannot be avoided, increasing noise could affect the ability to locate and communicate with other individuals. However, given that pile driving occurs intermittently, with some quiet periods between pile strikes, it is unlikely that complete masking would occur. For vibratory pile driving, the overall levels are reduced compared to impact pile driving but the source is transmitting for a longer and continuous period. If animals are vocalizing in the same band, it would be expected that the masking effect would be more disruptive, but that due to the lower source levels, the range from the source of this disruption would be reduced. The range for masking would be similar to that for Level B because below that 120-dB threshold, this signal would be approaching ambient noise levels.

Overall, it is reasonable to assume that there would be greater impacts on LFC (i.e., baleen whales) than other species groups, even though direct research on pile-driving noise on baleen whales is limited. As discussed above, there is evidence suggesting that baleen whales may avoid or change their behavior when exposed to impulsive sounds. Secondly, their primary frequency range for listening to their environment and communicating with others overlaps with the dominant frequency of impact and vibratory pile-driving noise. Finally, because baleen whales have specific feeding and breeding grounds (unlike toothed whales who can perform these life functions over broader spatial scales), disturbance by anthropogenic noise occurring in one of these key geographic areas may come at an increased cost to these species. Considering the number and extent of projects planned in the geographic analysis area, moderate impacts, such as some individual-level fitness effects, are expected on marine mammals from pile-driving activities. These impacts could be reduced with implementation of project-specific avoidance, mitigation, and monitoring measures. For example, noise abatement devices, such as double-bubble curtains, can be used to reduce the overall acoustic energy that is introduced and decrease the geographic extent of noise-related impacts. The implementation of shutdown zones and seasonal restrictions based on species presence in an area can reduce the intensity and likelihood of effects to minor, by only allowing activity when animals are not present. Many of these are requirements as conditions of compliance with the ESA, MMPA, and other federal regulations. These measures would reduce the potential for PTS and TTS effects from pile driving on all marine mammals. The likelihood of behavioral avoidance and masking effects are still high, especially for baleen whales.

Drilling may be required at the site of WTG foundations in the unlikely event that pile refusal occurs prior to meeting the target embedment depth for the piles (e.g., if the pile cannot be driven deep enough into the seabed). While measurements of operations specifically for offshore wind installation have not been conducted, the closest proxy is from oil and gas-related operations, where a 6-meter-diameter drill bit was used for the excavation of mudline cellars (Austin et al. 2018). They measured received levels at 1,000 meters from the operations and back-calculated SPLs between 191–193 dB re 1 micropascal meter (μPa-m). Based on these levels, New England Wind estimated that received levels would reach 120 dB re 1 μPa at 21.5 kilometers from operations (JASCO 2022b).

Research suggests that the sensitivity of marine mammals to drilling noise varies between and within species and is likely context dependent (Richardson et al. 1990). For example, ringed seals and harbor porpoises may be relatively tolerant to drilling activities (Moulton et al. 2003; Todd et al. 2009). In fact, Todd et al. (2020) measured drilling noise from jack-up platforms and concluded that harbor porpoises can only detect drilling noise out to a distance of approximately 70 meters from the source at the study site and concluded that the noise is unlikely to interfere with or mask echolocation clicks. Given the low-frequency nature of drilling sounds, baleen whales may be more vulnerable to disturbance. The majority of studies on baleen whale behavioral responses to drilling noise have been conducted on arctic species in the context of oil and gas extraction, and these studies currently serve as the best available proxies. Bowhead whales have been reported to avoid a radius of about 10 kilometers around an operating drillship, with some individuals avoiding the site up to 20 kilometers away (Richardson et al. 1995). Richardson et al. (1990) performed playback experiments of drilling and dredging noises and observed bowhead whale responses. Behavioral reactions were observed for most of the animals, such as orienting away from the sound, cessation of feeding, and altered surfacing, respiration, and diving cycles (Richardson et al. 1990). Roughly half of the bowhead whales responded to the drilling noise playback at a received level of 115 dB re 1 μPa (20–1000 Hz band) (Richardson et al. 1990). Blackwell et al. 2017 reported that bowhead whale calling rates were correlated with increasing levels of drilling noise, where calling rates initially increased, peaked, and then decreased. While such behavioral responses may result from offshore drilling, they are expected to be short term and intermittent. Therefore, impacts on odontocetes are expected to be negligible and impacts on mysticetes are expected to be minor.

At export cable landfalls in nearshore areas, the installation and removal of sheet pile cofferdams, goal posts, and casing pipes may require the use of an impact or vibratory hammer. Pile driving in the nearshore environment is even more spatially dependent (i.e., affected by the shape of the surrounding seabed) than in the offshore environment. Noise from cable landfall construction pile-driving activities that could result in harassment of marine mammals for all offshore wind farms could range from kilometers to tens of kilometers. However, the duration of these activities is short (days to weeks). The physical distance separating planned offshore wind project landfall locations and the separation in planned construction timeframes make it unlikely that impacts associated with nearshore pile driving would overlap.

Cumulative impacts on marine mammals from noise resulting from impact and vibratory pile driving for planned offshore wind activities (without the Proposed Action) is expected to be similar to that described for the Proposed Action in Section 3.15.5.

G&G survey noise (HRG surveys and geotechnical drilling activities): Recently, BOEM and the U.S. Geological Survey characterized underwater sounds produced by HRG sources and their potential to affect marine mammals (Ruppel et al. 2022). Although some geophysical sources can be detected by marine mammals, given several key physical characteristics of the sound sources—including source level, frequency range, duty cycle, and beamwidth—most HRG sources, even without mitigation, are unlikely to result in substantial behavioral disturbances of marine mammals (Ruppel et al. 2022). Of the few empirical studies assessing the effect of HRG sources on marine mammals, Vires (2011) found no change in Blainville’s beaked whale click durations before, during, and after a scientific survey with a 38-kilohertz EK-60 scientific echosounder; Quick et al. (2017) found that short-finned pilot whales did not change foraging behavior but did increase their heading variance during use of an EK-60; and Cholewiak et al. (2017) found a decrease in beaked whale echolocation click detections during use of an EK-60. Kates Varghese et al. (2020) found no change in three of four beaked whale foraging behavior metrics (i.e., number of foraging clicks, foraging event duration, click rate) during two deep-water mapping surveys using a 12-kilohertz multibeam echosounder. There was an increase in the number of foraging events during one of the mapping surveys, but this trend continued after the survey ended, suggesting that the change was more likely in response to another factor, such as the prey field of the beaked whales, than to the mapping survey. During both multibeam mapping surveys, foraging continued in the survey area and the animals did not leave the area (Kates Varghese et al. 2020, 2021;). For some of the higher-amplitude sources such as bubble guns, some boomers, and the highest-power sparkers, behavioral disturbance is possible but unlikely if mitigation measures such as clearance zones and shutdowns are applied. Geotechnical surveys may introduce low-level, intermittent, broadband noise into the marine environment. These sounds could result in acoustic masking in LFC or MFC but are unlikely to result in behavioral disturbance given their low source levels and intermittent use. BOEM also requires applicants to develop mitigation plans to protect marine mammals during HRG surveys such as those outlined in Appendix H (e.g., protected species observers, clearance zones, shutdowns), which would further minimize exposure risk. There are project design criteria and BMPs that are laid out in a recent Programmatic Letter of Concurrence (BOEM 2021c) that, if followed, would result in limited effects on marine mammals. The physical and temporal separation of planned offshore wind survey activities make it unlikely for impacts associated with G&G surveys to overlap. Therefore, the cumulative effects of offshore wind geophysical survey noises (without the Proposed Action) are likely similar to those described for the Proposed Action in Section 3.15.5.

UXO detonation and deflagration noise: Planned offshore wind activities may encounter UXO on the seabed in their offshore wind lease areas or along export cable routes. While non-explosive methods may be employed to lift and move these objects (i.e., lift-and-shift), some may need to be removed by explosive detonation. Underwater explosions of this type generate high pressure levels that could cause disturbance and injury to marine mammals. A physical description of UXO detonation and deflagration can be found in Appendix J, *Underwater Sound and Acoustic Modeling Results*. The number and location of detonations that may be required for other offshore wind projects can be extrapolated based on information contained within COPs submitted to date: Revolution Wind (OCS-A 0486) (Revolution Wind 2022a:10), Sunrise Wind (OCS-A 0487) (Sunrise Wind 2022a:13), and New England Wind (OCS-A 0534) (New England Wind 2022:167–168) off the coast of Massachusetts and Rhode Island have proposed up to 13 UXO, 3 UXO, and 10 UXO detonations, respectively; while Atlantic Shores South Offshore Wind (OCS-A 0499) (Atlantic Shores 2022:10), off the coast of New Jersey, and CVOW-C (OCS-A 0483) (Dominion Energy 2022a:15) off the coast of Virginia are not proposing UXO detonation. Alternative strategies, such as avoidance, lifting and moving the UXO, low-order detonation, and deflagration, are typically considered prior to in-situ disposal and only one detonation per day, during daylight only, is being proposed. Therefore, the potential for overlapping UXO detonations from nearby projects is unlikely. If overlapping detonations were to occur, they would be instantaneous and limited in the zone of impact. Therefore, impacts associated with UXO detonations for other projects would be similar to those described and modeled for the Proposed Action in Section 3.15.5.

Vessel noise: In general, vessel noise increases with ship size, power/speed, propeller blade size, number of blades, and rotations per minute, with the majority of underwater noise generated by propeller cavitation and singing (Gray and Greeley 1980; JASCO 2011; Mitson 1995). A physical description of vessel noise can be found in Appendix J, *Underwater Sound and Acoustic Modeling Results*.

A comprehensive review of the literature (Erbe et al. 2019; Richardson et al. 1995) revealed that most of the reported adverse effects of vessel noise and presence are changes in behavior, although the specific behavioral changes vary widely across species. Physical behavioral responses include changes to dive patterns (e.g., longer dives in beluga whales [Finley 1990]), disruption to resting behavior (harbor seals [Mikkelsen et al. 2019]), increases in swim velocities (belugas [Finley 1990], humpback whales [Sprogis et al. 2020], narwhals [Williams et al. 2022]), and changes in respiration patterns (longer inter-breath intervals in bottlenose dolphins [Nowacek et al. 2001], increased breathing synchrony in bottlenose dolphin pods [Hastie et al. 2003], increased respiration rates in humpback whales [Sprogis et al. 2020]). A playback study of humpback whale mother-calf pairs exposed to varying levels of vessel noise revealed that the mother's respiration rates doubled and swim speeds increased by 37 percent in the high-noise conditions (low-frequency-weighted received SPL at 100 meters was 133 dB re 1 μPa) compared to control and low-noise conditions (104 dB re 1 μPa and 112 dB re 1 μPa, respectively [Sprogis et al. 2020]). Changes to foraging behavior, which can have a direct effect on an animal's fitness, have been observed in porpoises (Wisniewska et al. 2018) and killer whales (Holt et al. 2021) in response to vessel noise. Thus far, one study has demonstrated a potential correlation between low-frequency anthropogenic noise and physiological stress in baleen whales. Rolland et al. (2012) showed that fecal cortisol levels in NARWs decreased following the 9/11 terrorist attacks, when vessel activity was significantly reduced. NARWs do not seem to avoid vessel noise or vessel presence (Nowacek et al. 2004), yet they may incur physiological effects as demonstrated by Rolland et al. (2012). This lack of observable response, despite a physiological response, makes it challenging to assess the biological consequences of exposure. In addition, there is evidence that individuals of the same species may have differing responses if the animal has been previously exposed to the sound versus if it is a completely novel interaction (Finley 1990). Reactions may also be correlated with other contextual features, such as the number of vessels present, their proximity, speed, direction or pattern of transit, or vessel type. For a more detailed and comprehensive review of the effects of vessel noise on specific marine mammal groups, the reader is referred to Erbe et al. (2019).

Some marine mammals may change their acoustic behaviors in response to vessel noise, either due to a sense of alarm or in an attempt to avoid masking. For example, fin whales (Castellote et al. 2012) and belugas (Lesage et al. 1999) have altered the frequency characteristics of their calls in the presence of vessel noise. When vessels are present, bottlenose dolphins have increased the number of whistles (Buckstaff 2004; Guerra et al. 2014), while sperm whales decrease the number of clicks (Azzara et al. 2013), and humpbacks and belugas have been seen to completely stop vocal activity (Finley 1990; Tsujii et al. 2018). Some species may change the duration of vocalizations (fin whales shortened their calls [Castellote et al. 2012]) or increase call amplitude (killer whales [Holt et al. 2009]) to avoid acoustic masking from vessel noise.

Understanding the scope of acoustic masking is difficult to observe directly, but several studies have modeled the potential decrease in "communication space" when vessels are present (Clark et al. 2009; Erbe et al. 2016; Putland et al. 2017). For example, Putland et al. (2017) showed that during the closest point of approach (less than 10 kilometers) of a large commercial vessel, the potential communication space of Bryde's whale was reduced by 99 percent compared to ambient conditions.

Aircraft noise: Planned offshore wind activities will also employ helicopters and fixed-wing aircraft. Noise generated from aircraft associated with projects in the geographic analysis area could affect marine mammals. In general, marine mammal behavioral responses to aircraft most commonly occur at distances of less than 1,000 feet (less than 305 meters) (Patenaude et al. 2002). Patenaude et al. (2002) showed that aircraft operations (helicopter and fixed wing) could result in temporary behavioral responses from beluga (*Delphinapterus leucas*) and bowhead whales (*Balaena mysticetus*). Responses included short surface durations, abrupt dives, and percussive behaviors (i.e., breaching and tail slapping) (Patenaude et al. 2002). Most observed reactions by bowheads (63 percent) and belugas (86 percent) occurred when the helicopter was at altitudes of 150 meters or less and lateral distances of 250 meters or less. BOEM would require all aircraft operations to comply with current approach regulations for NARWs or unidentified large whales (50 CFR 222.32). These include the prohibition of aircraft from approaching within 1,500 feet (457 meters).

Most aircraft operations would likely occur above this altitude except under specific circumstances (e.g., helicopter landings on the service operations vessel or visual inspections of WTGs). Aircraft operations could result in temporary behavioral responses including short surface durations, abrupt dives, and percussive behaviors (i.e., breaching and tail slapping) (Patenaude et al. 2002).

Cable-laying or trenching noise: Noise associated with cable emplacement and maintenance activities for planned offshore wind activities or for other submarine cables associated with non-offshore wind activities (i.e., for undersea transmission lines or submarine telecommunication cables) could periodically occur in the geographic analysis area. Cable laying and trenching can involve a variety of methods including jetting, vertical injection, controlled-flow excavation, trenching, and plowing. HDD may also be used at landfalls. Cable laying and installation would likely involve several vessels including dynamic positioning vessels and associated support craft. For a detailed description of the physical attributes of these noise sources, see Appendix J, *Underwater Sound and Acoustic Modeling Results*. Impacts of noise generated by planned cable-laying and trenching activities on marine mammals would likely be similar to that described for the Proposed Action in Section 3.15.5.

Site preparation (e.g., boulder clearance, sandwave clearance, pre-lay grapnel run, dredging) noise: Prior to offshore wind project foundation and export cable installation, boulder clearance and pre-lay grapnel runs may be conducted to clear the area of obstructions. This may involve the use of a displacement plow, a subsea grab or, in shallower waters, a backhoe dredger. Sandwave clearance may also be conducted in advance of export cable installation to remove mobile sediments using suction hopper dredger, controlled-flow excavation, or plow. At landfall locations, export cables may be installed using HDD, which may require mechanical dredging of the HDD exit pit. Mechanical dredging uses crane-operated buckets, grabs (clamshell), or backhoes, whereas hydraulic dredging uses suction or controlled-flow excavation. Underwater noise generated by dredging depends on the type of dredge equipment used; for a physical description of this noise source, see Appendix J, *Underwater Sound and Acoustic Modeling Results*.

Given the low source levels and transitory nature of these sources, exceedance of PTS and TTS levels are not likely for harbor porpoise and seals, according to measurements and subsequent modeling by Heinis et al. (2013). For other marine mammals, PTS is not likely, but if dredging occurs in one area for relatively long periods, TTS and behavioral thresholds could be exceeded (Todd et al. 2015; NMFS 2018a).

Behavioral reactions and masking of low-frequency calls in baleen whales and seals are considered more likely to occur due to the low-frequency spectrum over which the sounds occur. Of the few studies that have examined behavioral responses from dredging noise, most have involved other industrial activities, making it difficult to attribute responses specifically to dredging noise (e.g., Bryant et al. 1984). Some found no observable response (beluga whales [Hoffman 2012]), while others showed avoidance behavior (bowhead whales in a playback study of drillship and dredge noise [Richardson et al. 1990]). Diederichs et al. (2010) found short-term avoidance of dredging activities by harbor porpoises near breeding and calving areas in the North Sea. Pirotta et al. (2013) found that, despite a documented tolerance of high vessel presence, as well as high availability of food, bottlenose dolphins spent less time in the area during periods of dredging. The study also showed that with increasing intensity in the activity, bottlenose dolphins avoided the area for longer durations (with one instance being as long as 5 weeks) (Pirotta et al. 2013). Brief behavioral effects or acoustic masking over small spatial scales may occur for baleen whales due to the low-frequency nature of these sound sources.

Turbine operation noise: Sound is generated by operating WTGs due to pressure differentials across the airfoils of moving turbine blades and from mechanical noise of bearings and the generator converting kinetic energy to electricity. Both airfoil sound and mechanical vibration may result in long-term, continuous noise in the offshore environment. A physical description of turbine operation noise can be found in Appendix J, *Underwater Sound and Acoustic Modeling Results*.

Once wind farms are operational, low-level sounds are generated by each WTG, but sound levels are much lower than during construction. This type of sound is considered to be continuous, omnidirectional radially from the pile, and non-impulsive. Most of the energy associated with operations is below 120 Hz. Sound levels from wind turbine operations are likely to increase somewhat with increasing generator size and power ratings, as well as with wind speeds. Recordings from Block Island Wind Farm indicated that there was a correlation between underwater sound levels and increasing wind speed, but this was not clearly influenced by turbine machinery; rather it may have been explained by the natural effects that wind and sea states have on underwater sound levels (Elliott et al. 2019; Urick 1983).

A recent compilation (Tougaard et al. 2020) of operational noise from several wind farms, with turbines up to 6.15 MW in size, showed that operational noise generally attenuates rapidly with distance from the turbines (falling to near-ambient sound levels within approximately 1 kilometer from the source), and the combined noise levels from multiple turbines are lower or comparable to that generated by a small cargo ship. Tougaard et al. (2020) developed a formula predicting a 13.6-dB increase for every tenfold increase in WTG power rating. This means that operational noise could be expected to increase by 13.6 dB when increasing in size from a 0.5-MW turbine to a 5-MW one, or from 1 MW to 10 MW. The least squares fit of that dataset would predict that the SPL measured 100 meters from a hypothetical 15-MW turbine in operation in 10-meter-per-second (19-knot or 22-mile-per-hour) wind would be 125 dB re 1 μPa. However, all of the 46 data points in that dataset—with the exception of the two from Block Island Wind Farm—were from WTGs operated with gear boxes of various designs rather than the newer use of direct-drive technology, which is expected to lower underwater noise levels substantially. Only one study of direct-drive turbines presented in Elliott et al. (2019) was available in the literature. The study measured SPLs of 114 to 121 dB re 1 μPa SPL_{RMS} at 50 meters for a 6-MW direct-drive turbine. Stöber and Thomsen (2021) make predictions for source levels of 10-MW turbines based on a linear extrapolation of maximum received levels from WTGs with ratings up to 6.15 MW. The linear fit is likely inappropriate, and the resulting predictions may be exaggerated. Tougaard et al. (2020) point out that received level differences among different pile types could be confounded by differences in water depth and turbine size. In any case, additional data are needed to fully understand the effects of WTG size and foundation type on operational noise. Jansen and de Jong (2016) and Tougaard et al. (2009a) concluded that marine mammals would be able to detect operational noise within a few thousand feet of 2-MW WTGs, but the effects would have no significant impacts on individual survival, population viability, distribution, or behavior. Lucke et al. (2007) exposed harbor porpoise to simulated noise from operational wind turbines and found masking effects at 128 dB re 1 μPa within the frequencies of 0.7, 1,000, and 2,000 Hz. This suggests the potential for a reduction in effective communication space within the wind farm environment for marine mammals that communicate primarily in frequency bands below 2,000 Hz. Any such effects would likely be dependent on hearing sensitivity and the ability to adapt to low-intensity changes in the noise environment.

Based on the currently available data, underwater noise from turbine operations from offshore wind activities (without the Proposed Action) is likely to reach ambient noise levels within relatively short distances of the foundations. It is unlikely operational noise would cause PTS or TTS in marine mammals but could cause behavioral and masking effects at relatively short distances from the foundations (Miller and Potty 2017; Tougaard et al. 2009b, 2020). However, more acoustic research is warranted to characterize SPLs originating from large direct-drive turbines.

Summary of noise impacts: Underwater noise impacts on marine mammals from planned offshore wind activities are anticipated to occur. Noise generated from planned offshore wind activities include impulsive (e.g., impact pile driving, UXO detonations, some HRG surveys) and non-impulsive sources (e.g., vibratory pile diving, some HRG surveys, vessels, aircraft, cable laying or trenching, site preparation activities, turbine operations). Of those activities, only pile driving and UXO detonations are anticipated to cause PTS/injury-level effects in marine mammals. Vibratory pile driving of WTG and

OSS foundations could result in PTS if conducted continuously for long time periods. UXO detonation may also cause mortality, slight lung injury, and gastrointestinal tract injury at close range. All noise sources that are audible by a given species have the potential to cause behavioral responses ranging from very low to more severe. All projects are expected to include applicant-proposed measures (e.g., exclusion zones, protected species observers), similar to the measures included in Vineyard Wind 1 and South Fork, that would minimize underwater noise impacts on marine mammals. The effects of implementing underwater noise impact minimization measures would likely be similar to that described for the Proposed Action in Section 3.15.5.

The intensity of this IPF is considered severe for UXO detonations, as mortality thresholds will be exceeded; medium for impact pile driving, as PTS thresholds will be exceeded; and low for all other activities, as TTS and behavioral thresholds will be exceeded. The predicted effect would be permanent in the case of some PTS effects and mortality and slight lung injury resulting from UXO detonations and short term with respect to TTS, behavioral effects, and masking. The geographic extent is considered localized for PTS effects and extensive for behavioral disturbance effects, as noise could exceed behavioral thresholds several tens of kilometers away depending on the activity. The frequency of the activity causing the effect is considered infrequent for impact pile driving, vibratory pile driving, UXO detonations, aircraft, cable laying and trenching, and dredging noise; frequent for HRG survey noise; and continuous for WTG operation noise. With the application of mitigation measures similar to those outlined in Appendix H for UXO detonations, the likelihood of mortality and non-auditory injury of a marine mammal from UXO detonations is considered low. Based on the source levels available in the literature and using the underwater noise modeling completed for the Proposed Action as a proxy for planned offshore wind activities, some PTS, TTS, behavioral disturbance, and masking effects on LFC, MFC, HFC, and phocid pinnipeds in water are considered likely, with respect to this IPF, but would vary by species and population. Based on the available information regarding offshore wind activities in the marine mammal geographic analysis area (Figure 3.15-1) the impact of noise is considered moderate and short term for LFC, MFC, HFC, and phocid pinnipeds in water.

Noise impacts from planned offshore wind activities would likely result in moderate short-term impacts for LFC, MFC, HFC, and pinnipeds. Impacts on individual marine mammals would be detectable and measurable; however, populations are expected to recover from the impacts. Impacts from noise from planned non-offshore wind activities could be moderate for listed species such as NARW because impacts on an individual could result in population-level effects; however, applicant-proposed measures and agency-required mitigation would be implemented to minimize impacts.

Presence of structures: Ongoing non-offshore wind activities (i.e., the installation of hard-bottom and vertical structures in soft-bottom habitat) have resulted in the creation of 130 artificial reefs in the Mid-Atlantic region. Ongoing offshore wind projects will add a total of 81 WTGs and 2 OSS to the offshore environment. The addition of up to 3,000 new WTG and OSS foundations in the geographic analysis area associated with planned activities would result in hydrodynamic and artificial reef effects that influence primary and secondary productivity and the distribution and abundance of fish and invertebrate community structure within and in proximity to project footprints. Depending on proximity and extent, hydrodynamic and reef effects from planned activities could influence the availability of prey and forage resources for marine mammals. Project-specific effects would vary, recognizing that larger and contiguous projects could have more significant hydrodynamic effects and broader scales. An increase in offshore wind farms may weaken the regional thermocline and affect heat storage, atmospheric CO_2 uptake, and benthic resupply of oxygen gas (Dorrell et al. 2022). This could in turn lead to more significant effects on prey and forage resources, but the extent and significance of these effects cannot be predicted based on currently available information.

Atmospheric wakes, characterized by reduced downstream mean wind speed and turbulence along with wind speed deficit, are documented with the presence of vertical structures. Magnitude of atmospheric wakes can change relative to instantaneous velocity anomalies. In general, lower impacts of atmospheric wakes are observed in areas of low wind speeds. Several hydrodynamic processes have been identified to exhibit changes from vertical structures:

- Advection and Ekman transport are directly correlated with shear wind stress at the sea surface boundary. Vertical profiles from Christiansen et al. 2022 exhibit reduced mixing rates over the entire water column. As for the horizontal velocity, the deficits in mixing are more pronounced in deep waters than in well-mixed, shallow waters, which is likely favored by the influence of the bottom mixed layer in shallow depths. In both cases, the strongest deficits occur near the pycnocline depth.
- Additional mixing downstream has been documented from Kármán vortices and turbulent wakes due to the pile structures of wind turbines (Carpenter et al. 2016; Grashorn and Stanev 2016; Schultze et al. 2020).
- Up-dwelling and down-dwelling dipoles under contact of constant wind directions affecting average surface elevation of waters have been documented as the result of offshore wind farms (Broström 2008; Paskyabi and Fer 2012; Ludewig 2015). Mean surface variability is between 1 and 10 percent.
- With sufficient salinity stratification, vertical flow of colder/saltier water to the surface occurs in lower sea surface level dipoles and warmer/less saline water travels to deeper waters in elevated sea surface heights (Ludewig 2015; Christiansen et al. 2022). This observation also suggested impacts on seasonal stratification, as documented in Christiansen et al. 2022. However, the magnitude of salinity and temperature changes with respect to vertical structures is small compared to the long-term and interannual variability of temperature and salinity.

Shelf sea dynamics have natural mixing driven by internal waves and flow over seafloor sand banks. In the Mid-Atlantic Bight, biological production from phytoplankton relies on seasonal stratification that occurs during the summer (Dorrell et al. 2022). As seen in van Berkel et al. (2020), the potential hydrodynamic effects identified above from the presence of vertical structures in the water column therefore affect nutrient cycling and could influence the distribution and abundance of fish and planktonic prey resources. Turbulence resulting from vertical structures in the water column could lead to localized changes in circulation and stratification patterns, with potential implications for primary and secondary productivity and fish distribution. Structures may reduce wind-forced mixing of surface waters, whereas water flowing around the foundations may increase vertical mixing (Carpenter et al. 2016). Increased mixing may also result in warmer bottom temperatures, increasing stress on some shellfish and fish at the southern or inshore extent of the range of suitable temperatures. Changes in cold pool dynamics resulting from future activities, should they occur, could conceivably result in changes in habitat suitability and fish community structure, but the extent and significance of these potential effects are unknown. These effects and their implications for fish, invertebrates, and primary and secondary productivity are discussed in detail in Appendix I.

However, the scale of vertical mixing is infrastructure specific. Strong thermoclines act as a barrier to vertical mixing and transport. In extreme scenarios, as seen near islands, enhanced mixing could prevent stratification; however, at regional scales, water columns typically re-stratify by natural buoyancy forcing (Dorrell et al. 2022). The waters surrounding offshore wind farms are characterized by strong seasonal stratification (NOAA Fisheries 2022d). The strong seasonal stratification of the Mid-Atlantic Bight is the dominant oceanographic feature limiting phytoplankton productivity, which then affects zooplankton prey productivity (Schofield et al. 2008).

Scour protection at WTG and OSS foundations may induce a reef effect. The reef effect and impacts from artificial reefs are described for the No Action Alternative in Section 3.15.3.1. Planned offshore wind activities would result in increased hard-bottom habitat and a potential for increased prey abundance;

however, it is anticipated that the beneficial impacts on foraging marine mammals would be localized and difficult to detect.

In contrast, broadscale hydrodynamic impacts could alter zooplankton distribution and abundance (van Berkel et al. 2020). This possible effect is primarily relevant to NARWs and other baleen whales, as their planktonic prey (calanoid copepods and krill) are driven primarily by hydrodynamic processes that can redistribute nutrients and create patchiness of prey both spatial and temporally. As aggregations of plankton, which provide a dense food source for NARWs to efficiently feed upon, are concentrated by physical and oceanographic features, increased mixing may disperse aggregations and may decrease efficient foraging opportunities. Potential effects of hydrodynamic changes in prey aggregations are specific to listed species that feed on plankton, whose movement is largely controlled by water flow, as opposed to other listed species that eat fish, cephalopods, crustaceans, and marine vegetation, which are either more stationary on the seafloor or are more able to move independent of typical ocean currents (NMFS 2021a). There is considerable uncertainty as to how these broader ecological changes will affect marine mammals in the future, and how those changes will interact with other human-caused impacts. The effect of the increased presence of structures on marine mammals and their habitats is likely to be negative, varying by species, and their significance is unknown.

The presence of structures could also concentrate recreational fishing around foundations, potentially increasing the risk of marine mammal entanglement in both lines and nets and increasing the risk of injury and mortality due to infection, starvation, or drowning (Moore and van der Hoop 2012). These structures could also result in fishing vessel displacement or gear shift. The potential impact on marine mammals from these changes is uncertain. However, if a shift from mobile gear to fixed gear occurs due to inability of the fishermen to maneuver mobile gear, there would be a potential increase in the number of vertical lines, resulting in an increased risk of marine mammal interactions with fishing gear. Entanglement in fishing gear has been identified as one of the leading causes of mortality in NARW and may be a limiting factor in the species’ recovery (Knowlton et al. 2012). Johnson et al. (2005) reports that 72 percent of NARWs show evidence of past entanglements. Additionally, recent literature indicates that the proportion of NARW mortality attributed to fishing gear entanglement is likely higher than previously estimated from recovered carcasses (Pace 2021). Entanglement may also be responsible for high mortality rates in other large whale species (Read et al. 2006). Abandoned or lost fishing gear may become tangled with foundations, reducing the chance that abandoned gear would cause additional harm to marine mammals and other wildlife, although debris tangled with WTG foundations may still pose a hazard to marine mammals. These potential long-term, intermittent impacts would persist until decommissioning is complete and structures are removed.

The long-term presence of WTG structures could also displace marine mammals from preferred habitats or alter movement patterns, potentially resulting in exposure to commercial and recreational fishing activity. The evidence for long-term displacement is unclear and varies by species. Long (2017) compiled a statistical study of seal and cetacean (including porpoises and baleen whales) behavior in and around Scottish marine energy facilities. The study found evidence of displacement during construction, but habitat use appeared to return to previous levels once construction was complete and the projects were in operation. The study cautioned that observational evidence was limited for certain species and further research would be required in order to draw a definitive conclusion about operational effects. Some research has suggested long-term displacement of species like harbor porpoise, but the evidence is mixed, and observed changes in abundance may be more indicative of general population trends than an actual wind farm effect (Nabe-Nielsen et al. 2011; Teilmann and Carstensen 2012; Vallejo et al. 2017). Other studies have documented apparent increases in marine mammal density around wind energy facilities. Russel et al. (2014) found clear evidence that seals were attracted to a European wind farm, apparently attracted by the abundant concentrations of prey created by the artificial reef effect. Gray seals are susceptible to entrapment in gillnet fisheries, as well as trawl fisheries to a lesser degree (Orphanides

2020; Lyssikatos 2015). If commercial trawling were to occur near wind farms, increased interactions and resulting mortality of gray seals could potentially occur.

The widespread development of offshore renewable energy facilities may facilitate a slowing of climate change. Hayes et al. (2021) note that marine mammals are following shifts in the spatial distribution and abundance of their primary prey resources driven by increased water temperatures and other climate-related impacts. These range shifts are primarily oriented northward and toward deeper waters. The artificial reef effect created by these structures forms biological hotspots that could support species range shifts and expansions and changes in biological community structure resulting from a changing climate (Degraer et al. 2020; Methratta and Dardick 2019; Raoux et al. 2017).

Impacts from the presence of structures from planned offshore wind activities would likely be minor for mysticetes, odontocetes, and pinnipeds; although impacts on individuals would be detectable and measurable, they would not lead to population-level effects. Impacts on odontocetes and pinnipeds may result in minor beneficial effects due to increases in aggregations of prey species.

Traffic (vessel strikes): Increased vessel traffic presents a potential increase in collision-related risks to marine mammals. Based on information available in COPs for planned offshore wind projects (e.g., Atlantic Shores 2021; Empire 2022), is assumed that construction of each individual offshore wind project would generate approximately 20 to 65 simultaneous construction vessels operating in the geographic analysis area for marine mammals at any given time. Planned offshore wind projects on the OCS would be constructed between 2023 and 2030, contributing to increases in vessel traffic within the marine mammal geographic analysis area. Vessels used during construction range in size from larger heavy-lift vessels and heavy transport vessels to smaller crew transfer vessels. BOEM anticipates that non-offshore wind vessel traffic would gradually increase over time. Additional information regarding the expected increase in vessel traffic is provided in Appendix F, *Planned Activities Scenario*. Once projects are operational, they would be serviced by crew transfer vessels and service operations vessels making routine trips between the wind farms and port-based O&M facilities. Crew transfer vessels generally make one round-trip per week while service operations vessels would make trips on an as-needed basis. Based on information available in COPs for planned offshore wind projects (e.g., Revolution Wind 2022b; Sunrise Wind 2022b; Dominion Energy 2022b; Empire 2022), it is assumed that annual O&M vessel trips could range from 76 crew transfer vessel and service operations vessel trips to up to 518 vessel trips. Unplanned maintenance activities would require the periodic use of larger vessels of the same class used for project construction. The number and size of crew transfer vessels and number of trips per week required for unplanned maintenance would vary by project based on the number of WTGs. Vessel requirements for unplanned maintenance would also likely vary based on overall project size. Additionally, vessels required to complete monitoring programs at various stages of project development will add to the number of vessel trips undertaken by other projects. These planned activities would pose the same type of vessel-related collision risks to marine mammals as for planned trips, but the potential extent and number of animals potentially exposed cannot be determined without project-specific information.

Marine mammal vessel strikes are possible; however, the risk is negligible. Developers would be required to abide by several vessel strike avoidance measures during construction, operation, and maintenance. If a vessel strike from ongoing and planned offshore wind activities (without the Proposed Action) did occur, the outcome could range from no apparent injury to mortality. As discussed in Section 3.15.3.1, *Impacts of the No Action Alternative*, the speed and size of a vessel influences the outcome. Impacts from traffic (vessel strikes) from planned offshore wind activities would likely be long term and major for NARW and have the potential to result in population-level effects through detectable and measurable impacts on the individual that could compromise the viability of the species. The impacts of traffic (vessel strikes) on odontocetes and pinnipeds from planned non-offshore wind activities would be minor because population-level effects are unlikely although consequences to individuals would be detectable and measurable. However, as described above, offshore wind vessels would be required to abide by mitigation measures designed to avoid vessel strike. If those measures are successful in avoiding vessel strikes, there would be no impact on marine mammal species from this IPF.

Accidental releases and discharges: Gradually increasing non-offshore wind vessel traffic over time would increase the risk of accidental releases. Accidental releases of fuel, fluids, hazardous materials, trash, and debris may also increase as a result of offshore wind activities. The risk of any type of accidental release would be increased primarily during construction when additional vessels are present, but also during operations and decommissioning of offshore wind facilities. Refueling of primary construction vessels at sea is anticipated for planned offshore wind projects.

In the planned activities scenario (see Table F2-3 in Appendix F), there would be a low risk of a leak of fuel, fluids, or hazardous materials from any one of approximately 2,946 WTGs, each with approximately 5,000 gallons (18,927 liters) stored. Total fuel, fluids, or hazardous materials within the geographic analysis area would be approximately 15.7 million gallons (71.3 million liters; see Table F2-3 in Appendix F). According to BOEM’s modeling (Bejarano et al. 2013), a release of 128,000 gallons (484,532.7 liters), which represents all available oils and fluids from 130 WTGs and an OSS, is likely to occur no more often than once per 1,000 years, and a release of 2,000 gallons (7,571 liters) or less is likely to occur every 5 to 20 years. The likelihood of a spill occurring from multiple WTGs and OSS at the same time is very low and, therefore, the potential impacts from a spill larger than 2,000 gallons (7,571 liters) are largely discountable.

Marine mammal exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality or sublethal effects on individual fitness, including adrenal effects, hematological effects, liver effects, lung disease, poor body condition, skin lesions, and several other health effects attributed to oil exposure (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008; Smith et al. 2017; Sullivan et al. 2019; Takeshita et al. 2017). Based on the volumes potentially involved, the likely amount of additional releases associated with offshore wind development would fall within the range of accidental releases that already occur on an ongoing basis from non-offshore wind activities.

Trash and debris may be released by vessels during construction, operations, and decommissioning of offshore wind facilities. Operators would be required to comply with federal and international requirements to minimize releases. In the unlikely event of a trash or debris release, it would be accidental and localized in the vicinity of offshore wind lease areas. Worldwide, 62 of 123 (about 50 percent) marine mammal species have been documented ingesting marine litter (Werner et al. 2016). The global stranding data indicate potential debris-induced mortality rates of 0 to 22 percent. Mortality has been documented in cases of debris interactions, as well as blockage of the digestive tract, disease, injury, and malnutrition (Baulch and Perry 2014). However, it is difficult to link physiological effects on individuals to population-level impacts (Browne et al. 2015). While precautions to prevent accidental releases will be employed by vessels and port operations associated with offshore wind development, it is likely that some debris could be lost overboard during construction, maintenance, and routine vessel activities. However, the amount would likely be miniscule compared to other inputs already occurring and considered negligible. If a release were to occur, it would be an accidental, low-probability event in the vicinity of offshore wind lease areas or the ports to the offshore wind lease areas used by vessels.

Intakes and discharges related to cooling offshore wind conversion stations are possible for planned offshore wind projects. Potential effects resulting from intake and discharge use include altered micro-climates of warm water surrounding outfalls, altered hydrodynamics around intakes/discharges, prey entrainment, and association with intakes if prey are aggregated on intake screens from which marine mammals scavenge. The number of OSS per project is likely small; therefore, these impacts, though long term, would be low in intensity and localized.

Impacts from accidental release and discharges from planned offshore wind activities would likely be negligible and long term for mysticetes, odontocetes, and pinnipeds, except for NARW. Offshore wind projects would be expected to comply with Oil Spill Response Plan and USCG requirements for the prevention and control of oil and fuel spills. If these releases or discharges were to occur, they would be likely to result in long-term consequences to a few individuals that are detectable and measurable but do not lead to population-level effects. Impacts from accidental release and discharges from planned offshore wind activities would likely be moderate and long term for NARW and have the potential to result in population-level effects through detectable and measurable impacts on the individual, but the population should sufficiently recover.

EMF: In the planned activities scenario, up to 10,297 miles (16,571 kilometers) of inter-array and export cable would be added in the marine mammal geographic analysis area, producing EMF in the immediate vicinity of each cable during operations (Table F2-2 in Appendix F). Studies documented electric or magnetic sensitivity up to 0.05 microTesla or Earth’s magnetic field for fin whale, humpback whale, sperm whale, bottlenose dolphin, common dolphin, long-fin pilot whale, Atlantic white-sided dolphin, Risso’s dolphin, and harbor porpoise (Tricas and Gill 2011). However, evidence used to make the determinations was only observed behaviorally/physiologically for bottlenose dolphins and the remaining species were concluded based on theory or anatomical details. Recent reviews by Bilinski (2021) of the effects of EMF on marine organisms concluded that measurable, though minimal, effects can occur for some species, but not at the relatively low EMF intensities representative of marine renewable energy projects. Electrical telecommunications cables are likely to induce a weak EMF on the order of 1 to 6.3 microvolts per meter within 3.3 feet (1 meter) of the cable path (Gill et al. 2005). Fiber-optic communications cables with optical repeaters would not produce EMF effects. Under the No Action Alternative, export cables would be added in 26 BOEM offshore wind lease areas. As of October 1, 2021, 12 of these projects have a COP under review and are presumed to include at least one identified cable route, which will produce EMF in the immediate vicinity of each cable during operations. Transmission cables using HVAC emit ten times less magnetic field than HVDC (Taormina et al. 2018); therefore, HVAC cables are likely to have less EMF impacts on marine mammals. Additionally, marine mammal species that are more likely to forage near the benthic organisms, such as certain delphinids, have more potential to experience EMF above baseline levels (Tricas and Gill 2011). This EIS anticipates that the proposed offshore energy projects would use HVAC transmission, but HVDC designs are possible and could occur.

EMF effects on marine mammals from these other projects would vary in extent and magnitude depending on overall cable length, the proportion of buried versus exposed cable segments, and project-specific transmission design (e.g., HVAC or HVDC, transmission voltage). However, measurable EMF effects are generally limited to within tens of feet of cable corridors. BOEM would require these submarine power cables to have appropriate shielding and burial depth to minimize potential EMF effects from cable operation.

Impacts from EMF from planned offshore wind activities would likely be negligible for mysticetes, odontocetes, and pinnipeds and are likely to be of the lowest level of detection and barely measurable, with no perceptible consequences to individuals or the population.

Impacts from EMF from planned non-offshore wind activities would likely be negligible for mysticetes, odontocetes, and pinnipeds, of the lowest level of detection, and barely measurable, with no perceptible consequences to individuals or the population.

Cable emplacement and maintenance: Cable emplacement and maintenance activities for ongoing and planned non-offshore wind activities (i.e., for undersea transmission lines or submarine telecommunication cables) could periodically occur in the geographic analysis area. Cable emplacement and maintenance activities disturb bottom sediments and cause temporary local increases in suspended sediment that are generally limited to the emplacement corridor. Planned offshore wind projects could disturb up to 34,299 acres (139 km^2) of seabed while installing associated undersea inter-array cables, and up to 150,280 acres (608 km^2) while installing undersea export cables, causing an increase in suspended sediment (see Table F2-2 in Appendix F for calculation details). Those effects would be similar in nature to those observed during construction of the Block Island Wind Farm (Elliot et al. 2017). While suspended sediment impacts would vary in extent and intensity depending on project- and site-specific conditions, measurable impacts are likely to be on the order of 500 mg/L or lower, short term lasting for minutes to hours, and limited in extent to within a few feet vertically and a few hundred feet horizontally from the point of disturbance.

Impacts from cable emplacement and maintenance from planned offshore wind activities would likely be minor for mysticetes, odontocetes, and pinnipeds and are likely to result in short-term, localized consequences to individuals that are detectable and measurable but do not lead to population-level effects.

Gear utilization (biological/fisheries monitoring surveys): Planned offshore wind projects are likely to include plans that monitor biological resources in and nearby associated project areas throughout various stages of development. These could include trawl, and trap surveys, as well as other methods of sampling the biota in the area. The presence of monitoring gear could affect marine mammals by entrapment or entanglement; however, developers have included marine mammal mitigation and monitoring procedures in COPs submitted to date designed to avoid entanglement or entrapment in any biological survey plans. Therefore, it is expected that monitoring plans will have sufficient mitigation procedures in place to avoid entanglement and entrapment and impacts would not occur. Should future developers not develop plans that avoid entanglement and entrapment, such an outcome could lead to injury, serious injury, or mortality of a marine mammal.

If entanglement or entrapment occurs, the impacts of gear utilization on mysticetes (with the exception of NARWs), odontocetes, and pinnipeds from planned non-offshore wind activities would be moderate because they are likely to result in long-term consequences to individuals or populations that are detectable and measurable. Population-level effects on these species are unlikely to occur because the rate of entanglement for any given species would likely not be high enough to result in population-level effects. Gear utilization from planned non-offshore wind activities could result in major long-term impacts for NARW if a NARW is entangled because impacts on individual NARWs could have severe population-level effects and compromise the viability of the species. However, the likelihood of NARW entanglement in biological monitoring gear is negligible given the amount of survey effort, many types of gear proposed (e.g., trawls) have not been implicated in NARW entanglement, and the implementation of mitigation and monitoring measures designed to avoid entanglement.

Port utilization: The development of an offshore wind industry in the marine mammal geographic analysis area may incentivize the expansion or improvement of regional ports to support planned projects. Three main activities surrounding port utilization have the potential to affect marine mammals: port expansion/construction, increased vessel traffic, and increased dredging. The State of New Jersey is planning to build an offshore wind port on the eastern shore of the Delaware River in Lower Alloways Creek (Appendix F). The Atlantic Shores South Offshore Wind project would construct an O&M facility in Atlantic City, New Jersey on a shoreside parcel that was formerly used for vessel docking and other port activities. As described for the Proposed Action in Section 3.15.5, at larger ports such as Charleston and Norfolk, offshore wind-related activities would make up a small portion of the total activities at the port; therefore, offshore wind activities are likely to have a negligible impact on marine mammals through increased port utilization at these ports. However, for smaller ports within the geographic analysis area, such as Paulsboro and Hope Creek, port expansion may be necessary to accommodate the increased activity, resulting in more significant increases to vessel traffic, dredging, and shoreline construction. USACE has proposed maintenance dredging of portions of the Newark Bay, New Jersey federal navigation channel, including the removal of material from the Port Elizabeth Channel, to occur between

July 2021 and February 2022 (USACE 2021). Additionally, in 2017 USACE Charleston District awarded contracts as part of the Charleston Harbor Deepening Project, which will create a 52-foot depth at the entrance channel to Charleston Harbor in South Carolina. Port improvements could lead to an increase in vessel traffic and underwater noise from pile driving and dredging during construction, O&M, and conceptual decommissioning of planned offshore wind projects. The realized impacts on marine mammals in the geographic analysis area from the activities described above include potential increased vessel interaction, exposure to noise, and localized turbidity plumes from dredging. See the *noise, vessel traffic (vessel strike)*, and *cable emplacement and maintenance* IPFs above for discussion of impacts on marine mammals from underwater noise, vessel strike, and elevated turbidity that would also be associated with port utilization and expansion.

Impacts from port utilization from planned offshore wind activities on mysticetes, odontocetes, and pinnipeds would likely be moderate and long term and result in population-level effects through detectable and measurable impacts on the individual, but the population should sufficiently recover, except the NARW. Impacts from port utilization from planned offshore wind activities would likely be long term and major for NARW and have the potential to result in population-level effects through detectable and measurable impacts on the individual that could compromise the viability of the species. However, any future port expansion and associated increase in vessel traffic would be subject to independent NEPA analysis and regulatory approvals requiring full consideration of potential effects on marine mammals regionwide.

Lighting: The addition of up to 2,937 new WTGs in the geographic analysis area with long-term hazard and aviation lighting, as well as lighting associated with construction vessels, would increase artificial lighting. Increased lighting associated with nighttime pile driving (if allowed) could increase prey concentrations and attract marine mammals. Orr et al. (2013) concluded that the operational lighting effects from wind farm facilities on marine mammal distribution, behavior, and habitat use were uncertain but likely negligible if recommended design and operating practices are implemented. BOEM would require wind farm developers to comply with the current design guidance for avoiding and minimizing artificial lighting effects; however, artificial light could aggregate prey species at night. Impacts from lighting from planned offshore wind activities would likely be negligible for mysticetes, odontocetes, and pinnipeds and are likely to be of the lowest level of detection and barely measurable, with no perceptible consequences to individuals or the population.

Climate change: Global climate change is also an ongoing risk for marine mammal species in the geographic analysis area. Warming and sea level rise could affect marine mammals through increased storm frequency and severity, altered habitat/ecology, altered migration patterns, increased disease incidence, and increased erosion and sediment deposition (Evans and Bjørge 2013; Evans and Waggitt 2020; Learmonth et al. 2006). Increased storm severity or frequency may result in increased energetic costs, particularly for young life stages, reducing individual fitness. Altered habitat/ecology associated with warming has resulting in northward distribution shifts for some prey species (Hayes et al. 2021) and marine mammals are altering their behavior and distribution in response to these alterations (Davis et al. 2017, 2020; Hayes et al. 2020, 2021). Warming is expected to influence the frequency of marine mammal diseases, particularly for pinnipeds. Ocean acidification may affect some marine mammals through negative effects on zooplankton (PMEL 2020). Warming and sea level rise, with their associated consequences, and ocean acidification could lead to long-term impacts on marine mammals. Impacts of climate change would likely be moderate for mysticetes, odontocetes, and pinnipeds and are likely to result in long-term consequences to individuals or populations that are detectable and measurable, except for NARW. Impacts from climate change would likely be major for NARW and have the potential to result in population-level effects through detectable and measurable impacts on the individual that could compromise the viability of the species.

Planned offshore wind is expected to combat the effects from climate change over the long term by providing clean energy and reducing use of fossil fuels. Minor beneficial impacts on mysticetes, odontocetes, and pinnipeds are anticipated because planned offshore wind activities may reduce the ongoing and predicted rate of climate change. Therefore, impacts on marine mammals from climate change may be reduced.

3.15.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, BOEM would not approve Ocean Wind's COP. As such, stressors from construction, operation, and maintenance of the Ocean Wind 1 Project would not occur. Baseline conditions of the existing environment would remain unchanged. Therefore, not approving the COP would have no additional incremental effect on marine mammals. Similarly, NMFS's No Action Alternative (i.e., not issuing the requested incidental take authorization) would also have no additional incremental impact on marine mammals and their habitat.

Under the No Action Alternative, ongoing stressors and activities contributing to baseline conditions would result in a range of temporary to long-term impacts (disturbance, displacement, injury, mortality, and reduced foraging success) on marine mammals. Climate change would continue to affect marine mammal foraging and reproduction through changes to the distribution and abundance of marine mammal prey. Vessel activity (vessel collisions) and gear utilization associated with ongoing non-offshore wind activities would continue to cause long-term detectable and measurable injury and mortality to individual marine mammals. Underwater noise from pile driving during construction of offshore wind structures would also result in detectable impacts on marine mammals; however, these impacts would be short term. Accidental releases and discharges, EMF, the presence of structures, cable emplacement and maintenance, port utilization, and lighting would also result in long-term negligible or minor impacts on marine mammals. Although impacts on individual marine mammals and their habitat are anticipated from offshore wind activities, the level of impacts would be minimized due to the mitigation measures that are being implemented during construction, operation, and maintenance. The No Action Alternative would result in **minor** to **moderate** impacts on mysticetes (with the exception of NARW), odontocetes, and pinnipeds.

Because of the low population size for the NARW and continuing stressors, population-level effects on NARWs are occurring. Vessel activity (vessel collisions) and gear utilization associated with ongoing non-offshore wind activities would continue to result in long-term population-level impacts. The effects of climate change would further exacerbate impacts on NARW. For NARW, the No Action Alternative (in consideration of baseline conditions) would result in **moderate** to **major** long-term impacts. Ongoing offshore wind construction, operation, and maintenance activities would be conducted with applicant-proposed and agency-required mitigation measures developed to avoid and minimize impacts on NARW, so impacts from offshore wind activities are not anticipated to substantially contribute to the major impacts.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue in addition to impacts from planned offshore wind activities. Mysticetes, odontocetes, and pinnipeds would continue to be affected by natural and human-caused IPFs. Planned non-offshore wind activities would also contribute to impacts on marine mammals. Planned non-offshore wind activities include increasing vessel traffic; new submarine cable and pipeline installation and maintenance; marine surveys; commercial and recreational fishing activities; marine minerals extraction; port expansion; channel-deepening activities; military readiness activities; and the installation of new towers, buoys, and piers. BOEM anticipates that planned non-offshore wind activities would result in moderate long-term impacts on marine mammals (with the exception of NARW) primarily driven by ongoing underwater noise impacts, vessel activity (vessel collisions), entanglement, and seabed disturbance and the lack of knowledge regarding any mitigation and monitoring requirements for these planned non-offshore wind activities. Offshore wind activities would be responsible for a majority of the impacts associated with pile-driving noise, which could lead to moderate short-term impacts on marine mammals in the geographic analysis area. BOEM anticipates that the combined ongoing and planned activities would result in moderate impacts on marine mammals (with the exception of NARW). Additionally, the presence of structures could contribute adverse impacts with potentially beneficial impacts on some marine mammal species.

Impacts are often magnified in severity to major long-term impacts for the NARW due to low population numbers and the potential to compromise the viability of the species from the loss of a single individual. Offshore wind construction, operation, and maintenance activities would be conducted with applicant-proposed and agency-required mitigation measures developed to minimize impacts on NARW, so impacts from offshore wind activities are not anticipated to substantially contribute to the major impacts.

BOEM anticipates that the cumulative impacts of the No Action Alternative would result in **moderate** impacts on mysticetes, odontocetes, and pinnipeds, with the exception of the NARW, on which impacts could be **moderate** t**o major**. Impacts on individual NARWs could have population-level effects, and it is unknown whether the population can sufficiently recover from the loss of an individual to maintain the viability of the species.

3.15.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix E) would influence the magnitude of the impacts on marine mammals:

- The number and size of WTG foundations, including scour protection;
- The number, size, and type of OSS foundations, including foundations and scour protection;
- The number and location of inter-array cables, OSS cables, and offshore export cables, including landfall and scour protection;
- The number of vessels, number of trips, and size of the vessels;
- The vessels and gear utilized to sample environmental parameters in the project area through HRG surveys, fisheries, and biological monitoring; and
- Number, size, and location of UXO detonations;

Ocean Wind has committed to measures to minimize impacts on marine mammals. The APMs are considered part of the Proposed Action and applicable action alternatives and are assessed within each IPF. The measures outlined in the COP include adhering to vessel speed restriction requirements and maintaining reasonable distances from marine mammals (MMST-01); adhering to NMFS Regional Viewing Guidelines to minimize the risk of vessel collision (MMST-02); monitoring NMFS NARW reporting systems (MMST-03); posting protected species observers as required by NMFS during construction activities (MMST-04); obtaining necessary permits and establishing appropriate and practicable mitigation and monitoring measures (MMST-05); and developing and implementing a Protected Species Mitigation and Monitoring Plan (MMST-06). A detailed list of the APMs is provided in Appendix H, Table H-1. Several monitoring programs may require the use of additional vessels beyond those noted in Table 3.15-15, Table 3.15-16, and Table 3.15-17. These include:

- Monitoring of marine mammals during construction activities including visual (e.g., protected species observers) and passive acoustic monitoring on the construction vessels as well on a secondary vessel as noted in Appendix H
- Benthic monitoring of the seafloor habitat as described in the Benthic Monitoring Plan (see Section 3.6.4 in Section 3.6, *Benthic Resources*, for additional details)
- SAV monitoring in Barnegat Bay as described in the SAV Monitoring and Mitigation Plans (see Section 3.6.4 in Section 3.6, *Benthic Resources*, for additional details)
- Fisheries monitoring as described in the Fisheries Monitoring Plan (see Section 3.9.4 in Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, for additional details). Fisheries monitoring would employ the use of trawling methods, underwater video and chevron traps, clamming methods using a towed fishing dredge, and tagging methods using a towed omni-directional hydrophone. See the *Gear Utilization* section for additional details.
- HRG surveys and monitoring would involve 88 survey days annually in years 1, 4, and 5, and 180 survey days per year in years 2 and 3 (see Chapter 2, Section 2.1.2.2.1 for details). Up to three vessels may be active concurrently to support HRG surveys for the Project.

In addition to the measures outlined in Table 1.1-2 of COP Volume II, Ocean Wind has committed to measures to minimize impacts on marine mammals in COP Appendix AA, Protected Species Mitigation and Monitoring Plan: Marine Mammals, Sea Turtles, and ESA-Listed Fish Species (Ocean Wind 2023), and as part of its MMPA Incidental Take Authorization application (Ocean Wind 2022). These measures are listed in Appendix H, Table H-1. The marine mammal section of the Protected Species Mitigation and Monitoring Plan, appended to the draft Incidental Take Authorization application as Appendix B,[4] provides a full description of these measures. The measures to be implemented include noise attenuation through use of a noise mitigation system; seasonal restrictions; standard protected species observer training and equipment requirements; visual monitoring, including low-visibility monitoring tools; passive acoustic monitoring; establishment and monitoring of shutdown zones; pre-start clearance; ramp-up procedures; operations monitoring; operational shutdowns and delay; sound source measurements of at least one foundation installation; survey sighting coordination; vessel strike avoidance procedures; and data recording and reporting procedures.

3.15.5 Impacts of the Proposed Action on Marine Mammals

3.15.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.15.8, *Impacts of Alternative E on Marine Mammals*. The sections below summarize the potential impacts of the Proposed Action on marine mammals during the various phases of the Project. Routine activities would include construction, O&M, and decommissioning of the Proposed Action, as described in Chapter 2, *Alternatives*. The Proposed Action would have the same IPFs as those described in Section 3.15.3.2, *Cumulative Impacts of the No Action Alternative*, because that analysis considers full build-out of all other wind farms and wind farm construction, operation, and decommissioning generally include the same (or similar) activities (e.g., pile driving, UXO detonation, site preparation work, vessel use) regardless of the specific project. The magnitude of impacts in this

[4] Ocean Wind's Incidental Take Authorization application is available on NMFS's website at: https://www.fisheries.noaa.gov/action/incidental-take-authorization-ocean-wind-lcc-construction-ocean-wind-1-wind-energy-facility.

section pertain to the construction, operation, and decommissioning of the Ocean Wind 1 Project. The analysis and conclusions regarding the impacts in this section, when compared with the analysis in Section 3.15.3.1, *Impacts of the No Action Alternative*, reflect the incremental impacts of the Proposed Action.

As described above, all IPFs apply to marine mammals. The most impactful construction-phase IPFs include noise (from pile driving, HRG surveys, and UXO detonation) and traffic (vessel strike). The IPFs of greatest concern during operations include noise (from operations), traffic (vessel strike), and presence of structures.

Noise: Activities associated with the Proposed Action that could cause underwater noise effects on marine mammals are impact pile driving (for the installation of WTGs and OSS), impact and vibratory pile driving (for the installation and removal of casing pipes, goal posts, or cofferdams at landfall sites), geophysical (HRG surveys) and geotechnical surveys, detonations of UXO, vessel traffic, aircraft, cable laying or trenching, and dredging. While all of these noise sources occur during construction, only WTG operation, HRG surveys, vessel traffic, and cable laying or trenching for cable repairs, if necessary, would occur during operation. Decommissioning activities related to noise would likely be similar to or less than those outlined for construction activities (with the exception of impact pile driving for foundations). Project construction activities could generate underwater noise and result in auditory injury, behavioral disturbance, and masking effects on marine mammals. WTG operations have the potential to result in long-term behavioral disturbance and masking effects on marine mammals.

Assessment of the potential for underwater noise to injure or disturb a marine mammal requires acoustic thresholds against which received sound levels can be compared. The thresholds used to assess the potential for Project-generated underwater noise to cause PTS and behavioral disturbance in marine mammals are outlined in Section 3.15.1.

The assessment of underwater noise in this EIS uses modeling, exposure estimates, and take numbers presented in Ocean Wind's application for a Letter of Authorization dated February 2022, and supplemented with an update memorandum submitted to NMFS in August 2022 (see Appendix J, Attachment J-1). In total, 17 marine mammal species (comprising 18 stocks) are likely to be affected by construction-related noise activities.

Impact pile-driving noise: Noise from impact pile driving for the installation of 98 WTGs and 3 OSS foundations would occur intermittently over 1 to 2 years. Pile driving would involve two pile types: monopiles and pin piles. For the WTGs, a single (8-meter diameter at top, 11-meter diameter at seafloor) vertical hollow steel monopile would be installed for each location using an impact hammer (IHC-4000 or IHC-S-2500 kilojoule impact hammer or similar) to an expected penetration depth of 50 meters. Installation of a single monopile is expected to take 9 hours (1 hour clearance period, 4 hours piling, and 4 hours moving to the next location). Up to two piles are expected to be installed per 24-hour period. Concurrent monopile installation at more than one location is not planned. For the OSS, a piled jacket foundation is being considered. This would involve installing 16 2.44-meter-diameter pin piles as a foundation for each OSS foundation using an impact hammer (IHC-S-2500 kilojoule impact hammer or similar) to an expected penetration depth of 70 meters. Alternatively, a single monopile like the ones used for WTGs may be used for each OSS. Each pin pile takes approximately 4 hours to install and a single OSS foundation is expected to take 6 days to install. For installation of both the WTG and OSS monopile foundations, 24-hour-per-day pile driving is expected to occur. A total of 98 monopiles would be installed for WTGs and 48 pin piles (or three monopiles) would be installed for OSS, constituting about 584 hours of active pile driving (404 if monopiles are used, assuming OSS monopile installation is identical to that for WTGs).

For both WTG and OSS installations, concurrent installation of more than one pile is not expected to occur. Ocean Wind has committed to using a noise mitigation system (also termed *noise abatement system*) during installation of both monopiles and pin piles (see Section 3.15.5 for a summary and Appendix H, Table H-1 for additional details). The noise mitigation system would be a combination of two devices that function together as a system to reduce noise propagation during pile driving. The same or a different noise mitigation system would be used during UXO detonations. The noise mitigation system ultimately selected for the Project would be tailored to and optimized for site-specific conditions, but the exact system to be used is not specified at this time. Bellmann et al. (2020) found three noise abatement systems to have proven effectiveness and to be offshore suitable: (1) the near-to-pile noise abatement systems – noise mitigation screen; (2) the near-to-pile hydro sound damper; and (3) for a far-from-pile noise abatement system, the single and double big bubble curtain. With the near-to-pile noise abatement systems – noise mitigation screen or the single big bubble curtain, noise reductions of approximately 15 to 17 dB in depths of 82 to 131 feet (25 to 40 meters) could be achieved. The near-to-pile hydro sound damper system, independent of the water depth, demonstrated noise reductions of 10 dB with an optimum system design. The achieved broadband noise reduction with a single or double big bubble curtain was dependent on the technical-constructive system configuration. Based on Bellmann et al. (2020), the noise mitigation system performance of 10 dB broadband attenuation assumed for the Project is considered achievable with currently available technologies for pile-driving activities. Ocean Wind has committed to achieving a minimum 10 dB broadband noise reduction during impact pile-driving operations (Appendix H, Table H-1).

Acoustic source level, propagation, and animal movement modeling of the impact pile-driving activities for the Proposed Action was undertaken by JASCO Applied Sciences to determine ranges to established PTS and disturbance thresholds and exposure estimates (Küsel et al. 2022). The modeling assumed a 10-dB-per-hammer-strike noise attenuation rate.

Simplistic acoustic modeling methods used to identify distances to PTS thresholds assume that marine mammals remain stationary for the duration of the sound event (i.e., acoustic range). However, the pathway a marine mammal travels through the sound field determines the accumulated received sound levels; therefore, treating marine mammals as stationary may not produce realistic estimates for the monitoring zones. For the Project, animal movement modeling was used to estimate the distance to the closest point of approach for each of the species-specific animats (simulated animals) during a simulation. The resulting values are termed *exposure ranges* (ER). To estimate exposure ranges, a conservative hammer schedule and sophisticated site-specific propagation modeling was applied. To estimate exposures from WTG installation, the Project assumed that 60 WTG monopiles (two per day for 30 days) would be installed in the highest-density month of each species and the remaining 38 WTG monopiles (two per day for 19 days) would be installed during the month with the second highest animal density. To estimate exposures from OSS foundation installation, the Project assumed either three monopiles (two per day for 1 day and one on a third day) or 48 pin piles (three per day for 16 days) would be installed in the highest-density month. Both OSS scenarios were modeled and evaluated and the worst-case scenario was applied to estimate exposure ranges and the number of animals exposed to underwater noise above acoustic thresholds.

Results of the acoustic and exposure modeling are presented in Appendix J and include $ER_{95\%}$ values as the horizontal distance that includes 95 percent of the closest point of approach of animats exceeding a PTS and behavioral threshold and the numbers of individual marine mammal species predicted to receive sound levels above PTS (e.g., injury) and behavioral exposure criteria.

The APMs outlined for impact pile driving include seasonal clearance zones and shutdown zones and specific monitoring requirements for NARW and are provided in Appendix H, Table H-1. As outlined in Table 3.15-6 below, the clearance zones and shutdown zones are based upon the maximum PTS zones for each species group and specific to seasonal variation (e.g., one for summer and one for winter months).

This is particularly important due to the larger exposure ranges expected during the winter months. These zones would be monitored by protected species observers on the pile-driving vessel and a separate, dedicated protected species observer vessel. In addition to visual monitoring, Ocean Wind would conduct passive acoustic monitoring as described in the APMs in Appendix H. Ocean Wind would acoustically monitor a clearance zone of 3,500 meters during summer (May–November) and 3,800 meters during winter (December) to minimize exposures. Ocean Wind would also implement a passive acoustic monitoring shutdown zone for NARWs of 1,650 meters in summer and 2,500 meters in winter.

Soft-start procedures are proposed in Appendix H and would occur over a 20-minute period. Soft starts can be an effective mechanism to reduce the potential for PTS by deterring species from the area. They are considered highly effective in deterring harbor porpoises from the area but not as effective in deterring pinnipeds, as described in Southall et al. 2021 and outlined below. The efficacy of deterring other marine mammal species through pile driving soft-start procedures is less clear.

As the clearance and shutdown zones are based on the maximum PTS zones modeled for LFC and separated by season, the potential for PTS effects is reduced. The extended NARW clearance zones to be implemented during all impact pile-driving operations would further reduce the potential for PTS. This also reduces exposure to higher noise levels considered to potentially result in behavioral disturbance, thereby minimizing the severity of any behavioral reaction on NARWs. In addition, no pile installation would occur from January 1 to April 30 during the time of year when NARWs are present in the region in higher numbers, further reducing effects on this species. Ocean Wind has proposed nighttime pile driving; however, no nighttime pile driving would be allowed unless Ocean Wind demonstrates the ability to effectively monitor clearance and shutdown zones. In addition to passive acoustic monitoring, other visual monitoring techniques would be implemented during any possible nighttime installation or during periods of daytime low visibility. These techniques include electro optical/infrared camera systems, thermal or infrared cameras, night vision devices, and infrared spotlight. As outlined in the Letter of Authorization application submitted to NMFS (Ocean Wind 2022), piling during the night would reduce the total duration of construction activities and limit crew transfers and vessel trips and allow the work to be conducted during low NARW density months in the summer, which would reduce the overall potential impact on this species.

Table 3.15-6 $ER_{95\%}$ PTS Zones and Applicable Clearance and Shutdown Zones to Be Applied during Impact Pile Driving (with 10-dB attenuation)

Hearing Group	Max. PTS Zones – $ER_{95\%}$ (m)		Clearance/Shutdown Zones (m)		Behavior zones – $ER_{95\%}$ (m)	
	Summer	Winter	Summer	Winter	Summer	Winter
LFC (excluding NARW)	1,650	2,490	1,650	2,490	3,130	3,450
NARW	1,650	2,490	3,500	3,800	3,130	3,450
MFC	0	0	1,650	2,490	3,090	3,410
HFC	880	1,430	880	1,430	3,070	3,370
PW	80	240	80	240	3,090	3,420

$ER_{95\%}$ represents the 95th percentile of the maximum exposure ranges calculated for each hearing group for each scenario that was modeled. See Appendix R of the COP for more detail.
m = meters; PW = phocid pinnipeds in water

The results of marine mammal exposure modeling for the full monopile scenario (WTG and OSS) and joint foundation approach (WTGs use monopiles; OSS use jackets with pin piles) over 5 years assuming 10 dB attenuation only are shown in Table 3.15-7 and Table 3.15-8 below.

Table 3.15-7 Modeled Potential Level A and Level B Harassment Exposures (Assuming 10 dB Sound Attenuation) Due to Impact Pile Driving of a Monopile Foundation (Assuming 98 Total Monopiles for WTGs) Over 5 Years

Marine Mammal Species	Population Estimate	Level A Harassment (SEL_{cum})	Level B Harassment (160 dB RMS)
NARW[1]	338	0.9[3]	3.11
Blue whale[1]	Unknown[2]	N/A[5]	N/A[5]
Fin whale[1]	6,802	3.69	7.05
Sei whale[1]	6,292	0.89	2.00
Minke whale	21,968	18.42	52.25
Humpback whale	1,396	4.24	13.82
Sperm whale[1]	4,349	0	0
Atlantic white-sided dolphin	93,233	0	71.5
Atlantic spotted dolphin	39,921	N/A[5]	N/A[5]
Bottlenose dolphin (offshore stock)	62,851	0	935.91
Bottlenose dolphin (coastal stock)	6,639	0	0
Short-finned pilot whale	28,924	0	0.04
Long-finned pilot whale	39,215	0	0
Risso's dolphin	35,215	0	7.06
Common dolphin	172,974	0	1,229.37
Harbor porpoise[4]	95,543	51.31	233.89
Gray seal	27,300	3.04	197.56
Harbor seal	61,336	12.16	554.22

Source: Taking Marine Mammals Incidental to the Ocean Wind 1 Wind Energy Facility Offshore of New Jersey, 87 *Federal Register* 64868–65009 (October 26, 2022)
[1] Listed as endangered under the ESA.
[2] The minimum blue whale population is estimated at 412, although the exact value is no known. NMFS is utilizing this value for the preliminary small numbers determination, as shown in parentheses.
[3] Level A harassment exposures were initially estimated for this species, but due to mitigation measures that Ocean Wind would be required to abide by, no Level A harassment take would be requested or expected. Instead, the requested Level A harassment take from these exposure estimates was added to the requested Level B harassment take.
[4] The calculated Level A harassment exposures are likely an overestimate, as the modeled 10 dB sound reduction from the noise mitigation systems does not take into account that the reduction is greater at higher frequencies, which are best heard by harbor porpoises.
[5] Exposure modeling for blue whales and Atlantic spotted dolphins was not conducted because the impacts on the species approached zero due to the low density estimates. Because of this, values for these species have been excluded from the quantitative analyses and subsequent tables.

Table 3.15-8 Modeled Potential Level A and Level B Harassment Exposures (Assuming 10 dB Sound Attenuation) Due to Impact Pile Driving of OSS Foundations (Assuming Three Monopiles or Three Jackets with 48 Pin Piles) Over 5 Years

Marine Mammal Species	Population Estimate	8-/11-meter Monopile Foundation Scenario		2.44 Pin Pile for Jacket Foundation Scenario	
		Level A Harassment (SEL_{cum})	Level B Harassment (160 dB RMS)	Level A Harassment (SEL_{cum})	Level B Harassment (160 dB RMS)
NARW[1]	338	0.04[3]	0.14	0.10[3]	0.75
Blue whale[1]	Unknown[2]	N/A[5]	N/A[5]	N/A[5]	N/A[5]
Fin whale[1]	6,802	0.15	0.27	0.48	1.20
Sei whale[1]	6,292	0.04	0.08	0.14	0.45
Minke whale	21,968	0.76	2.32	2.29	15.81
Humpback whale	1,396	0.18	0.51	0.54	3.63
Sperm whale[1]	4,349	0	0	0	0
Atlantic white-sided dolphin	93,233	0	2.37	0	16.20
Atlantic spotted dolphin	39,921	N/A[5]	N/A[5]	N/A[5]	N/A[5]
Bottlenose dolphin (offshore stock)	62,851	0	30.44	0	168.23
Bottlenose dolphin (coastal stock)	6,639	0	0	0	0
Short-finned pilot whale	28,924	0	Less than 0.01	0	0
Long-finned pilot whale	39,215	0	0	0	0
Risso's dolphin	35,215	0	0.26	0	1.79
Common dolphin	172,974	0	40.51	0	293.89
Harbor porpoise[4]	95,543	2.38	10.004	16.60	70.97
Gray seal	27,300	0.08	6.98	0.32	38.59
Harbor seal	61,336	0.37	19.76	0.43	99.14

Source: Taking Marine Mammals Incidental to the Ocean Wind 1 Wind Energy Facility Offshore of New Jersey, 87 *Federal Register* 64868-65009 (October 26, 2022)
[1] Listed as endangered under the ESA.
[2] The minimum blue whale population is estimated at 412, although the exact value is no known. NMFS is utilizing this value for the preliminary small numbers determination, as shown in parentheses.
[3] Level A harassment exposures were initially estimated for this species, but due to mitigation measures that Ocean Wind would be required to abide by, no Level A harassment take would be requested or expected. Instead, the requested Level A harassment take from these exposure estimates was added to the requested Level B harassment take.
[4] The calculated Level A harassment exposures are likely an overestimate, as the modeled 10 dB sound reduction from the noise mitigation systems does not take into account that the reduction is greater at higher frequencies, which are best heard by harbor porpoises.
[5] Exposure modeling for blue whales and Atlantic spotted dolphins was not conducted because the impacts on the species approached zero due to the low density estimates. Because of this, values for these species have been excluded from the quantitative analyses and subsequent tables.

Based on the literature reviewed in Section 3.15.3.2, *Cumulative Impacts of the No Action Alternative*, it is possible that impact pile driving could cause behavioral effects such as short-term habitat avoidance, decreases in foraging success, or a change in vocal behavior in HFC. Baleen whales have exhibited similar behaviors in response to other impulsive sound sources, so it is possible that these effects could occur during impact pile driving as well. Acoustic masking is possible over larger spatial scales and is likely to occur over long periods of time when vibratory pile driving is in use. Only certain sound sources used throughout the Project would overlap with the vocalization range of marine mammals. As a result, a complete masking of all marine mammal communications would not be expected. In addition, the duty cycle of sound sources is also important when considering masking effects. Low-duty cycle sound sources such as impact pile driving are less likely to mask marine mammal communications, as the sound transmits less frequently with pauses or breaks between impacts, providing opportunities for communications to be heard. Modeling results indicate that dominant frequencies of impact pile driving activities for the Proposed Action were concentrated below 1 kilohertz. Based on these results, LFC and pinnipeds are more likely to experience acoustic masking from impact pile driving than MFC and HFC. Masking from impact pile driving would occur only during times pile driving would be occurring (4–8 hours per day). Pile driving is unlikely to occur every day from May 1 through November 31 due to weather and logistical constraints. Furthermore, marine mammals such as whales are likely to be moving through the area or remaining for short periods of time (days to weeks). Therefore, it is highly unlikely individual marine mammals would experience masking during the duration of pile installation. As a result, more severe impacts such as those listed above are unlikely to occur.

Vibratory pile installation noise: Temporary cofferdams are being considered at four locations to connect the cables to shore:

- Oyster Creek HDD, two cofferdams (Atlantic Ocean to Island Beach State Park; sea-to-shore)
- Island Beach State Park Barnegat Bay HDD, two cofferdams or sheet piling for temporary shoring (Barnegat Bay onshore; bay-to-shore)
- Farm Property HDD, two cofferdams or sheet piling for temporary shoring (bayside of Oyster Creek; shore-to-bay)
- BL England HDD, one cofferdam (sea-to-shore)

If required, they may be installed either as sheet pile structures into the seafloor or gravity cell structures placed on the seafloor using ballast weight. Selection of a preferred design for cofferdams and landfall works is pending additional design and coordination. Ocean Wind anticipates that impacts relating to cofferdam installation and removal would eclipse any potential impacts of alternative methods, and therefore cofferdam estimates represent the most conservative values and are carried forward in this EIS.

Installation and removal of sheet piles would require the use of a vibratory hammer. The level (at 10 meters) of the vibratory pile driver was assumed to be 165 dB re 1 µPa squared (JASCO 2022a). Ocean Wind assumed sound levels during cofferdam removal would be similar to those during installation and therefore this source level was applied to both installation and removal activities. A practical spherical spreading model was used by JASCO (JASCO 2022a) to estimate the extent of potential underwater noise effects as a result of vibratory driving of sheet piles. The modeling assumed that the installation and removal of cofferdams would require 18 hours over 2 days to complete, with vibratory pile driving taking place for no longer than 12 hours each 24-hour period over the installation period. Cofferdam installation using vibratory pile driving would only take place during daylight hours. Appendix J summarizes the maximum distances to injury (e.g., PTS) and behavioral thresholds (e.g., TTS and behavior) per hearing group. The number of marine mammal species potentially exposed to noises above thresholds for vibratory sheet installation was estimated by multiplying the maximum distances to thresholds by the highest monthly species density by 4 days of vibratory pile driving, as summarized in Attachment J-1 of Appendix J. Due to lower densities of marine mammals in the nearshore areas of the cofferdam installation and removal, the transitory nature of marine mammals, and the very short duration of vibratory pile driving, these estimates are likely conservative.

Estimated PTS exposures to marine mammal species by month resulting from vibratory installation and removal of cofferdams was less than one in all cases and are not expected to occur. However, Ocean Wind has requested PTS (Level A harassment) takes in its Letter of Authorization application for coastal common bottlenose dolphins and gray and harbor seals due to the tendency for seals to actively investigate construction disturbances and in recognition that some coastal common bottlenose dolphins are likely to be encountered in higher numbers in the nearshore environment.

The APMs outlined for vibratory pile driving include clearance zones, shutdown zones, and ramp-up procedures and are provided in Appendix H, Table H-1. As outlined in Table 3.15-9 below, the clearance zones and shutdown zones cover the largest PTS zone modeled for each species group. Due to the relatively small PTS zones and the application of APMs including the zones outlined in Table 3.15-9, the potential for PTS effects on all marine mammal species would be greatly reduced. Although some auditory injury (PTS) and behavioral disturbance effects on marine mammals as a result of vibratory pile driving are possible, the work is only expected to occur over a 4-day period, limiting the potential for effects. Furthermore, this work would only occur during daylight hours when monitoring would be effective in detecting marine mammals to implement clearance and shutdown zones. For vibratory pile driving, masking effects are possible and would be greater due to the continuous nature of the sound. However, the activity is only expected to occur over a 4-day period, reducing the potential for masking to occur.

Table 3.15-9 Maximum PTS Zones and Applicable Clearance and Shutdown Zones to Be Applied during Vibratory Pile Driving[1]

Hearing Group	Max. PTS Zone (m) from $SEL_{cum24hr}$ Thresholds	Clearance Zone (m)	Shutdown Zone (m)	Max. Behavior Zone (m)	Area of Level A Harassment Zone (km^2)
LFC	86.7	150	100	10,000	0.024
NARW	86.7	150	100	10,000	0.024
MFC	7.7	150	50	10,000	Less than 0.000
HFC	128.2	150	150	10,000	0.052
PW	52.7	150	60	10,000	0.009

[1] Area of Level B Harassment Zone (km^2) varies by location but does not vary by hearing group. Ocean City HDD: 163.75; BL England HDD: 158.59; Holtec/Farm HDD: 77.01; Island Beach State Park Barnegat Bay HDD: 76.70
m = meter; PW = phocid pinnipeds in water

Ocean Wind's proposed Level A and Level B harassment takes resulting from vibratory pile driving for installation and removal of temporary cofferdams are shown in Table 3.15-10. For some species, calculated Level B harassment exposures were zero or very low, but Ocean Wind requested take of an average group size and NMFS concurred this was appropriate given the species potential occurrence in the area.

Table 3.15-10 Proposed Level A and Level B Harassment Take Resulting from Vibratory Pile Driving Associated with the Installation and Removal of Temporary Cofferdams Over 5 Years

Marine Mammal Species	Population Estimate	Requested Level A Harassment	Requested Level B Harassment
NARW[1]	338	0	1
Blue whale[1]	Unknown	0	0

Marine Mammal Species	Population Estimate	Requested Level A Harassment	Requested Level B Harassment
Fin whale[1]	6,802	0	2
Sei whale[1]	6,292	0	1
Minke whale	21,968	0	3
Humpback whale	1,396	0	3
Sperm whale[1]	4,349	0	0
Atlantic white-sided dolphin	93,233	0	5
Atlantic spotted dolphin	39,921	0	45[2]
Bottlenose dolphin (offshore stock)	62,851	0	472
Bottlenose dolphin (coastal stock)[6]	6,639	11[3]	1,031
Short-finned pilot whale	28,924	0	10[4]
Long-finned pilot whale	39,215	0	10[4]
Risso's dolphin	35,215	0	30[4]
Common dolphin	172,974	0	13
Harbor porpoise	95,543	0	28
Gray seal	27,300	28[5]	115
Harbor seal	61,336	28[5]	320

Source: Taking Marine Mammals Incidental to the Ocean Wind 1 Wind Energy Facility Offshore of New Jersey, 87 *Federal Register* 64868-65009 (October 26, 2022)
[1] Listed as endangered under the ESA.
[2] No Level B harassment exposures were estimated for Atlantic spotted dolphins, but Ocean Wind has requested a group size estimate of up to 45 Level B harassment takes.
[3] No Level A harassment exposures were estimated for bottlenose dolphins of the coastal stock but a group size estimate of 11 Level A harassment takes has been requested by Ocean Wind.
[4] Level B harassment takes for pilot whales (short-finned and long-finned) and Risso's dolphins were adjusted to account for an average pod size.
[5] No Level A harassment exposures were estimated for gray seals and harbor seals, but 28 Level A harassment takes have been requested in the event up to two animals are taken during either removal or installation of cofferdams due to the nearshore location of the cofferdams and seal haul-outs.
[6] The estimate for coastal bottlenose dolphins (bayside versus Atlantic Ocean-facing) is likely an overestimate, as this stock has demonstrated a preference for coastal environments as opposed to estuarine.

G&G survey noise (HRG surveys and geotechnical drilling activities): A total of 31,375 kilometers of HRG surveys are estimated to be required in the Project area and export cable route area, with a single vessel being able to cover 43.5 miles (70 kilometers) per day. As a result, up to three vessels may be active concurrently within a 24-hour period and would transit at speeds of 4 knots (2 meters per second). In certain shallow-water areas, vessels may conduct surveys during daylight hours only, with a corresponding assumption that the daily survey distance would be halved (35 kilometers). However, for purposes of analysis, a single vessel survey day is assumed to cover the maximum 70 kilometers. In years 1, 4, and 5, 88 survey days per year are expected. It is estimated that a total of 6,110 linear kilometers would be needed within the Wind Farm Area and export cable route area during this time. Survey effort would be split between the Wind Farm Area and the export cable route area: 3,000 kilometers for the array cable, 2,300 kilometers for the Oyster Creek export cable, 510 kilometers for the BL England export cable, and 300 kilometers for the OSS interconnector cable. During years 2 and 3 (when construction would occur), 180 survey days per year would be required. HRG surveys during WTG and OSS construction and operation would include up to 11,000 kilometers of export cable surveys, 10,500 kilometers of array cable surveys, 1,065 kilometers of foundation surveys, 250 kilometers of WTG surveys, and up to 2,450 kilometers of monitoring and verification surveys. To cover the requirements of the Project, several HRG surveys were considered in the modeling:

- Shallow-penetration, non-impulsive, non-parametric sub-bottom profilers (compressed high-intensity radiated pulses), 2 to 20 kilohertz
- Medium-penetration, impulsive boomers, 3.5 Hz to 10 kilohertz
- Medium-penetration, impulsive sparkers, 50 Hz to 4 kilohertz

Equipment with operating frequencies above 180 kilohertz would be used but were not considered in modeling, as it is above the hearing ranges of marine mammals (see Table 3.15-1) and therefore not anticipated to cause injury or disturbance.

For HRG surveys, the NMFS User Spreadsheet Tool and transmission loss equations were used to estimate the distances to PTS and behavioral thresholds, respectively. Source levels relied upon measurements recorded from equipment, the best available manufacturer specifications (representing maximum output), or the closest proxy source (Crocker and Fratantonio 2016). The largest injury isopleth distance calculated for HRG surveys is 36.5 meters for HFC and for all other hearing groups is less than 2 meters (see Table 3.15-11 below Appendix J). Appendix J summarizes the number of marine mammals potentially exposed to underwater noise exceeding acoustic thresholds per species and maximum distances to injury and behavioral effects per marine mammal hearing group. A small number of Level A exposures were estimated based on density calculations for common bottlenose dolphins (offshore population), harbor porpoise, and gray and harbor seals; however, no Level A takes are being requested by Ocean Wind as part of its Letter of Authorization. The spreadsheet calculations are overly conservative and actual potential for a marine mammals to incur PTS from HRG surveys is discountable. Regardless, Ocean Wind has proposed APMs to minimize the potential and severity of any behavioral harassment.

The APMs outlined for HRG surveys include clearance zones, shutdown zones, and ramp ups as detailed in Appendix H. Pre-start clearance surveys and ramp-ups would be conducted for non-impulsive, non-parametric sub-bottom profilers and impulsive, non-parametric HRG survey equipment other than CHIRP sub-bottom profilers operating at frequencies of less than 180 kilohertz. Shutdowns would be conducted for impulsive, non-parametric HRG survey equipment other than CHIRP sub-bottom profilers operating at frequencies of less than 180 kilohertz. The clearance zones and shutdown zones proposed for the selected HRG surveys cover the maximum PTS zones modeled, part of the behavioral zones for most species, and the entire behavioral zone for NARWs (Table 3.15-11). In addition, the clearance and shutdown zones would limit the potential for behavioral effects on NARW.

For HRG surveys, masking of communications would depend on the frequency at which the survey is completed and the frequency range of the sound sources being used. A total of 88 survey days (annually) in years 1, 4, and 5 and 180 days (annually) in years 2 and 3 would include non-impulsive sources in the 2- to 20-kilohertz range and impulsive boomers and sparkers in the 3.5-Hz to 10-kilohertz and 50-Hz to 4-kilohertz range. Due to the range of frequencies emitted during HRG surveys, masking of all hearing groups is considered possible. However, masking of LFC communications is considered more likely due to the overlap of these surveys with lower-frequency signals produced by these species. Masking of high-frequency echolocation clicks used by MFC and HFC is not anticipated; however, some masking of other communication used by these species is possible.

Table 3.15-11 Maximum PTS Zones and Applicable Clearance and Shutdown Zones to Be Applied during HRG Surveys

Hearing Group	Max. PTS Zone (m) using $SEL_{cum, 24hr}$ Thresholds	Max. Behavioral Disturbance Zone (m)[1]	Shutdown/Clearance Zone (m)
LFC	1.5	141	100
NARW	1.5	141	500
MFC	<1	141	100
HFC	36.5	141	100
PW	<1	141	100

Source: Ocean Wind 2022 (Table 1 of Appendix B, Protected Species Monitoring and Mitigation Plan).
Note: Pre-start clearance surveys and ramp-ups would be conducted for non-impulsive, non-parametric sub-bottom profilers and impulsive, non-parametric HRG survey equipment other than CHIRP sub-bottom profilers operating at frequencies of less than 180 kilohertz. Shutdowns would be conducted for impulsive, non-parametric HRG survey equipment other than CHIRP sub-bottom profilers operating at frequencies of less than 180 kilohertz.
[1] The maximum behavioral disturbance zone is generated by the AA Dura-Spark.
m = meter; PW = phocid pinnipeds in water

Modeled Level A and Level B harassment exposures for marine mammals resulting from HRG survey activities are shown in Table 3.15-12.

Table 3.15-12 Calculated Annual Maximum Level A and Level B Harassment Exposures of Marine Mammals Resulting from HRG Surveys

Marine Mammal Species	Population Estimate	Estimated Level A Harassment Exposures[2]		Estimated Level B Harassment Exposures	
		Years 1, 4, & 5 (88 days annually)	Years 2 & 3 (180 days annually)	Years 1, 4, & 5 (88 days annually)	Years 2 & 3 (180 days annually)
NARW[1]	338	less than 0.01	0.01	0.46	0.94
Blue whale[1]	Unknown	less than 0.01	less than 0.01	0.02	0.03
Fin whale[1]	6,802	0.01	0.02	1.24	2.56
Sei whale[1]	6,292	less than 0.01	less than 0.01	0.33	0.68
Minke whale	21,968	0.02	0.04	2.40	4.98
Humpback whale	1,396	0.01	0.02	1.10	2.27
Sperm whale[1]	4,349	less than 0.01	less than 0.01	0.04	0.09
Atlantic white-sided dolphin	93,233	0.03	0.05	4.79	10.04
Atlantic spotted dolphin	39,921	N/A	N/A	N/A	N/A
Bottlenose dolphin (offshore stock)	62,851	1.23	2.46	173.84	348.37
Bottlenose dolphin (coastal stock)	6,639	3.28	6.60	464.18	933.46
Short-finned pilot whale	28,924	less than 0.01	less than 0.01	0.14	0.29

Marine Mammal Species	Population Estimate	Estimated Level A Harassment Exposures[2]		Estimated Level B Harassment Exposures	
		Years 1, 4, & 5 (88 days annually)	Years 2 & 3 (180 days annually)	Years 1, 4, & 5 (88 days annually)	Years 2 & 3 (180 days annually)
Long-finned pilot whale	39,215	less than 0.01	less than 0.01	0.19	0.40
Risso's dolphin	35,215	less than 0.01	less than 0.01	0.31	0.65
Common dolphin	172,974	0.20	0.42	28.38	59.52
Harbor porpoise	95,543	5.60	11.59	21.69	44.88
Gray seal	27,300	0.23	0.48	33.23	67.56
Harbor seal	61,336	0.66	1.34	92.88	188.83

Source: Taking Marine Mammals Incidental to the Ocean Wind 1 Wind Energy Facility Offshore of New Jersey, 87 *Federal Register* 64868-65009 (October 26, 2022)
[1] Listed as endangered under the ESA.
[2] Some Level A harassment exposures were estimated to occur during HRG surveys, but due to the proposed mitigation measures Ocean Wind would be required to undertake, no Level A harassment takes were carried forward.

Geotechnical surveys for engineering purposes and to resolve adverse effects on archaeological resources would take place prior to construction. The environmental consequences of these surveys were analyzed in BOEM's *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia Final Environmental Assessment*. Acoustic impacts associated with this work would be minor and ensonify only a localized area. No geotechnical surveys are planned for the construction or post-construction phases.

UXO detonation noise: Ocean Wind may encounter UXO on the seabed in the Wind Farm Area and along export cable routes. While non-explosive methods may be employed to lift and move these objects, some may need to be removed by explosive detonation. Underwater explosions of this type generate high pressure levels that could cause disturbance, injury, and mortality to marine mammals. Ocean Wind conducted modeling of acoustic ranges to thresholds for UXO, which included three sound pressure metrics (peak pressure level, SEL, and acoustic impulse), four different depths at four different sites, and five charge weight bins (ranging from 2.3 kilograms [bin E4] up to 454 kilograms [bin E12]). The modeling of acoustic fields was performed using a combination of semi-empirical and physics-based computational models. The modeling assumed that the full weights of UXO explosive charges are detonated together with their donor charges and that no shielding by sediments occurs. It also assumed that up to 10 UXOs may need to be detonated in place and that these detonations would occur on different days, such that only one UXO would be detonated within a 24-hour period. UXO detonations would only occur during daylight hours and would not be planned between January 1 and April 30. Ocean Wind is committing to the use of a noise mitigation system during all detonations (see Appendix H, Table H-1) and, based on previous experience, 10 dB minimum of attenuation is possible with the use of a noise mitigation system (review provided in Hannay and Zykov 2022). Modeling of mitigated (10 dB attenuation) and unmitigated scenarios were conducted of detonations of all charge weights, with the largest charge weight being 454 kilograms (category E12) defined by the U.S. Navy (Table 3.15-13). As Ocean Wind has committed to attaining a 10-dB attenuation for all UXO detonation events, mitigated values are presented herein (Appendix J). The largest distance to auditory injury (PTS) thresholds was 6,200 meters for HFC (Hannay and Zykov 2022). The PTS distances for LFC and NARW were 3,780 meters, for MFC 461 meters, and for pinnipeds in water 1,600 meters (Hannay and Zykov 2022). Auditory injury thresholds (PTS PK or SEL noise metrics) were larger than modeled distances to mortality and non-auditory injury criteria and are presented in Table J-19 (Hannay and Zykov 2022).

Maximum ranges to mortality and non-auditory injury were based on worst-case scenario modeling results for charge size E12 (454 kilograms) and deepest water depth (45 meters) based on 1 percent of animals exposed (mortality/lung and gastrointestinal injury). The largest mortality distance was estimated for porpoise pup/calf at 353 meters; for lung injury at 648 meters for porpoises pup/calf; and for gastrointestinal injury at 125 meters for all marine mammal species (Hannay and Zykov 2022).

The APMs outlined for UXO detonation surveys include sound attenuation devices during all detonations, clearance zones, detonations occurring only during daylight, and the potential inclusion of aerial surveys to cover clearance zones as detailed in Appendix H (see Table 3.15-13 for clearance zones). Ocean Wind has committed that a sufficient number of vessels would be deployed to provide 100-percent temporal and spatial coverage of the clearance zones and, if necessary, aerial survey would be used to provide coverage. APMs are designed to avoid mortality and non-auditory injury; therefore, these impacts would be avoided. Passive acoustic monitoring would also occur to acoustically monitor a zone that encompasses a minimum of a 10-kilometer radius around the source for all detonations. Due to the large PTS zones estimated for HFC, LFC/NARW, and pinnipeds in water, some PTS effects are considered possible, particularly if larger charge detonations are encountered (e.g., E12). With implementation of vessel-based monitoring or aerial surveys to cover the clearance zones, the potential for PTS effects would be reduced. As the TTS zones are considerably larger than the PTS zones, TTS (and any associated behavioral disturbance) may occur. Marine mammals are likely to be startled and move away from the area temporarily; a small amount of TTS may occur. Severe, long-term reactions are not anticipated, as the stimulus would be short (seconds) and implementation of the clearance zone would be designed such that any marine mammal exposed would be receiving relatively low levels of noise. The low number of potential UXOs identified in the Project area and Ocean Wind's commitment to using a dual noise-mitigation system for all detonations would further reduce all potential underwater noise effects associated with UXO detonations. For UXO detonation, masking is not anticipated to occur due to the very short time frame (seconds) over which the noise would occur.

Table 3.15-13 Maximum PTS Zones and Applicable Clearance Zones to Be Applied during UXO Detonations: Mitigated

Hearing Group	Charge Size									
	E4 (2.3 kilograms)		E6 (9.1 kilograms)		E8 (45.5 kilograms)		E10 (227 kilograms)		E12 (454 kilograms)	
	Max. PTS/ Clearance Zone (m)	Max. Behavioral Zone (m)	Max. PTS/ Clearance Zone (m)	Max. Behavioral Zone (m)	Max. PTS/ Clearance Zone (m)	Max. Behavioral Zone (m)	Max. PTS/ Clearance Zone (m)	Max. Behavioral Zone (m)	Max. PTS/ Clearance Zone (m)	Max. Behavioral Zone (m)
LFC	552	2,820	982	4,680	1,730	7,490	2,970	10,500	3,780	11,900
NARW	552	2,820	982	4,680	1,730	7,490	2,970	10,500	3,780	11,900
MFC	50	453	75	773	156	1,240	337	2,120	461	2,550
HFC	1,820	6,160	2,590	8,000	3,900	10,300	5,400	12,900	6,200	14,100
PW	182	1,470	357	2,350	690	3,820	1,220	5,980	1,600	7.020

Note: Pre-start clearance zones were calculated by selecting the largest PTS threshold (the larger of either the PK or SEL [$R_{95\%}$] noise metric). The chosen values were the most conservative per charge weight bin across each of the four modeled sites.
Behavioral monitoring zones were calculated by selecting the largest TTS threshold (the larger of either the PK or SEL noise metric). The chosen values were the most conservative per charge weight bin across each of the four modeled sites.
The maximum PTS zones shown here are the largest zones associated with injury (auditory or non-auditory) associated with UXO detonations.
m = meters; PW = phocid pinnipeds in water

Level A harassment exposures resulting from UXO/MEC detonations are considered unlikely but possible. To reduce impacts, Ocean Wind would use a noise abatement system capable of achieving 10 dB of sound attenuation. The estimated maximum PTS and TTS exposures assuming 10 dB of sound attenuation are presented in Table 3.15-14.

Table 3.15-14 Estimated Potential Maximum PTS and TTS Exposures of Marine Mammals Resulting from the Possible Detonations of up to 10 UXOs/MECs Assuming 10 dB Sound Attenuation

Marine Mammal Species	Population Estimate	Level A Harassment (PTS SEL)	Level B Harassment (TTS SEL)
NARW[1,3]	338	0.03	0.35
Blue whale[1]	Unknown[2]	Less than 0.01	0.04
Fin whale[1]	6,802	0.28	2.87
Sei whale[1]	6,292	0.08	0.87
Minke whale	21,968	2.53	26.42
Humpback whale	1,396	0.33	3.41
Sperm whale[1]	4,349	Less than 0.01	0.01
Atlantic white-sided dolphin	93,233	0.03	1.05
Atlantic spotted dolphin	39,921	N/A	N/A
Bottlenose dolphin (offshore stock)	62,851	0.68	24.36
Bottlenose dolphin (coastal stock)	6,639	3.84	137.31
Short-finned pilot whale	28,924	Less than 0.01	0.02
Long-finned pilot whale	39,215	Less than 0.01	0.02
Risso's dolphin	35,215	Less than 0.01	0.04
Common dolphin	172,974	0.13	4.65
Harbor porpoise	95,543	9.49	46.50
Gray seal	27,300	2.28	50.98
Harbor seal	61,336	6.39	142.49

[1] Listed as endangered under the ESA.
[2] The minimum blue whale population is estimated at 412, although the exact value is no known. NMFS is utilizing this value for the preliminary small numbers determination, as shown in parentheses.
[3] Level A harassment exposures were initially estimated for this species, but due to mitigation measures, no Level A harassment take would be requested or expected.

Vessel noise: There are several types of vessels that would be required throughout the life of the Project. Table 3.15-15 and Table 3.15-16 outline the type of vessels that would be required for Project construction and operations as well as the maximum number of vessels required by vessel type. Additional activities that may require vessels not outlined in Section 3.15.3 include monitoring initiatives (e.g., marine mammals and fisheries) and HRG surveys. For a physical description of the sounds from vessels, see Appendix J, *Underwater Sound and Acoustic Modeling Results*. The effects of vessel noise on marine mammals under the Proposed Action are expected to be similar to those outlined in Section 3.15.3.2, *Cumulative Impacts of the No Action Alternative*. BOEM anticipates that underwater noise generated by larger vessels used for Project activities would overlap the hearing range of all marine mammals but particularly mysticetes (e.g., LFC) including the blue, fin, humpback, sei, and minke and NARW. As outlined in Section 3.15.3.2, vessel noise could result in a range of behavioral responses, including the onset of avoidance behavior (e.g., heading away or increasing range from the source), changes in acoustic behavior (brief or minor changes in vocal rates or signal characteristics potentially related to higher auditory masking potential), diving and subsurface interval behavior (increased interval between surfacing bouts), and brief or minor changes in vocal rates or signal characteristics potentially related to higher auditory masking potential (Southall et al. 2021). Marine mammals may also not exhibit any detectable response (Southall et al. 2021). Any noise-related effects would be expected to dissipate once the vessel or individual has left the area or the animal has moved away from the immediate vicinity of the vessel.

Aircraft noise: Fixed-wing aircraft may be utilized for monitoring activities during construction, O&M, and decommissioning (see Appendix H). BOEM would require all aircraft operations to comply with current approach regulations for any sighted NARWs or unidentified large whale. Current regulations (50 CFR 222.32) prohibit aircraft from approaching within 1,500 feet (457 meters) of NARW. BOEM expects that most aircraft operations would occur above this altitude limit. No PTS or TTS effects on marine mammals are anticipated as a result of Project aircraft. Behavioral impacts are unlikely to occur given operational altitudes.

Cable-laying or trenching noise: Cables would typically be laid and post-lay burial would be performed using a jetting tool, if seabed conditions allow. Cables may remain on the seabed within the Wind Farm Area for up to 2 weeks. Alternatively, the array cables may be simultaneously laid and buried. Array cables can be installed using a tool towed behind the installation vessel to simultaneously open the seabed and lay the cable, or by laying the cable and following with a tool to embed the cable. Possible installation methods for these options include jetting, vertical injection, controlled-flow excavation (covered below under *site preparation noise*), trenching, and plowing. Dynamic positioning vessels rated DP2 with associated support craft would be used to install the array cables. Cable failures (i.e., reduction or loss in transmission) are expected to occur over the life of the Project, and noise associated with repair of cable failures would be similar to that of cable laying and trenching.

The action of laying the cables on the seafloor itself is unlikely to generate high levels of underwater noise. Most of the noise energy would originate from the vessels themselves including propeller cavitation noise and noise generated by onboard thruster/stabilization systems and machinery (e.g., generators), including noise emitted by the tugs when moving the anchors.

There is limited information regarding underwater noise generated by cable-laying and burial activities in the literature. Johansson and Andersson (2012) recorded underwater noise levels generated during a comparable operation involving pipelaying and a fleet of nine vessels. Mean noise levels of 130.5 dB re 1 µPa were measured at 1,500 meters from the source. Reported noise levels generated during a jet trenching operation provided a source level estimate of 178 dB re 1 µPa measured at 1 meter from the source (Nedwell et al. 2003). This value was used as a proxy for modeling underwater noise fields for the Project jetting operation relative to existing acoustic thresholds for marine mammals in the Project area. To estimate the extent of behavioral disturbance from cable-laying operations, the Greater Atlantic Region Field Office acoustics spreadsheet (NMFS 2018b, 2018c) for potential behavioral effects from vibratory pile driving was applied. The acoustic spreadsheet used a standard transmission loss constant (15 log) calculation methodology and assumed a stationary source. Cable-laying noise sources associated with the Project were below the established PTS injury thresholds for all marine mammal hearing groups.

Modeling results indicate that Project-generated noise from cable-laying operations would exceed the disturbance threshold for marine mammals (120 dB re 1 µPa SPL_{RMS}) at distances up to 7.5 kilometers for cable-laying operations (with support vessels) and up to 7.4 kilometers for jet sled trenching (e.g., jetting). Expected acoustic frequencies emitted by these sound sources are more likely to overlap with the hearing range of baleen whales (LFC). These noise levels and characteristics are comparable to those of transiting vessels and dredges. While some low-level behavioral reactions may occur, the degree of disturbance is not anticipated to rise to a level considered harassment. Any slight behavioral changes resulting from exposure to cable-laying noise are likely to have minimal effects on marine mammals.

Site preparation (e.g., boulder clearance, sandwave clearance, pre-lay grapnel run, dredging) noise: Boulder clearance would take place prior to construction to clear the cable corridor in preparation for trenching and burial operations. A combination of displacement plow, subsea grab, or, in shallower waters, a back hoe dredger may be used to clear boulders and undertake route clearance activities. Noise generated by boulder clearance is likely similar to that for mechanical dredging (e.g., clamshell). Dredging may be done in the Wind Farm Area and export cable corridors for sandwave clearance. Ocean Wind has indicated that sandwave clearance work could be undertaken by traditional dredging methods such as a mechanical clamshell dredge, or sand wave removal plow as well as hydraulic trailing suction hopper, or controlled-flow excavator. Dredging would also be required at the HDD in-water exit pit at the Oyster Creek landfall site on the east side of Island Beach State Park and at the HDD in-water exit pit for the BL England site.

Dredging may also be required in the shallow areas of Barnegat Bay to allow vessel access for export cable installation. Locations include the prior channel (west side of Island Beach State Park/east side of Barnegat Bay), the west side of Barnegat Bay at the export cable landfall, and the Oyster Creek section of the federal channel in Barnegat Bay if USACE is unable to conduct dredging in this area as part of the federal channel dredging that is currently under contract. In 2020, USACE completed an environmental assessment, Section 7 ESA consultation, and an EFH Assessment for maintenance dredging of the Barnegat Inlet Federal Navigation Project and use of maintenance material for shoreline protection and habitat creation/restoration in Barnegat Bay. This analysis concluded that dredging Oyster Creek channel and beneficial use placement operations were not anticipated to result in significant direct, indirect, or cumulative adverse impacts on federally or state-listed threatened or endangered species (USACE 2020). NMFS concurred that the action was not likely to adversely affect listed species or critical habitat. The environmental assessment and ESA consultation for maintenance dredging of the Barnegat Inlet Federal Navigation Project did not assess the transfer of dredged materials via pipeline for upland facility disposal.

A physical description of the sounds produced during dredging can be found in Appendix J, *Underwater Sound and Acoustic Modeling Results*. The effects of site preparation noise on marine mammals under the Proposed Action are expected to be similar to those outlined in Section 3.15.3.2, *Cumulative Impacts of the No Action Alternative*. It is unlikely PTS thresholds would be exceeded in any marine mammals from dredge noise. This could be due to source levels being low enough to never accumulate to levels that would exceed PTS thresholds or that animals would have to remain at very close distances to the dredge for several hours, which is unrealistic. The same concepts applies to TTS; therefore, TTS is also unlikely. Source levels generated by mechanical or hydraulic dredges are likely to exceed behavioral thresholds and could result in masking of marine mammal communications (Todd et al. 2015; NMFS 2018a). However, any short duration and small spatial extent of masking or any slight behavioral changes resulting from dredge exposure are likely to be minimal. While some low-level behavioral reactions may occur, the degree of disturbance is not anticipated to rise to a level considered harassment.

Turbine operation noise: Current and near-term commercially available WTGs likely used for the Project range from 12.4-MW to 14.7-MW WTGs using the direct-drive GE Haliade-X 12-MW WTG. SPLs measured from direct-drive WTGs within this size range do not currently exist in the literature and modeling scenarios are limited to two studies with a high degree of uncertainty. Based on the currently available data on underwater noise from turbine operations, effects of the Project’s large direct-drive WTGs on marine mammals would likely be similar to the effects outlined for planned offshore wind activities in Section 3.15.3.2, *Cumulative Impacts of the No Action Alternative*. Turbine operation noise is unlikely to cause PTS or TTS in marine mammals but could cause behavioral and masking effects. Masking of the low-frequency calls emitted from LFC and phocid pinnipeds in water would be more likely to occur. It is expected that these effects would be at relatively short distances from the foundations and would reach ambient underwater noise levels within relatively short distances of the foundations (Miller and Potty 2017; Tougaard et al. 2009b, 2020).

Summary of noise impacts: Noise generated from Project construction would include impact pile driving, UXO detonations, HRG survey sources, vibratory pile driving, vessels, aircraft, cable laying or trenching, boulder removal, and dredging. Noise sources during operation would include turbine operation, vessels, and HRG surveys. Of those activities, the sophisticated modeling conducted by Ocean Wind on construction noise sources indicates that only impact pile driving and UXO detonations could cause PTS in marine mammals (see Appendix J). In general, UXO detonation may also cause mortality and non-auditory injury (lung and gastrointestinal injuries) and this impact would be permanent and severe. However, mortality and non-auditory injury impacts would be avoided through implementation of required mitigation measures; therefore, they would not occur due to the Proposed Action.

Foundation installation and UXO detonation could result in PTS, which is a long-term, permanent impact. However, the auditory damage would be concentrated in the frequencies of the noise source and would not span entire hearing ranges for any given marine mammal hearing group. In addition, the shift in hearing would be expected to be small (only a few dB) given the nature of sources and, for pile driving, the animal's ability to move away from the source before incurring more severe PTS. Only a few marine mammals of select species are anticipated to incur PTS incidental to impact pile driving and UXO detonation (Appendix J). APMs are designed to avoid PTS to NARWs. MFCs are unlikely to incur PTS from pile driving and UXO detonation given their thresholds. Some phocids may experience PTS. TTS may also result from these activities, as well as others; however, TTS is recoverable. Similar to PTS, hearing shift would be concentrated in the frequencies of the sound source and is anticipated to be small.

All audible noise sources have the potential to result in behavioral responses. Exposure to a noise source could result in no reaction to more severe reactions such as prolonged avoidance; cessation of behaviors such as foraging, socializing, and communication; and stress. Noise from construction is also likely to mask marine mammal communication to varying spatial and temporal degrees. No displacement or avoidance of critical habitat areas is expected, as no critical habitat for any marine mammal species is designated in the Project area. Critical habitat for NARW is approximately 418.43 kilometers north of the Project area and 396 kilometers north of the cofferdam installation area (e.g., from vibratory pile-driving work). The Project area is a migratory BIA for NARWs. Animals migrating through the Project area are likely to be exposed to noise; however, it is anticipated that the amount of deflection from the migratory path would be minimal. No concentrated foraging areas for NARWs are present with the Project area. Other marine mammals are likely foraging in the Project area, particularly odontocetes; however, ample foraging habitat not affected by the Project would remain. For these reasons, any temporary avoidance of the area by marine mammals during construction is not anticipated to result in any fitness consequences.

PTS and behavioral responses of LFC, MFC, HFC, and phocid pinnipeds to construction activities in water are considered likely, varying by population. With implementation of known and highly effective APMs such as a noise mitigation system (for impact pile driving), protected species observers programs, clearance and shutdown zones based on maximum PTS zones, ramp-ups, and implementation of passive acoustic monitoring, the impact of all underwater noise activities is considered moderate and short term for LFC, MFC, HFC, and phocid pinnipeds in water.

During operations, noise sources would be primarily limited to WTG operation, vessel use, HRG surveys, and cable laying or trenching for cable repairs, if necessary. Impacts from these sources are anticipated to be minor for all marine mammals.

Presence of structures: Under the Proposed Action, Ocean Wind proposes to install up to 98 WTGs, up to three OSS, and up to 77 acres (0.31 km^2) of inter-array cable hard protection, and 84 acres (0.34 km^2)

of foundation and scour protection, for a total of 161 acres (0.65 km^2) of new hard scour/cable protection. The structures and scour/cable protection, and the potential consequential impacts, would remain at least until decommissioning of each facility is complete. The 98 monopile foundations would be placed in a grid-like pattern with approximate spacing of 1 by 0.8 nm (1.85 kilometers) between WTGs. Based on documented lengths (Wynne and Schwartz 1999), the largest NARW (59 feet [18 meters]), fin whale (79 feet [24 meters]), sei whale (59 feet [18 meters]), and sperm whale (59 feet [18 meters]) would fit end to end between two foundations spaced at 1 nm (1.9 kilometers) 100 times over. This simple assessment of spacing relative to animal size indicates that the physical presence of the monopile foundations is unlikely to pose a barrier to the movement of large marine mammals, and even less likely to impede the movement of smaller marine mammals.

The presence of the monopile foundations over the life of the Project would alter the character of the ocean environment that could indirectly affect marine mammals; however, the likelihood and significance of these effects are difficult to determine. The various types of impacts on marine mammals that could result from the presence of structures (i.e., hydrodynamic and artificial reef effects and their influence on the availability of prey and forage resources, potential for interaction with active or abandoned fishing gear, and displacement) are described in detail in Section 3.15.3.2. The strong seasonal stratification of the Mid-Atlantic Bight is the dominant oceanographic feature limiting phytoplankton productivity, which then affects zooplankton prey productivity (Schofield et al. 2008). Localized turbulence and upwelling effects around the monopiles are likely to transport nutrients into the surface layer, potentially increasing primary and secondary productivity. That increased productivity at a local scale could be partially offset by the formation of abundant colonies of filter feeders on the monopile foundations. While the net impacts of these interactions are difficult to predict, they are not likely to result in more than localized effects on the abundance of zooplankton. Turbulent mixing would be increased locally within the flow divergence and in the wake, which would enhance local dispersion and dissipation of flow energy. However, because the monopiles would be spaced between 0.8 and 1 nm (1.3 and 1.6 kilometers) apart, there would be less than 1 percent areal blockage and the net effect over the spatial scale of the Project would be negligible. When considered relative to the broader oceanographic factors that determine primary and secondary productivity in the region, localized impacts on zooplankton abundance and distribution associated with the WTG structures are not likely to measurably affect the availability of prey resources for marine mammals.

Long-term reef effects resulting from the Proposed Action could result in negligible beneficial effects on fish-eating odontocetes and pinnipeds that benefit from increased prey abundance around the structures. Conversely, minor adverse effects due to disruption in hydrodynamics from the Proposed Action could result in impacts on mysticetes that forage on plankton and forage fish. Structures associated with the Project would be expected to provide some level of reef effect and may result in long-term, minor beneficial impacts on pinniped and small odontocete foraging and sheltering. Long-term, minor, adverse impacts could occur as a result of increased interaction with active or abandoned fishing gear.

Traffic (vessel strikes): All vessels associated with all phases of the Project (construction, operation, and decommissioning) pose a potential collision risk to marine mammals. Vessel use would peak during the construction phase. A summary of construction vessel types and sizes is presented in Table 3.15-15. Typical large construction vessels used in this type of project range from 325 to 350 feet (99 to 107 meters) in length, from 60 to 100 feet (18 to 30 meters) in beam, and draft from 16 to 20 feet (5 to 6 meters) (Denes et al. 2021). In total, the Proposed Action would generate approximately 2,870 vessel trips during the construction and installation phase. A breakdown of the maximum number of simultaneous vessels and maximum number of round trips per vessel type is presented in Table 3.15-16. The construction vessels that would be used for Project construction are described in Section 6.1.2.4.2 and Tables 6.1.2-1 to 6.1.2-4 in the COP (Ocean Wind 2023). Construction activities (including offshore installation of WTGs, substations, array cables, interconnection cable, and export cable) would require up to 20 to 65 simultaneous construction vessels (COP Volume I, Tables 6.1.2-1 to 6.1.2-4; Ocean Wind 2023).

When the areas of densest vessel traffic in the Project area were analyzed, three were shown to have greater than 10 transits per day or 3,650 transits per year: the entrance to Delaware Bay, with an average of 18 transits per day; Barnegat Inlet, with an average of 16 transits per day; and the eastern end of Delaware Bay, with an average of 11 transits per day (COP Volume III, Appendix M; Ocean Wind 2023).

Table 3.15-15 Construction Vessel Size Summary

Construction Activity	Vessel Type
WTG installation	**Installation Vessel:** 476 by 197 feet (145 by 60 meters) (not including helideck, crane); displacement: 43000t
	Unpowered Feeder Barges: 410 by 115 feet (125 by 35 meters); displacement: 21000t
	Tug: 148 by 49 feet (45 by 15 meters)
Foundations	**MP Installation: Floating Heavy Lift Vessel:** 787 by 164 feet (240 by 50 meters); displacement: 61.000T
	SS Installation: Jack-Up Vessel: 459 by 131 feet (140 by 40 meters); displacement: 8.000T
	Noise Mitigation Vessel: 295 by 66 feet (90 by 20 meters); displacement: 4900T
Export Cable Installation	
Export cable lay (offshore)	Approx. Length: 427 feet (130 meters); beam: 98 feet (30 meters); deadweight: 10,800Te
Trenching support	Approx. Length: 328 feet (100 meters); beam: 66 feet (20 meters); deadweight: 3,000Te
Export cable lay (inshore)	Approx. Length: 410 feet (125 meters); beam: 115 feet (35 meters); depth: 26 feet (8 meters) plus anchor handler support vessels
Export Cable Installation: Secondary Support Vessels	
Pre-lay grapnel runs, boulder removal, mattressing, surveys	Approx. length: 262 feet (80 meters); beam: 66 feet (20 meters); gross: 2,400 GT
Survey	Approx. length: 164 feet (50 meters); beam: 33 feet (10 meters); gross 615 GT
Anchor-handling tug	Approx. length: 98 feet (30 meters); beam: 49 feet (15 meters); gross: 345 GT
Rock installation	Approx. length: 525 feet (160 meters); beam: 131 feet (40 meters); cargo: 24,000Te
Crew transfer vessel	Approx. length: 89 feet (27 meters); beam: 36 feet (11 meters); gross: 235
Array Cable Installation: Primary Array Cable Installation Vessels	
Array cable lay	Approx. length: 459 feet (140 meters); beam: 98 feet (30 meters); deadweight: 10,000Te
Trenching support	Approx. length: 328 feet (100 meters); beam: 98 feet (30 meters); displacement: 12,200Te
Array Cable Installation: Secondary Support Vessels	
Pre-lay grapnel runs	Approx. length: 230 feet (70 meters); beam: 66 feet (20 meters); gross: 1,660 ITC
Boulder removal	Approx. length: 312 feet (95 meters); beam: 66 feet (20 meters); deadweight: 3,285 LT

Construction Activity	Vessel Type
Survey	Approx. length: 164 feet (50 meters); beam: 39 feet (12 meters); gross: 615 GT
Crew transfer vessel	Approx. length: 98 feet (30 meters); beam: 36 feet (11 meters); gross: 235
Crew transfer and accommodation	Approx. length: 295 feet (90 meters); beam: 66 feet (20 meters); deadweight: 4,870 LT
Rock installation	Approx. length: 525 feet (160 meters); beam: 118 feet (36 meters); cargo: 24,000Te

Source: COP Volume I, Section 6.1, Tables 6.1.2-2, 6.1.2-6, 6.1.2-9; Ocean Wind 2023
GT = gross tonnage; ITC = International Convention on Tonnage Measurement; LT = long ton; t = tonnes; T = tons; Te = tonne

Table 3.15-16 Construction Vessel Trip Summary

Vessel Type	Maximum Number of Simultaneous (at any one time) Vessels in the Project Area	Maximum Number of Round Trips per Vessel Type[1]
WTG Foundation Installation		
Scour protection vessel	1	50
Installation vessel	4	99
Support vessels	16	396
Transport/feeder vessels (including tugs)	40	396
number of which are anchored	2	198
WTG Structure Installation		
Installation vessels	2	99
Transport/feeder vessels	12	99
Other support vessels	24	594
Substation Installation[2]		
Primary installation vessels	2	12
Support vessels	11	72
Transport vessels	4	24
Array Cable Installation[3]		
Main laying vessels	3	99
Main burial vessels	3	99
Support vessels	12	594
Substation Inter-link Cable Installation[4]		
Main laying vessels	Included in numbers for export and array cables	8
Main burial vessels		8
Support vessels		12
Offshore Export Cable Installation[5]		
Main laying vessels	3	48
Main cable-joining vessels	3	36
Main burial vessels	3	48
Support vessels	15	72
Federal Channel Dredging		

Vessel Type	Maximum Number of Simultaneous (at any one time) Vessels in the Project Area	Maximum Number of Round Trips per Vessel Type[1]
Dredging	1	1
Scow/barge/tug	2	4

Source: COP Volume I, Section 6.1, Tables 6.1.2-1, 6.1.2-3, 6.1.2-5, 6.1.2-7, and 6.1.2-8; Ocean Wind 2023
[1] Total number of trips to complete entire construction activity.
[2] Substation installation is anticipated to occur over a maximum duration of 67 days.
[3] Array cable installation is anticipated to occur over a maximum duration of 12 months. Installation of each cable section is anticipated to occur over 3.5 days.
[4] Substation inter-link cable installation is anticipated to occur over a maximum duration of 1 month. Installation of each cable section is anticipated to occur over 20 days.
[5] Offshore export cable installation is anticipated to occur over a maximum duration of 6 months. Installation of each cable section is anticipated to occur over 59 days.

The associated vessel trips to execute monitoring for the Project (passive acoustic monitoring, HRG surveys, benthic, and fisheries) would include:

- 624 days of HRG surveys totaling approximately 16,942 nm (31,376 kilometers) in distance traveled, not including round-trip vessel transit to the survey site
- The Benthic Monitoring Plan is composed of five separate surveys with varying levels of effort pre-, during, and post-construction. Vessel traffic for these surveys was analyzed based on the number of stations visited during each survey event. Surveys would deploy visual equipment at 162 stations for pre-construction, 500 stations for immediately after construction, 662 stations 1 year post-construction, 112 stations 2 years post-construction, 662 stations 3 years post-construction, and 112 stations 5 years post-construction. A minimum total of 2,210 stations would require visitation over the 5-year post-construction period (sand ridge and cable-associated benthic surveys have the potential to be extended if benthic organism densities and assemblages continue to differ from the baseline after 3 years). Hard-bottom and structure-associated soft-bottom surveys would overlap at the same sites and were considered together. Exact vessel details such as homeport were not included in the plan and distance transited to complete surveys was not analyzed.
- 960 separate trawl surveys with 20-minute tows (320 hours total) over a 6-year period with an approximately 428-nm (793-kilometer) round-trip vessel transit to the site for each seasonal survey
- 24 separate survey events for structure-associated fishes survey that span 3 days each at 12 to 15 locations over a 6-year period with a 90-minute soak time on six baited traps and an approximately 90-nm (167-kilometer) area for each survey event
- Six separate clam dredge survey events with 40 minutes total of dredge time across three sites over a 6-year period with an approximately 44-nm (81-kilometer) round-trip vessel transit for each survey event
- 24 separate acoustic telemetry tows of an omni-directional hydrophone for an unspecified amount of time per survey event over a 6-year period with an approximately 42- to 46-nm (78- to 85-kilometer) round-trip vessel transit per survey event (transits for the telemetry tow vessel are unclear, as it can be driven on a trailer to a nearby boat ramp; BOEM assumes that a nearby boat ramp from Ocean City or Atlantic City would be chosen)

Regular maintenance during O&M would require the use of a variety of support vessels including crew transfer vessels, service operation vessels, jack-up vessels, and supply vessels. Annual vessel trips for O&M are summarized in Table 3.15-17.

Table 3.15-17 Operations and Maintenance Vessel Trip Summary

Vessel Type	Average/Normal Operating Speed (knots)	Number of Expected Round Trips
Crew transfer vessel or service operation vessel	23	2,278
Jack-up vessel	10	102
Crew vessel	23	908
Supply vessel	11	104

The Project would result up to 2,870 vessel trips during construction and installation, up to 3,392 vessel trips per year during O&M, and approximately 120 vessel trips during decommissioning. The vessels that would be used for Project O&M are described in Table 3.15-15, Table 3.15-16, and Table 3.15-17. During O&M, a crew transfer vessel or Surface Effect Ship would be active daily except in severe weather, and round trips would originate from the Atlantic City O&M facility. Surface Effect Ships are high-speed crew transfer air-cushion catamarans. While the lack of in-water hull from the Surface Effect Ships would reduce the likelihood of a subsurface collision, marine mammals resting or breathing on the surface could be affected. Additionally, the high rate of speed of these vessels allows less reaction time from the marine mammal and for the vessel operator conducting a maneuver to avoid the marine mammal. Conceptual decommissioning would require marine construction vessels of the same or similar class as those used during construction (see Table 3.15-15 and Table 3.15-16). The area around the Project area (including Project vessel transit routes) is used by a number of different vessels including tugs, fishing vessels, and large, deep-draft vessels operating to and from ports in Delaware, New Jersey, New York, and abroad (COP Volume III, Appendix M, Ocean Wind 2023). The vessel trips associated with the Proposed Action would be relatively small when compared to the number of vessel trips associated with ongoing non-offshore activities throughout the marine mammal geographic analysis area.

Vessel collisions are a major source of mortality and injury for many marine mammal species (Hayes et al. 2021; Laist et al. 2001). A summary of vessel collision data and a description of the effects of vessel collisions on marine mammals are presented in Section 3.15.3.2, *Cumulative Impacts of the No Action Alternative*. The geographic extent is considered localized to the vessel transit routes and the Project area. As Project vessels would operate throughout the construction, O&M, and decommissioning phases, the potential for a vessel to strike a marine mammal is considered continuous (life of Project). If a vessel strike does occur, the impact on individual marine mammals would be severe (ranging from injury to mortality); however, the population-level impacts would range from negligible to major, depending on the species and severity of the strike. However, Ocean Wind has committed to a range of APMs to avoid vessel collisions with marine mammals (Appendix H, Table H-1). These APMs would minimize encounters that have a high risk of resulting in collision or injury by reducing both the encounter potential (e.g., vessel separation distances, seasonal restrictions, avoidance of aggregations, strict adherence to NMFS Regional Viewing Guidelines for vessel strike avoidance) and severity potential (e.g., vessel speed reduction, vessel positioning parallel to animals).

The standard vessel speed restriction plan includes a speed restriction of less than 10 knots for all Project vessels between November 1 and April 30 when NARW are likely to be present in higher densities. Year-round restrictions include vessels of all sizes operating at 10 knots or less in any Dynamic Management Areas. In addition, between May 1 and October 31, all vessels traveling at greater 10 knots will have a dedicated visual observer (or NMFS-approved automated visual detection system) on duty at all times to monitor for marine mammals. An additional adaptive vessel speed restriction plan is also outlined and includes measures to be implemented when crew safety is at risk, or labor restrictions, vessel availability, costs to the Project, or other unforeseen circumstances make the standard plan impracticable. Adaptive measures include the installation of a semi-permanent acoustic network comprising a near real-time acoustic monitoring system to monitor for the presence of NARWs year-round. When NARWs are detected in the area, slow-down to 10 knots would be required for the following 12-hour period. All vessel operators would receive training to ensure these APMs are fully implemented for vessels in transit. Vessel operators would monitor the NMFS NARW reporting systems during planning, construction, and operations. Ultimately, the reduction in strike/injury risk relies on the ability for a responsive action to be taken if a marine mammal is detected. The APM for deployment of trained observers on all vessels along with effective monitoring equipment would minimize the collision and injury risk. APMs to minimize vessel-marine mammal strikes are expected to be highly effective and reduce the likelihood of occurrence to low.

Therefore, with implementation of known and highly effective measures such as reduced vessel speeds and ships maintaining minimum distances from marine mammals, vessel strikes are not anticipated to occur; as such, there would be no effect. However, if a vessel strike of a NARW were to occur, this impact could be major and long term. The risk of vessel strike would be long term because vessel interactions with marine mammals could occur during construction, O&M, or decommissioning of the Project. Given general population status, any vessel strikes to non-NARW mysticetes would be minor to moderate and vessel strikes to odontocetes and pinnipeds would be negligible to minor. However, again, given implementation of the APMs, vessel strike risk is very low and not anticipated to occur. There would be no effect on all marine mammals if no vessel strikes occur.

Accidental releases and discharges: The risk of accidental releases of fuel, fluids, hazardous materials, trash, and debris may increase as a result of the Proposed Action. The effects of accidental releases and discharges on marine mammals are discussed in Section 3.15.3.1, *Impacts of the No Action Alternative*. The risk of any type of accidental release would be increased primarily during construction when additional vessels are present and during the proposed refueling of primary construction vessels at sea, but also during operations and decommissioning. Lessees must conduct all authorized activities in a manner that prevents unauthorized discharge of pollutants including marine trash and debris into the offshore environment (30 CFR 285.105). USCG similarly prohibits the dumping of environmentally damaging trash or debris (International Convention for the Prevention of Pollution from Ships, Annex V, Public Law 100−220 (101 Stat. 1458)). Ocean Wind would establish and implement a Spill Prevention, Control, and Countermeasures Plan, which would include an Oil Spill Response Plan and Spill Prevention, Control, and Countermeasures Plan specific to vessels as part of the APMs (Appendix H, Table H-1, GEN-11). The combined regulatory requirements and APMs would effectively avoid accidental debris releases and avoid and minimize the impacts from accidental spills such that adverse effects on marine mammals are unlikely to occur. Therefore, impacts of accidental releases and discharges as a result of the Proposed Action would be negligible and long term for mysticetes, odontocetes, and pinnipeds, except for NARW. If these releases or discharges were to occur, they would be likely to result in long-term consequences to a few individuals that are detectable and measurable but do not lead to population-level effects. Although they are unlikely to occur, impacts from accidental release and discharges as a result of the Proposed Action would likely be moderate and long term for NARW and have the potential to result in population-level effects through detectable and measurable impacts on the individual, but the population should sufficiently recover.

EMF: BOEM performed literature reviews and analyses of potential EMF effects from offshore renewable energy projects (CSA Ocean Sciences Inc. 2021; Inspire 2019; Normandeau et al. 2011). These and other available reviews and studies (Gill et al. 2005; Kilfoyle et al. 2018) suggest that most marine species cannot sense low-intensity EMF generated by the HVAC power transmission cables commonly used in offshore wind energy projects. Normandeau et al. (2011) concluded that marine mammals are unlikely to detect magnetic field intensities below 50 milligauss, suggesting that these species would be insensitive to EMF effects from the Project's electrical cables. Project-related EMFs would be below this threshold and therefore undetectable, except for in areas where the cables lie on the bed surface. The area exposed to magnetic field effects greater than 50 milligauss would be small, extending only a few feet from the cable. Marine mammal species that are more likely to forage near the benthic organisms, such as certain delphinids, have more potential to experience EMF above baseline levels (Tricas and Gill 2011). The 50-milligauss detection threshold is theoretical and an order of magnitude lower than the lowest observed magnetic field strength resulting in observed behavioral responses (Normandeau et al. 2011). These factors indicate that the likelihood of marine mammals encountering detectable EMF effects is low, and any exposure would be below levels associated with measurable biological effects. Therefore, EMF effects on marine mammals (mysticetes, odontocetes, and pinnipeds) would be negligible.

Cable emplacement and maintenance: The Proposed Action would include up to 3,785 acres (15.3 km^2) of seafloor disturbance by cable installation, which would result in turbidity effects with the potential to have temporary impacts on some marine mammal prey species (see Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*). Desktop analyses of similar projects and environmental conditions show that plumes during trenching of offshore areas would be limited to directly above the seabed and not extend into the water column (COP Volume II; Ocean Wind 2023). This EIS expects plume concentrations of 10 mg/L, extending 164–656 feet (50–200 meters) from the trench centerline for 6 hours, although this may be less extensive at varying locations along the route (COP Volume II; Ocean Wind 2023).

Inshore trenching could result in more extensive suspended sediment, with concentrations above 10 mg/L occurring over 14.6 to 55.3 acres (59,084 to 223,791 m^2) for 1 to 10 hours, respectively (COP Volume II; Ocean Wind 2023). Areas of higher concentrations modeled averaged 4.8 acres (19,425 m^2) at 100 mg/L, 0.7 acre (283.3 m^2) at 1,000 mg/L, and 0.05 acre (202.3 m^2) at 5,000 mg/L. Trenching with a jet plow in areas of shallower water depths could cause plumes to nearly reach the surface of the water (COP Volume II; Ocean Wind 2023). In areas where dredging is required to install cable along sand waves or when crossing federal and state navigation channels, concentrations greater than 10 mg/L filling the water column could reach 10 miles (16 kilometers) and remain for 3 hours (COP Volume II; Ocean Wind 2023). Localized areas up to 15 acres (60,703 m^2) could experience the same elevated concentrations for up to 6 to 12 hours (COP Volume II; Ocean Wind 2023). Elevated turbidity levels would be short term and temporary, and marine mammals often reside in turbid waters, so significant impacts from turbidity are not likely (Todd et al. 2015). The effects of turbidity on marine mammals are described in more detail in Section 3.15.3.1, *Impacts of the No Action Alternative*. Increased turbidity effects could affect the prey species of marine mammals, both in offshore and inshore environments, such as the SAV near the inshore export cable route in Barnegat Bay. Studies of the effects of turbid water on fish suggest that concentrations of suspended solids can reach thousands of mg/L before an acute reaction is expected (Wilber and Clark 2001). However, as mentioned previously, sedimentation effects would be temporary and localized, with regions returning to previous levels soon after the activity.

During construction, turbidity reduction measures would be implemented to the extent practical to minimize impacts (Appendix H, Table H-1, GEN-08 and WQ-01). Therefore, BOEM anticipates short-term and localized water quality impacts from inter-array cable installation and undetectable, negligible impacts on mysticetes, odontocetes, and pinnipeds from turbidity. Suspended sediment concentrations during activities other than dredging would be within the range of natural variability for this location. Any dredging necessary prior to cable installation could generate additional impacts. However, individual marine mammals, if present, would be expected to successfully forage in nearby areas not affected by increased sedimentation, and only non-measurable, negligible to minor impacts, if any, on individuals would be expected given the localized and temporary nature and isolated nature of the potential impacts.

Gear utilization: The presence of gear used for fisheries and benthic monitoring surveys under the Proposed Action could affect marine mammals by entrapment or entanglement. Trawl nets pose a discountable threat to mysticetes (NMFS 2016) and the slow speed of mobile gear and the short tow times (20 minutes) further reduce the potential for entanglements or other interactions. Chevron traps and baited remote underwater video systems and the anchoring lines and buoys used to secure them and passive acoustic monitoring equipment may pose an entanglement risk to marine mammals, although these risks would be reduced through implementation of mitigation procedures included in monitoring plans. Equipment used in the fisheries monitoring surveys would use both weak-link and weak-rope technologies that are consistent with the proposed changes in the Atlantic Large Whale Take Reduction Plan (NOAA 2020b). Additionally, traps and baited remote underwater video systems would have limited soak times of less than 90 minutes and the vessel would remain on location during deployment. Lastly, neither traps nor baited remote underwater video systems would be deployed if marine mammals are sighted near the proposed sampling station. Therefore, impacts on marine mammals from traps and baited remote underwater video systems are expected to be discountable based upon the limited number of associated buoy lines, the implementation of NOAA-required risk reduction measures, and the fact that entanglement in gear would be extremely unlikely to occur. The equipment used in the clam, oceanography, and pelagic fish surveys would pose minimal risks to marine mammals. Tows for the clam surveys would have a very short duration of 120 seconds, and the vessel would be subject to similar mitigation measures as the trawl survey. Both the oceanography and pelagic fish surveys would be non-extractive and also subject to similar mitigation measures as the structure-associated fish surveys. Therefore, the effects of the equipment used in clam, oceanography, and pelagic fish surveys on marine mammals would be discountable. Moored passive acoustic monitoring systems would use the best available technology to reduce any potential risks of entanglement. Passive acoustic monitoring system deployment would follow the same procedures as those described above to avoid and minimize impacts on marine mammals. Given the short-term, low-intensity, and localized nature of the impacts of gear utilization for the Proposed Action, as well as the mitigation procedures included in monitoring plans, it is not likely that marine mammals would be entangled or entrapped in gear used for monitoring. Therefore, there would be no effect from this IPF. However, if entanglement did occur (although it is not anticipated), the most likely species to be entangled would be pinnipeds and odontocetes. Given the population status, it is likely that effects on odontocetes and pinnipeds would be negligible to minor.

Port utilization: Ocean Wind 1's proposed use of the Port of Atlantic City, New Jersey; Paulsboro, Hope Creek, and Port Elizabeth, New Jersey; and Port Charleston, South Carolina would increase vessel traffic in the area and potentially contribute to the need for expansion or increased maintenance of port facilities within the marine mammal geographic analysis area. However, no specific project proposals were developed as part of the Proposed Action; therefore, impacts resulting from potential port expansion or increased maintenance of port facilities cannot be evaluated in this EIS. Expansion could result in adverse effects on coastal and estuarine habitats from shoreline noise during construction and disturbance or loss of habitat for prey species. Increased maintenance such as dredging could expose marine mammals to increased levels of underwater noise and increase turbidity, affecting individual marine mammals or their prey. Increased vessel traffic, port expansion, and port maintenance would likely be extensive and long term. Any future port maintenance or expansion projects would be subject to additional NEPA analysis.

Lighting: The Proposed Action would introduce stationary artificial light sources in the form of navigation, safety, and work lighting. Orr et al. (2013) summarized available research on potential operational lighting effects from offshore wind energy facilities and developed design guidance for avoiding and minimizing lighting impacts on aquatic life, including marine mammals. BOEM concluded that the operational lighting effects on marine mammal distribution, behavior, and habitat use were negligible if recommended design and operating practices are implemented. Therefore, BOEM anticipates that operational lighting effects on mysticetes, odontocetes, and pinnipeds would be negligible.

3.15.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned wind activities. Ongoing and planned non-offshore wind activities would contribute to impacts on marine mammals through the primary IPFs of traffic (vessel strikes), gear utilization, noise, accidental releases and discharges, EMF, and climate change. The construction, O&M, and decommissioning of offshore wind activities across the geographic analysis area would also contribute to the primary IPFs of noise, presence of structures, traffic (vessel strikes), accidental releases and discharges, EMF, cable emplacement and maintenance, gear utilization (biological/fisheries monitoring surveys), port utilization, lighting, and climate change. Ongoing and planned offshore wind activities in combination with the Proposed Action would result in an estimated 2,946 WTGs, of which the Proposed Action would contribute 98 WTGs, or 3 percent.

Noise: The Proposed Action would contribute a noticeable increment to the cumulative noise impacts of all future planned non-wind and wind projects. Construction-related noise impacts (from activities including pile driving, UXO detonation, and HRG surveys) would occur within a limited time frame. However, long-term noise sources from operational turbines and vessels would persist. All effects on marine mammals from noise (e.g., some PTS, TTS, behavioral changes, masking) are anticipated to be the same as described in Section 3.15.3.2, *Cumulative Impacts of the No Action Alternative*. The incremental addition of the noise from the Proposed Action is not anticipated to result in cumulative impacts such that the cumulative impacts from the Proposed Action would be appreciably different from the impact findings for the cumulative impacts of the No Action Alternative given the amount of planned offshore wind activities in the Atlantic. Cumulative impacts of the Proposed Action from noise would likely result in moderate short-term impacts for LFC, MFC, HFC, and pinnipeds, with the exception of NARWs. Cumulative noise impacts could be moderate for listed species such as NARW because impacts on an individual could result in population-level effects.

Presence of structures: The incremental impact contributed by the Proposed Action would result in a noticeable increase in the presence of structures in the marine mammal geographic analysis area beyond that described under the No Action Alternative. However, the cumulative impacts from the presence of structures would likely be minor for mysticetes, odontocetes, and pinnipeds, as well as localized and long term. Using the assumptions in Table F2-2 in Appendix F, there is potential for up to approximately 5,743 acres (31 km^2) of new hard protection. Of this area, 161 acres (0.65 km^2) would result from the Proposed Action, and the remainder would result from other offshore wind projects in the geographic analysis area. Of the estimated 3,101 structures, 101 would result from the Proposed Action.

Traffic (vessel strikes): The Proposed Action would contribute a detectable increment to the cumulative traffic (vessel strike) impacts, which would be minor for pinnipeds and odontocetes, major for NARW, and moderate for all other mysticetes. Impacts would occur in close spatial proximity to vessel routes but would be long term in temporal scale.

Accidental releases and discharges: The Proposed Action would contribute an undetectable increment to the cumulative accidental release and discharge impacts, which would likely be negligible for mysticetes, odontocetes, and pinnipeds. An Oil Spill Response Plan and Spill Prevention, Control, and Countermeasures Plan specific to vessels would be implemented for the proposed Project and other planned offshore wind projects. The implementation of these plans and regulatory requirements would effectively avoid accidental debris releases and avoid and minimize the impacts from accidental spills such that adverse effects on marine mammals are unlikely to occur. Impacts would likely occur in close temporal and spatial proximity, although these impacts would not be expected to be biologically significant.

EMF: The incremental impact contributed by the Proposed Action would result in a noticeable increase in EMF in the geographic analysis area beyond that described under the No Action Alternative. However, the cumulative impacts from EMF on mysticetes, odontocetes, and pinnipeds would likely still be negligible, localized, and long term.

Cable emplacement and maintenance: The Proposed Action would contribute an undetectable increment to the cumulative cable emplacement impacts on mysticetes, odontocetes, and pinnipeds, which are expected to be negligible. Some non-measurable, negligible impacts could occur if impacts occur in close temporal and spatial proximity, although these impacts would not be expected to be biologically significant.

Gear utilization (biological/fisheries monitoring surveys: The Proposed Action would contribute an undetectable increment to the cumulative impacts of gear utilization. As described above, entanglement or entrapment in gear is not anticipated to occur. If entanglement or entrapment did occur for other planned offshore wind projects (or from other ongoing non-offshore wind activities), it would likely result in major impacts on NARWs, moderate impacts on non-NARW mysticetes, and negligible to minor impacts on odontocetes and pinnipeds.

Port utilization: The Proposed Action would contribute a noticeable increment to the cumulative impacts of port utilization, which would likely be moderate, extensive, and likely to result in long-term consequences to individuals or populations of mysticetes, odontocetes, and pinnipeds, except the NARW. The Proposed Action would contribute a noticeable increment to the cumulative impacts of port utilization, which would likely be major, extensive, and likely to result in long-term consequences to individuals or the population of the NARW due to low population numbers. However, any future port expansion and associated increase in vessel traffic would be subject to independent NEPA analysis and regulatory approvals requiring full consideration of potential effects on marine mammals regionwide.

Lighting: The Proposed Action would contribute an undetectable increment to the cumulative lighting impacts, which would likely be negligible, localized, and long term for mysticetes, odontocetes, and pinnipeds. The cumulative impacts on mysticetes, odontocetes, and pinnipeds would likely be moderate and long term. BOEM anticipates that impacts from planned non-offshore wind activities would primarily be driven by underwater noise impacts, vessel activity (vessel collisions), entanglement, and seabed disturbance. Impacts from ongoing and planned offshore wind activities, when combined with the Proposed Action, would primarily be driven by pile-driving noise, increased vessel traffic, and port utilization. The presence of structures could contribute adverse impacts with potentially beneficial impacts on some marine mammal species. The moderate impact level conclusion assumes that mortality of individual marine mammals would not have negative significant consequences at the population level and that effects would be recoverable, with the exception of the NARW. Impacts on NARW may be magnified in severity due to low population numbers and the potential to compromise the viability of the species from the loss of a single individual.

3.15.5.3. Conclusions

Impacts of the Proposed Action. Project construction would primarily result in noise that would disturb marine mammals and potentially result in permanent impacts (i.e., PTS). APMs would minimize noise exposure such that any PTS of NARWs would be avoided and, for all marine mammals, the severity of any behavioral responses would be minimized. Therefore, the incremental impact of the Proposed Action when compared to the No Action Alternative would be minor for NARWs from construction given the likely outcome of noise exposure would be a deflection, but not abandonment of their migratory path. More severe impacts on marine mammals such as mortality or serious injury from vessel strikes, UXO detonation, and entanglement are not anticipated to occur due to the APMs and additional measures that would be required as part of the environmental permitting processes. The incremental impact of the

Proposed Action when compared to the No Action Alternative would be minor to moderate for other large whales, minor for small whales and delphinids, and minor for pinnipeds because with the implementation of APMs, mortality and non-auditory injury would not occur as a result of UXO detonation, only a few marine mammals of select species are anticipated to incur PTS incidental to pile driving and UXO detonation, vessel strike risk is very low and not anticipated to occur, and accidental spills are also not anticipated to occur.

When including the baseline status of marine mammals into the impact findings and considering all phases of the Project, the impacts of the Proposed Action on NARW would be long term and **moderate** to **major** (primarily due to ongoing vessel strike and entanglement), and long term and **moderate** for other mysticetes. Impacts of the Proposed Action on odontocetes and pinnipeds would be long term and **minor**. Some **minor beneficial** impacts on odontocetes and pinnipeds could be realized through artificial reef effects. Beneficial effects, however, may be offset given the increased risk of entanglement due to derelict fishing gear on the structures.

Cumulative Impacts of the Proposed Action. Existing environmental trends and ongoing activities would continue, and mysticetes, odontocetes, and pinnipeds would continue to be affected by natural and human-caused IPFs. Planned activities would also contribute to impacts on marine mammals. Although injury or mortality of individuals may occur, long-term population-level effects are not anticipated for marine mammals (with the exception of NARW). Underwater noise impacts, vessel activity (vessel collisions), entanglement, and seabed disturbance, primarily from non-offshore wind activities, would result in moderate impacts. Accidental releases and discharges, EMF, the presence of structures, cable emplacement and maintenance, port utilization, and lighting associated with offshore wind activities would be implemented with measures to minimize impacts on marine mammals. Incremental impacts contributed by the Proposed Action to the cumulative impact on marine mammals would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts for mysticetes, odontocetes, and pinnipeds in the geographic analysis area from the Proposed Action would be **moderate** to **major** and long term for NARW, **moderate** for other mysticetes, and **minor** for odontocetes and pinnipeds. Impacts from the Proposed Action are not anticipated to substantially contribute to the moderate to major long-term cumulative impacts for NARW.

3.15.6 Impacts of Alternatives B-1, B-2, C-1, and D on Marine Mammals

Impacts of Alternatives B-1, B-2, C-1, and D. Impacts resulting from individual IPFs associated with construction and installation, O&M, and conceptual decommissioning of the Project under Alternatives B-1, B-2, C-1, and D would be similar to those described under the Proposed Action. No changes in gear utilization, accidental releases and discharges, or port utilization impacts are anticipated. While the effect of each IPF is anticipated to be similar, the number of instances would decrease slightly given the Project size would also decrease. Alternative B-1 would exclude placement of WTGs at up to 9 WTG positions that are nearest to coastal communities (positions F01 to K01 and B02 to D02). Alternative B-2 would exclude placement of WTGs at up to 19 WTG positions that are nearest to coastal communities (positions F01 to K01, A02 to K02, A03, and C03). Alternative C-1 would exclude 8 WTG positions, relocate up to 8 WTG positions to the northern portion of the Ocean Wind 1 Lease Area, or some combination of exclusion and relocation of WTG positions, to allow for an 0.81-nm to 1.08-nm buffer between WTGs in the Ocean Wind 1 Lease Area and WTGs in the Atlantic Shores South Lease Area. Alternative D would exclude up to 15 WTG positions in the sand ridge and trough area that include A07 to E07, A08 to E08, and A09 to E09. Reductions in the WTGs would also reduce the number of monopiles required. As a result, the number of hours of impact pile driving required to install the WTGs would be reduced. The length of inter-array cable to be installed would also be reduced if fewer WTGs are installed. IPFs that could change as a result include presence of structures, underwater noise from pile driving and vessels during construction activities, habitat alteration, vessel strikes, artificial lighting, decommissioning activities, and cable emplacement and maintenance. The changes in the number of monopiles and associated Project construction vessels between the Proposed Action and each alternative are considered relatively minor to the assessment of effects on marine mammals. A reduction in the duration of the effects from construction would occur; however, the magnitude of the effects would remain unchanged from that of the Proposed Action. Alternatives B-1, B-2, C-1, and D may change the duration for the IPFs in comparison to that described for the Proposed Action in Section 3.15.5, as described in following paragraphs. Table 3.15-18 summarizes the differences in the number of monopiles as they related to each alternative. The corresponding reduction to the number or duration of construction vessels in the Project area is unknown; therefore, the discussion regarding a reduction in vessels during construction is qualitative. The duration of effects from WTG operation would remain the same.

Table 3.15-18 Summary of Changes to Impact Pile Driving Requirements Among Alternatives

Alternative	WTGs	Reduction in Monopiles	Total Number of Monopiles	Total Hours of Impact Pile Driving (4 to 6 hrs/pile)	Number of days
Proposed Action	98	98	98	392 to 588 hours	98
Alternative B-1	exclusion of up to 9 WTG positions	Up to 9 fewer	89	356 to 534 hours	89
Alternative B-2	exclusion of up to 19 WTG positions	Up to 19 fewer	79	316 to 474 hours	79
Alternative C-1	exclusion of 8 WTG positions	Up to 8 fewer	90	360 to 540 hours	90
Alternative D	exclusion of up to 15 WTG positions	Up to 15 fewer	83	332 to 498 hours	83

Notes: Assumes each pile would require 4 to 6 hours of impact pile driving per pile, with a maximum-case scenario of one pile per day.
hrs/pile = hours per pile

Noise: The 10- to 20-percent reduction in the number of monopiles for Alternatives B-1, B-2, C-1, and D would reduce the overall number of impact pile-driving hours required for installation (Table 3.15-18). This would limit the duration of the effect by the hours and days outlined in Table 3.15-18. However, the overall effects would remain the same (e.g., PTS, TTS, disturbance, and masking) as described in Section 3.15.5. Limiting the duration of the effect could reduce the number of marine mammals exposed to underwater sound in excess of acoustic thresholds. This could be particularly important for species who are particularly sensitive to impact pile-driving activities (e.g., harbor porpoise). Taking Alternative B-2 as an example, the number of pile-driving hours would be reduced by between 76 and 114 hours or 19 days in comparison to the Proposed Action. However, the APMs outlined in Appendix H would apply to these action alternatives and are expected to be effective in reducing the potential effects on marine mammals and specifically in limiting the potential for PTS and behavioral effects on NARW (see Section 3.15.5). For other marine mammal species who have large home ranges (e.g., most species of dolphins listed in Appendix I), migrate through the area (e.g., humpback whales), or prefer deeper offshore waters (e.g., blue whales), these action alternatives are unlikely to result in a change to the impact determinations outlined for the Proposed Action.

A reduction in the number of monopiles would result in a reduction in the number of construction vessels or the duration of vessels in the Project area during construction activities that would be required for installation. The magnitude of the effects of underwater noise from Project vessels during construction would remain the same (e.g., disturbance, masking) as described in Section 3.15.5; however, the duration of the effects would be reduced.

A 10- to 20-percent reduction in the number of monopiles would also result in a reduced behavioral disturbance footprint around the total Lease Area during operations. As stated in Section 3.15.5, the noise generated by the proposed WTGs is relatively unknown; however, a reduction in the number of WTGs would reduce the underwater noise footprint and limit the extent of behavioral disturbance and masking effects.

EMF: A 10- to 20-percent reduction in WTGs would result in a reduction of inter-array cable approximately correlated to the 10- to 20-percent reduction of WTGs. This could result in 19 miles (31 kilometers) to 38 miles (61 kilometers) less inter-array cable length within the Project area, which would limit the footprint of potential EMF exposure, particularly for marine mammals that are more likely to forage on the benthic organisms, in closest proximity to the cable, such as odontocetes.

Presence of structures: The 10- to 20-percent reduction in the number of monopiles would reduce the overall footprint on the seafloor of the alternatives, as compared to the Proposed Action. Fewer structures in the water could also reduce the reef effect, indirectly reducing recreational fishing and the subsequent risk to marine mammals from entanglement.

As described in Section 3.15.5, the presence of vertical structures in the water column can cause localized hydrodynamic effects that can influence the distribution and abundance of fish and planktonic prey resources (van Berkel et al. 2020). Turbulence resulting from vertical structures in the water column could lead to localized changes in circulation and stratification patterns, with potential implications for primary and secondary productivity and fish distribution. By reducing the number of monopiles in the water column as a result of Alternatives B-1, B-2, C-1, and D, the potential for localized hydrodynamic effects would be reduced.

Traffic (vessel strikes): A reduction in the number of monopiles would result in a reduction in the number of construction vessels or the duration of vessels in the Project area during construction activities that would be required for installation, O&M, and decommissioning. A 10- to 20-percent reduction in vessel trips would result in 253 to 505 fewer construction-related vessel trips, 111 to 223 fewer O&M-related vessel trips, and a similar reduction in trips for decommissioning as under construction. This could reduce the probability of a vessel strike on a marine mammal during Project construction.

Lighting: A 10- to 20-percent reduction in the number of monopiles would result in a 10- to 20-percent reduction in the amount of artificial light required to install the WTGs and lighting associated with the WTG structures through operations. In addition, a reduction in the number of vessels required for installation or the duration vessels would be required for installation would further limit this effect.

Cable emplacement and maintenance: Alternatives B-1, B-2, C-1, and D would have short-term and localized water quality impacts from inter-array cable installation and undetectable, negligible impacts on marine mammals from turbidity. A 10- to 20-percent reduction in WTGs would result in a reduction of inter-array cable approximately correlated to the 10- to 20-percent reduction of WTGs. This could result in 19 miles (31 kilometers) to 38 miles (61 kilometers) less inter-array cable within the Project area and less area over which the emplacement disturbance and resulting impacts would occur. It would also decrease the amount of time waters in the Project area experience short-term elevated turbidity. This may reduce the number of animals exposed to potentially adverse effects, but some individual animals would still be exposed to those effects at the same levels of significance under the criteria described in Section 3.15.5. Conceptual decommissioning effects would be similar in magnitude but reduced in extent and duration relative to the Proposed Action due to the reduction in number of piles required to be decommissioned. However, in the vicinity of the Project, effects would not be measurably different than under the Proposed Action.

Cumulative Impacts of Alternatives B-1, B-2, C-1, and D. The cumulative impact on marine mammals would range from negligible to major. The incremental impacts contributed by Alternatives B-1, B-2, C-1, and D to the cumulative impacts on marine mammals would be similar to those of the Proposed Action.

3.15.6.1. Conclusions

Impacts of Alternatives B-1, B-2, C-1, and D. As discussed in above sections, the anticipated impacts from these alternatives would reduce the number of WTGs and their associated inter-array cables 10 to 20 percent, which would in turn result in an incremental reduction in effects on marine mammals from certain construction and installation, O&M, and conceptual decommissioning impacts. However, BOEM anticipates that any incremental reduction in impacts would not change the resulting effects on marine mammals to the extent necessary to alter the impact level conclusions for any impact mechanism. The incremental impact of Alternatives B-1, B-2, C-1, and D, when each compared to the No Action Alternative, would be minor to moderate for other large whales, minor for small whales and delphinids, and minor for pinnipeds because with the implementation of APMs, mortality and non-auditory injury would not occur as a result of UXO detonation, only a few marine mammals of select species are anticipated to incur PTS incidental to pile driving and UXO detonation, vessel strike risk is very low and not anticipated to occur, and accidental spills are also not anticipated to occur.

The impacts resulting from Alternatives B-1, B-2, C-1, and D individually, when including the baseline status of marine mammals into the impact findings and considering all phases of the Project, would be similar to those of the Proposed Action and would be **moderate** for mysticetes except for the NARW, which would range from **moderate** to **major**. BOEM anticipates that the impacts resulting from the Proposed Action would be **minor** for odontocetes and pinnipeds and could include **minor beneficial** impacts. Adverse impacts are expected to result mainly from underwater noise (e.g., UXO detonations and impact pile driving) and increased vessel traffic potentially leading to vessel strikes. Beneficial impacts for odontocetes and pinnipeds are expected to result from the presence of structures.

Cumulative Impacts of Alternatives B-1, B-2, C-1, and D. The incremental impacts contributed by Alternatives B-1, B-2, C-1, and D to the cumulative impacts on marine mammals would be similar to those of the Proposed Action and would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts of Alternatives B-1, B-2, C-1, and D when each combined with ongoing and planned activities including offshore wind would be the same level as under the Proposed Action: **moderate** to **major** and long term for NARW, **moderate** for other mysticetes, and **minor** for odontocetes and pinnipeds.

3.15.7 Impacts of Alternative C-2 on Marine Mammals

Impacts of Alternative C-2. The impacts of Alternative C-2 would include no surface occupancy along the northeastern boundary of the Ocean Wind 1 Lease Area to allow for an 0.81-nm to 1.08-nm buffer the boundary between WTGs in the Ocean Wind 1 Lease Area and WTGs in the Atlantic Shores South Lease Area. The wind turbine array layout would be compressed to allow for a full build of up to 98 WTGs. Therefore, no changes to the number of monopiles are anticipated. The Project’s turbine array row spacing would be reduced from 1 nm between rows to no less than 0.92 nm between rows. Spacing of 1 by 0.8 nm (1.85 kilometers) was assessed under the seabed disturbance and displacement IPF (Section 3.15.5). Therefore, the effects on marine mammals considered under Alternative C-2 would be the same as for the Proposed Action.

Cumulative Impacts of Alternative C-2. The cumulative impact on marine mammals would range from negligible to major. The incremental impacts contributed by Alternative C-2 to the cumulative impacts on marine mammals would be similar to those of the Proposed Action.

3.15.7.1. Conclusions

Impacts of Alternative C-2. Although Alternative C-2 would result in a decreased construction and operational footprint, BOEM anticipates that the impacts resulting from Alternative C-2 would be similar to those of the Proposed Action. The incremental impact of Alternative C-2, when compared to the No Action Alternative, would be minor to moderate for other large whales, minor for small whales and delphinids, and minor for pinnipeds because with the implementation of APMs, mortality and non-auditory injury would not occur as a result of UXO detonation, only a few marine mammals of select species are anticipated to incur PTS incidental to pile driving and UXO detonation, vessel strike risk is very low and not anticipated to occur, and accidental spills are also not anticipated to occur.

Impacts resulting from Alternative C-2, when including the baseline status of marine mammals into the impact findings and considering all phases of the Project, would be **moderate** to **major** and long term for NARW, **moderate** for other mysticetes, and **minor** for odontocetes and pinnipeds. BOEM anticipates that the impacts for odontocetes and pinnipeds could include **minor beneficial** impacts.

Cumulative Impacts of Alternative C-2. The cumulative impact on marine mammals would be **moderate** to **major** for NARW, **moderate** for other mysticetes, and **minor** for odontocetes and pinnipeds. The incremental impacts contributed by Alternative C-2 to the cumulative impacts on marine mammals would be similar to those of the Proposed Action and would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts of Alternative C-2 would be the same level as under the Proposed Action: **moderate** to **major** and long term for NARW, **moderate** for other mysticetes, and **minor** for odontocetes and pinnipeds.

3.15.8 Impacts of Alternative E on Marine Mammals

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. Alternative E would minimize impacts on SAV within Barnegat Bay. Effects on SAV are summarized below and described in greater detail in Section 3.6. Alternative E would continue to affect SAV at the three landings on the western shore of Barnegat Bay, consistent with the original proposed Oyster Creek route. However, the acreage of SAV affected by cable emplacement and maintenance would be reduced (0.69 acre [2,792 square meters] versus 15.4 acres [62,322 square meters]). Although the acreage of SAV potentially affected by this alternative would be reduced compared to the Proposed Action, recovery of seagrass where it is affected could still take multiple years depending on the nature of damage. Once affected, SAV can be difficult to replace and such efforts are often deemed unsuccessful (Lefcheck et al. 2019). However, seagrasses have varying abilities to withstand at least small changes in their environment; therefore, short-term light reductions or thin smothering from dredging should have only short-term effects (Todd et al. 2015). A study by Wisehart et al. (2007) showed that eelgrass density and seedling recruitment 5 months following disturbance was higher in dredged aquaculture beds than in areas with long-line aquaculture beds. Although losses to a shaded (for a duration of 3 months) Australian seagrass meadow resulted in a significant loss of leaf biomass, recovery of that biomass was achieved in 10 months (McMahon et al. 2011).

The decreased impact on SAV, a critical component of the marine food web, would potentially decrease impacts on marine mammal prey species. Impacts on marine mammal prey availability resulting from SAV disturbance are not expected to be significant under Alternative E. Herbivorous sireniancs that rely entirely on SAV as a food source are not present within the Project area. Similarly, planktonic prey items for mysticetes that occur within the Project area would not be affected by impacts on SAV. Other marine mammals species may feed on prey within SAV beds, but are not restricted to them. In fact, bottlenose dolphins in Clearwater, Florida preferred non-seagrass habitats, suggesting that seagrasses may create an obstruction that could hinder pre-location and capture (Allen et al. 2001). Prey sizes are also bigger outside of seagrass habitats, and therefore potentially more energetically viable (Todd et al. 2015). Marine mammals are not expected to be foraging in the SAV beds potentially affected by the Project area, but may be indirectly affected by a reduction in prey species that utilize the affected SAV as a nursery or for refuge. Section 3.13 examines the impacts of the Proposed Action on marine mammal prey species.

Alternative E would lead to the same types of impacts on marine mammals from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. Impacts within the Project area would stay the same as under the Proposed Action and would be **moderate**, and **moderate** to **major** and long term for NARW. BOEM anticipates that the impacts resulting from the Proposed Action would be **moderate** for odontocetes and pinnipeds and could include beneficial impacts. Adverse impacts are expected to result mainly from underwater noise (e.g., UXO detonations and impact pile driving) and increased vessel traffic potentially leading to vessel strikes. Minor beneficial impacts for odontocetes and pinnipeds may result from the presence of structures.

Cumulative Impacts of Alternative E. The cumulative impacts on marine mammals would be moderate, and moderate to major and long term for NARW. The incremental impacts contributed by Alternative E to the cumulative impacts on marine mammals would be similar to those of the Proposed Action and would range from undetectable to noticeable.

3.15.8.1. Conclusions

Impacts of Alternative E. The incremental impact of Alternative E, when compared to the No Action Alternative, would be minor to moderate for other large whales, minor for small whales and delphinids, and minor for pinnipeds because with the implementation of APMs, mortality and non-auditory injury would not occur as a result of UXO detonation, only a few marine mammals of select species are anticipated to incur PTS incidental to pile driving and UXO detonation, vessel strike risk is very low and not anticipated to occur, and accidental spills are also not anticipated to occur. Impacts resulting from Alternative E, when including the baseline status of marine mammals into the impact findings and considering all phases of the Project, would likely have the same **moderate** to **major** and long term for NARW, **moderate** for other mysticetes, and **minor** for odontocetes and pinnipeds adverse impacts and could also result in **minor beneficial** impacts on marine mammals, similar to those of the Proposed Action. While Alternative E would result in reduced acreage of SAV potentially affected, the overall impacts on marine mammals from the alternative would not be materially different from those of the Proposed Action.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on marine mammals would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts of Alternative E when combined with ongoing and planned activities including offshore wind would be the same level as under the Proposed Action: **moderate** to **major** and long term for NARW, **moderate** for other mysticetes, and **minor** for odontocetes and pinnipeds.

3.15.9 Proposed Mitigation Measures

Several measures are proposed to minimize impacts on marine mammals (Appendix H, Table H-2 and H-3). If one or more of the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced.

Table 3.15-19 Measures Resulting from Consultations (Also Identified in Appendix H, Table H-2): Marine Mammals

Measure	Description	Effect
Incorporate LOA requirements	The measures required by the final MMPA LOA would be incorporated into COP approval, and BOEM and/or BSEE will monitor compliance with these measures.	Compliance with LOA requirements would reduce risks for marine mammals under the Proposed Action. However, this measure would not alter impact determinations for marine mammals because analysis of the Proposed Action already includes analysis of the APMs included in Ocean Wind's LOA Application as outlined in Table H-1.
Passive Acoustic Monitoring (PAM) Plan	BOEM, BSEE, and USACE would ensure that Ocean Wind prepares a PAM Plan that describes all proposed equipment, deployment locations, detection review methodology and other procedures, and protocols related to the required use of PAM for monitoring. This plan would be submitted to NMFS, BOEM and BSEE (at OSWsubmittals@bsee.gov) for review and concurrence at least 120 days prior to the planned start of pile driving.	Ocean Wind has committed to implementing passive acoustic monitoring, pile driving monitoring, PSO coverage, sound field verification, and shutdown zones as part of the Proposed Action. Compliance with these APMs would be enforced by BOEM, BSEE, and NMFS as indicated in Table H-1. Implementation and enforcement of these APMs would minimize the potential for Level A or Level B exposures to marine mammals during of impact pile driving, vibratory pile driving, HRG surveys, and UXO detonation, as disclosed in the analysis of the Proposed Action. Agency-proposed mitigation measures would further define how the effectiveness and enforcement of APMs would be ensured, by requiring that Ocean Wind submit PAM and pile driving monitoring plans for approval by BOEM, BSEE, and NMFS and a sound field verification plan for approval by BOEM and BSEE; by ensuring that PSO coverage is sufficient and requiring deployment of additional PSOs or platforms if found
Pile driving monitoring plan	BOEM would ensure that Ocean Wind prepare and submit a *Pile Driving Monitoring Plan* to NMFS and BSEE (at OSWsubmittals@bsee.gov) for review and concurrence at least 90 days before the start of pile driving. The plan would detail all plans and procedures for sound attenuation as well as for monitoring ESA-listed whales and sea turtles during all impact and vibratory pile driving. The plan would also describe how BOEM, BSEE, and Ocean Wind would determine the number of whales exposed to noise above the Level B harassment threshold during pile driving with the vibratory hammer to install the cofferdam at the sea to shore transition. Ocean Wind would obtain NMFS' concurrence with this plan prior to starting any pile driving.	

Measure	Description	Effect
PSO Coverage	BOEM, BSEE, and USACE would ensure that PSO coverage is sufficient to reliably detect whales and sea turtles at the surface in clearance and shutdown zones to execute any pile driving delays or shutdown requirements. If, at any point prior to or during construction, the PSO coverage that is included as part of the proposed action is determined not to be sufficient to reliably detect ESA-listed whales and sea turtles within the clearance and shutdown zones, additional PSOs and/or platforms would be deployed. Determinations prior to construction would be based on review of the *Pile Driving Monitoring Plan*. Determinations during construction would be based on review of the weekly pile driving reports and other information, as appropriate.	insufficient or in the event that clearance or shutdown zones are expanded beyond the distances modeled prior to verification. While adoption of these measures would increase accountability and ensure the effectiveness of APMs, it would not alter the impact determination of moderate for the underwater noise IPF for LFC, MFC, HFC, and phocid pinnipeds in water, because analysis of the Proposed Action already includes analysis of the APMs outlined in Table H-1.
Sound field verification	BOEM, BSEE, and USACE would ensure that if the clearance and/or shutdown zones are expanded, PSO coverage is sufficient to reliably monitor the expanded clearance and/or shutdown zones. Additional observers would be deployed on additional platforms for every 1,500 m that a clearance or shutdown zone is expanded beyond the distances modeled prior to verification.	
Shutdown zones	BOEM, BSEE, and USACE may consider reductions in the pre-start clearance and/or shutdown zones based on the sound field verification measurements. BOEM and BSEE would ensure that Ocean Wind submits a Sound Field Verification Plan for review and approval at least 90 days prior to the planned start of pile driving.	
Sampling gear	All sampling gear would be hauled at least once every 30 days, and all gear would be removed from the water and stored on land between survey seasons to minimize risk of entanglement.	The regular hauling of sampling gear and recovery of lost survey gear would reduce risk of entanglement for marine mammals. Gear identification would improve accountability in the case of

Measure	Description	Effect
Gear identification	To facilitate identification of gear on any entangled animals, all trap/pot gear used in the surveys would be uniquely marked to distinguish it from other commercial or recreational gear. Using yellow and black striped duct tape, place a 3-foot-long mark within 2 fathoms of a buoy. In addition, using black and white paint or duct tape, place 3 additional marks on the top, middle and bottom of the line. These gear marking colors are proposed as they are not gear markings used in other fisheries and are therefore distinct. Any changes in marking would not be made without notification and approval from NMFS.	gear loss. While adoption of these measures would reduce risk and improve accountability under the Proposed Action, it would not alter the impact determination of negligible for gear utilization.
Lost survey gear	If any survey gear is lost, all reasonable efforts that do not compromise human safety would be undertaken to recover the gear. All lost gear would be reported to NMFS (nmfs.gar.incidental-take@noaa.gov) and BSEE (OSWIncidentReporting@bsee.gov) within 24 hours of the documented time of missing or lost gear. This report would include information on any markings on the gear and any efforts undertaken or planned to recover the gear.	
Marine debris awareness training	The Lessee would ensure that vessel operators, employees, and contractors engaged in offshore activities pursuant to the approved COP complete marine trash and debris awareness training annually. By January 31 of each year, the Lessee would submit to DOI an annual report that describes its marine trash and debris awareness training process and certifies that the training process has been followed for the previous calendar year.	Marine debris and trash awareness training would minimize the risk of marine mammal ingestion of or entanglement in marine debris. While adoption of this measure would decrease risk to marine mammals under the Proposed Action, it would not alter the impact determination of minor for accidental releases.
Monthly/annual reporting requirements	BOEM and BSEE would ensure that Ocean Wind submits regular reports (in consultation with NMFS) necessary to document the amount or extent of take that occurs during all phases of the proposed action.	Reporting requirements to document take would improve accountability for documenting marine mammal take associated with the Proposed Action. While adoption of these measures would improve accountability, it would not alter the overall impact determination for the Proposed Action.

Measure	Description	Effect
Data Collection BA BMPs	BOEM would ensure that all Project Design Criteria and Best Management Practices incorporated in the Atlantic Data Collection consultation for Offshore Wind Activities (June 2021) shall be applied to activities associated with the construction, maintenance and operations of the Ocean Wind project as applicable.	Compliance with project design criteria and BMPs for protected species would minimize risk to marine mammals during HRG surveys. While adoption of this measure would decrease risk to marine mammals under the Proposed Action, it would not alter the impact determination for HRG activities.
Alternative monitoring plan for pile driving	BOEM would require Ocean Wind to submit an alternative monitoring plan for nighttime pile driving at least 6 months prior to initiating nighttime impact pile-driving activities. The purpose of the plan is to demonstrate that Ocean Wind can meet the visual monitoring criteria with the technologies Ocean Wind is proposing to use for monitoring during nighttime impact pile driving. This plan may include deploying additional observers; alternative monitoring technologies such as night vision, thermal, and infrared technologies; or use of passive acoustic monitoring and must demonstrate the ability and effectiveness to maintain all clearance and shutdown zones during daytime and nighttime to BOEM's and NMFS's satisfaction.	Adoption of this measure would reduce the uncertainty in the ability of the nighttime monitoring techniques being proposed by Ocean Wind to detect marine mammals in the Level A monitoring zones. This would decrease the potential for PTS impacts to occur during nighttime impact pile-driving operations. However, it could still result in PTS effects on some marine mammal species (LFC, HFC, and phocid pinnipeds in water). In addition, the impact determination for underwater noise effects is made on all underwater noise sources and, therefore, implementation of the plan would not alter the impact determination of moderate for the underwater noise IPF for LFC, MFC, HFC, and phocid pinnipeds in water.
Periodic Underwater Surveys, Reporting of Monofilament and Other Fishing Gear Around WTG Foundations	The Lessee must monitor impacts associated with charter and recreational fishing gear lost from expected increases in fishing around WTG foundations by surveying at least 10 of the WTGs located closest to shore in the Ocean Wind 1 Lease Area (OCS-A 0498) annually and report the results of the surveys to BOEM and BSEE in an annual report.	Periodic underwater surveys and reporting of monofilament and other fishing gear around WTG foundations would reduce the risk of entanglement associated with the presence of structures. While adoption of this measure would reduce risk to marine mammals under the Proposed Action, it would not alter the impact determination associated with the presence of structures, which would range from minor beneficial to minor adverse.

Measure	Description	Effect
PDC Minimize Vessel Interactions with Listed Species	All vessels associated with survey activities (transiting [i.e., travelling between a port and the survey site] or actively surveying) must comply with the vessel strike avoidance measures. If any ESA-listed marine mammal is sighted within 500 meters of the forward path of a vessel, the vessel operator must steer a course away from the whale at <10 knots (18.5 km/hr) until the minimum separation distance has been established. If any ESA-listed marine mammal is sighted within 200 meters of the forward path of a vessel, the vessel operator must reduce speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 500 meters. If stationary, the vessel must not engage engines until the large whale has moved beyond 500 meters.	Ocean Wind has committed to implementing a vessel strike avoidance policy, vessel separation distances, and vessel speed restrictions as part of the Proposed Action and as described in Table H-1. These measures include maintaining a separation distance of greater than 500 meters from NARW and unidentified large marine mammals, greater than 100 meters from other large whales, and greater than 50 meters for dolphins, porpoises, seals, and sea turtles. Ocean Wind's vessel strike avoidance policy directs that if an animal is sighted in the vessel's path, the vessel will divert or reduce speed and shift gears to neutral (see Table H-1). Project design criteria to minimize vessel interactions with listed species would further clarify the distance at which vessels would divert their path and the distance at which vessels would reduce speed and shift to neutral. Adoption of these measures would further clarify requirements for vessel strike avoidance under the Proposed Action but would not alter the impact determinations for vessel traffic that would be minor for pinnipeds and odontocetes, minor to moderate for non-listed mysticetes, and moderate to major for NARW.
Operational Sound Field Verification Plan	BOEM would require the Lessee to develop an operational sound field verification plan to determine the operational noises emitted from the Offshore Wind Area. The plan would be reviewed and approved by BOEM and NMFS.	The development of an operational sound field verification plan would allow BOEM to confirm that impacts of operating WTG noise do not exceed predicted impacts based on existing monitoring data and modeling efforts. While adoption of this measure would improve accountability of WTG operational noise under the Proposed Action, it would not alter the impact determination for WTG noise.

Measure	Description	Effect
Biological Opinion Reasonable and Prudent Measures and Terms and Conditions	Reasonable and Prudent Measures and Terms and Conditions to minimize the impact of incidental take of ESA-listed species were documented in the NMFS Biological Opinion dated April 3, 2023. These measures include adherence to mitigation measures specified in the final MMPA ITA to minimize impacts during pile driving and UXO detonation; compliance with requirements for vessel operations within the Delaware River and Delaware Bay included in the Incidental Take Statements provided with the Paulsboro Marine Terminal Biological Opinion (dated July 19, 2022) and the New Jersey Wind Port Biological Opinion (dated February 25, 2022); reporting requirements related to effects to, or interactions with, ESA-listed species; submittal of required plans (e.g., PSO Training Plan for Trawl Surveys, Passive Acoustic Monitoring Plan, Marine Mammal and Sea Turtle Monitoring Plan, Cofferdam Installation and Removal Monitoring Plan, Alternative Monitoring Plan/Night Time Pile Driving Monitoring Plan, Sound Field Verification Plan, North Atlantic Right Whale Vessel Strike Avoidance Plan) to NMFS GARFO with sufficient time for review, comment and approval; and conducting on-site observation and inspection to gather information on the effectiveness and implementation of measures to minimize and monitor incidental take.	These RPMs and Terms and Conditions would minimize the exposure of ESA-listed species to pile-driving noise and the effects of UXO detonation. These RPMs and Terms and Conditions would also ensure that all incidental take that occurs is documented and reported to NMFS in a timely manner and that any incidentally taken individual specimens are properly handled, resuscitated if necessary, transported for additional care or reporting, or returned to the sea. Reporting requirements to document take would improve accountability for documenting take associated with the Proposed Action. In some cases, these RPMs and Terms and Conditions provide additional detail or clarification of measures that are included as part of the Proposed Action. Implementation of these RPMs and Terms and Conditions would provide incremental reductions in impacts on marine mammals and would improve accountability, but would not alter the overall impact determination of the Proposed Action.

DOI = Department of the Interior; GARFO = Greater Atlantic Regional Fisheries Office; ITA = incidental take authorization; km/hr = kilometers per hour; LOA = Letter of Authorization; m = meters; PAM = passive acoustic monitoring; PDC = project design criteria; PSO = protected species observer; RPM = Reasonable and Prudent Measure

Table 3.15-20 Additional Proposed Measures (Also Identified in Appendix H, Table H-3): Marine Mammals

Measure	Description	Effect
Vessel speed restrictions	A separate measure would stipulate that all vessels, regardless of size, would comply with a 10-knot speed restriction in any SMA, DMA, or Slow Zone.	Ocean Wind has committed to implementing vessel speed restrictions, including requirements that all vessels 65 feet or longer comply with a 10-knot speed restriction in any SMA during NARW migratory and calving periods and that vessels of all sizes would operate port to port (from ports in New Jersey, New York, Maryland, Delaware, and Virginia), within the offshore wind area, and in DMAs at 10 knots or less (Table H-1). Agency-proposed mitigation regarding vessel speed restrictions would further stipulate that all vessels regardless of size would comply with a 10-knot speed restriction in any SMA, DMA, or Slow Zone. While adoption of this measure would reduce risk to marine mammals under the Proposed Action, it would not alter the impact determinations for vessel traffic that would be minor for pinnipeds and odontocetes, minor to moderate for non-listed mysticetes, and moderate to major for NARW, given due to the current status of this ESA species a single loss of an individual would have major impacts to the population.

DMA = Dynamic Management Area; SMA = Seasonal Management Area

3.15.9.1. Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.15-19 and Table H-2 in Appendix H, *Mitigation and Monitoring*, are incorporated in the Preferred Alternative. BOEM has identified the following additional measures in Table 3.15-20 as incorporated in the Preferred Alternative: vessel speed restrictions. These measures, if adopted, would further define how the effectiveness and enforcement of APMs would be ensured and improve accountability for compliance with APMs by requiring the submittal of plans for approval by the enforcing agency(ies) and by defining reporting requirements. Because these measures ensure the effectiveness of and compliance with APMs that are already analyzed as part of the Proposed Action, implementation of these measures would not further reduce the impact level of the Proposed Action from what is described in Section 3.15.2, *Environmental Consequences*. Agency-proposed measures related to vessel speed restrictions would expand upon Ocean Wind's APMs to require that all vessels regardless of size would comply with a 10-

knot speed restriction in any Seasonal Management Area, Dynamic Management Area, or Slow Zone. While adoption of this measure would reduce risk to marine mammals under the Proposed Action, it would not alter the impact determinations for vessel traffic that would be minor for pinnipeds and odontocetes, minor to moderate for non-listed mysticetes, and moderate to major for NARW.

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3.16. Navigation and Vessel Traffic

This section discusses navigation and vessel traffic characteristics and potential impacts on waterways and water approaches from the proposed Project, alternatives, and ongoing and planned activities in the navigation and vessel traffic geographic analysis area. The navigation and vessel traffic geographic analysis area, as shown on Figure 3.16-1, includes coastal and marine waters within a 10-mile (16.1-kilometer) buffer of the Offshore Project area and adjacent Lease Areas OCS-A 0499, OCS-A 0532, and OCS-A 0549, as well as waterways leading to ports that may be used by the Project. These areas encompass locations where BOEM anticipates direct and indirect impacts associated with Project construction, O&M, and conceptual decommissioning. Information presented in this section draws primarily upon the NSRA[1] (COP Volume III, Appendix M; Ocean Wind 2023), which was conducted per the guidelines in USCG *Navigation and Vessel Inspection Circular 01-19* (USCG 2019).

Marine risk modeling was used to estimate the increase in the number of accidents that could occur because of the Project. One year of AIS data was the primary marine traffic input into the model. The quantified assessment of the navigation risk for the Project according to the NSRA concludes that the risk increase due to the Project lies within the Project area and between the Project area and the coast. In this assessment, the modeled risk increase is 0.40 accident per year, 72 percent of which are groundings, primarily of pleasure vessels. The NSRA did not identify any major areas of concern regarding the impact on marine navigation. Additional information about the NSRA is in Section 3.16.5. Details about the NSRA development and conformance with USCG guidelines for key areas of inquiry such as vessel traffic and assessment of navigation within or close to Project structures is in Appendix F of the NSRA.

3.16.1 Description of the Affected Environment for Navigation and Vessel Traffic

Regional Setting

Proposed Project facilities would be approximately 13 nm (24 kilometers) southeast of Atlantic City, New Jersey under a Commercial Lease for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0498). The entrance to Delaware Bay is approximately 25 nm (46 kilometers) southeast of the Lease Area, marked by a line drawn between Cape May Light and Harbor of Refuge Light. Figure 3.16-1 shows the location of the Lease Area and the waterways leading to ports that may be used by the Project. Figure 2-3 in the NSRA presents regional vessel traffic in the vicinity of the Lease Area (COP Volume III, Appendix M, NSRA; Ocean Wind 2023).

There are several routing measures[2] that regulate vessel traffic to help ships avoid navigational hazards in the vicinity of the Lease Area. Vessel traffic in and out of Delaware Bay is regulated by a Traffic

[1] The NSRA analyzed vessel traffic within a Marine Traffic Study Area, which is inclusive of the Lease Area, the remainder of the Lease Area, and offshore waters for more than 40 nm (74 kilometers) in any direction. The study area considers current traffic patterns, density, and vessel numbers as well as anticipated changes in traffic from the Project within the areas between the ports, to and from the Offshore Project area, and inclusive of the Offshore Project area. The navigation and vessel traffic geographic analysis area is generally consistent with the Marine Traffic Study Area but also includes more distant ports that may be used by the Project. Where this EIS references vessel data and risk analysis from the NSRA, they are specific to the geographic scope of the Marine Traffic Study Area.

[2] The term *routing* measure originates from the International Maritime Organization. The International Convention for the Safety of Life at Sea, Chapter V, recognizes the International Maritime Organization as the only international body for establishing routing measures (https://www.imo.org/en/OurWork/Safety/Pages/ShipsRouteing.aspx). USCG submits and obtains approval for routing measures within U.S. navigable waters to the International Maritime Organization. Areas to Be Avoided, Inshore Traffic Zones, No Anchoring Areas, Precautionary Areas, Roundabouts, and Traffic Separation Schemes are all routing measures (USCG 2020a, Appendix B).

Separation Scheme (TSS), which is 15 nm from the Lease Area (Figure 3.16-2). The TSS within the approach to Delaware Bay consists of four parts: an Eastern Approach, a Southwestern Approach, a Two-Way Traffic Route, and a Precautionary Area (33 CFR 167.170). The Inbound Five Fathom Bank to Cape Henlopen Traffic Lane, the Eastern Approach of the TSS, is 18 nm (33 kilometers) to the south of the Lease Area and is primarily a shipping route for deep-draft vessels. The Two-Way Traffic Route (15 nm, 28 kilometers from the Lease Area) is used primarily by tug and barge vessels entering and exiting Delaware Bay (COP Volume III, Appendix M, NSRA, Table 2-4; Ocean Wind 2023).

Farther to the north of the Lease Area (approximately 40 nm [74 kilometers]) is a TSS that regulates vessel traffic in the approach to New York Harbor (NOAA 2023:349). There is a speed-restricted area for NARW seasonal management 14 nm (26 kilometers) from the Lease Area (50 CFR 224.105).

Figure 3.16-2 shows vessel traffic in the vicinity of the Lease Area based on AIS data and nearby routing measures (traffic separation zones, precautionary areas).

Commercial fishing vessel traffic using 2014–2019 VMS data is further described in Section 3.9. A polar histogram (Figure 3.9-3), developed by BOEM using VMS data, shows that 377 VMS-enabled commercial fishing vessels (Figure 3.9-3) use the lease area with a predominant orientation of travel from the southwest to the northeast and a secondary operating pattern of northwest to southeast.

The primary traffic patterns in the Lease Area are in the north-northeast/south-southwest and northwest/ southeast directions (COP Volume II, Section 2.3.6.1, p. 342; Ocean Wind 2023). Traffic patterns, traffic density, and statistics were developed from 1 year of AIS data for the period from March 1, 2019, through February 29, 2020; data from the Mid-Atlantic Ocean Data Portal (MARCO 2020) for commercial fishing transits; and ongoing dialogue with organizations representing or serving different types of waterborne traffic in the area (such as recreational boating, fishing, and towing industry organizations and pilot organizations). These data and information were analyzed in the NSRA for the Proposed Action. Subsequent to the preparation of the NSRA, USCG published the Draft *Port Access Route Study: Seacoast of New Jersey Including Offshore Approaches to the Delaware Bay, Delaware* (USCG 2021a). Using 3 years (January 1, 2017, to December 31, 2019) of traffic data, this analysis offers an in-depth look at the traffic patterns and traffic composition along the New Jersey seacoast from year to year. The Port Access Route Study was finalized in March 2022 and is available through USCG docket number USCG 2020-0172 (USCG 2022a).

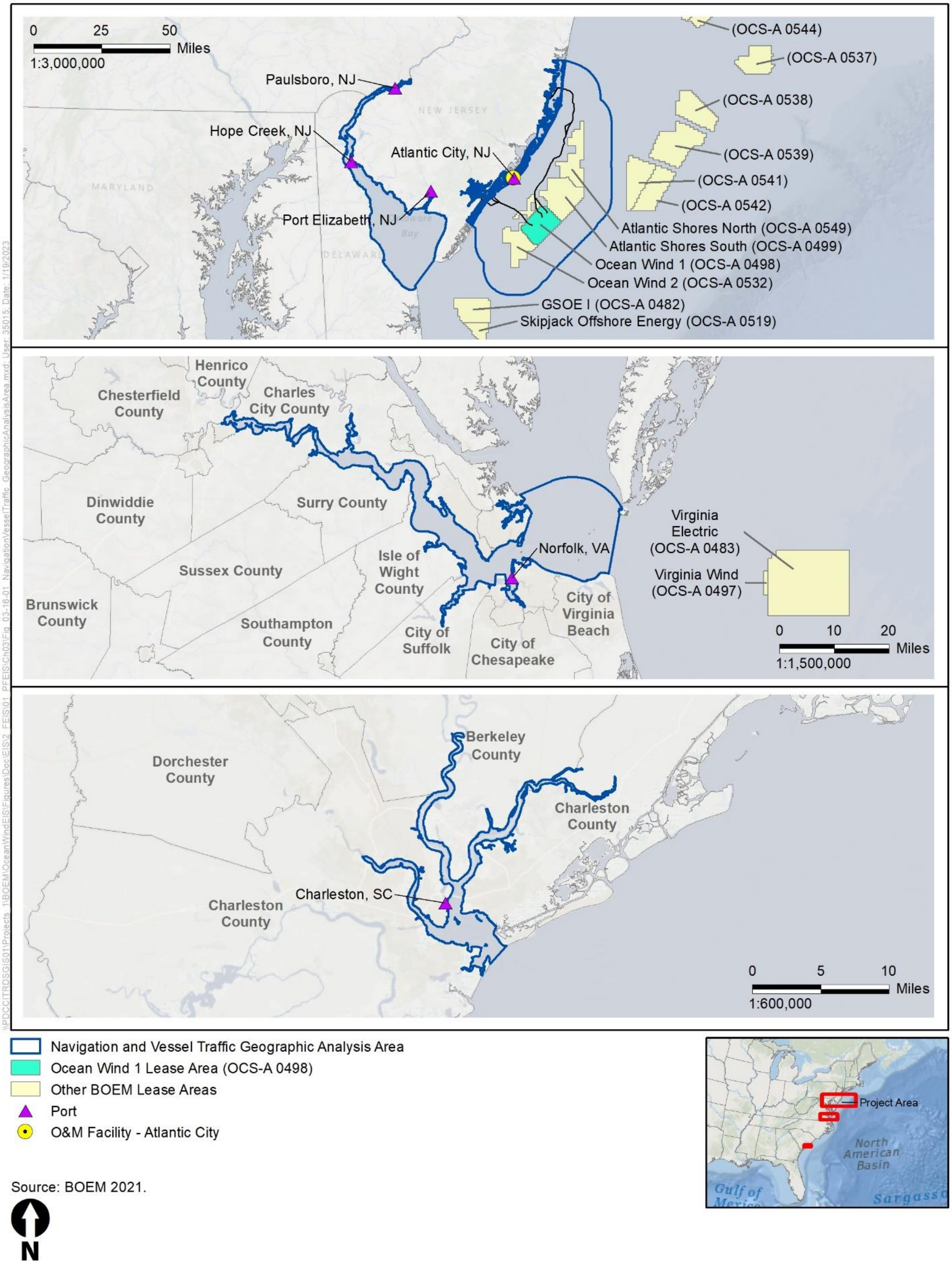
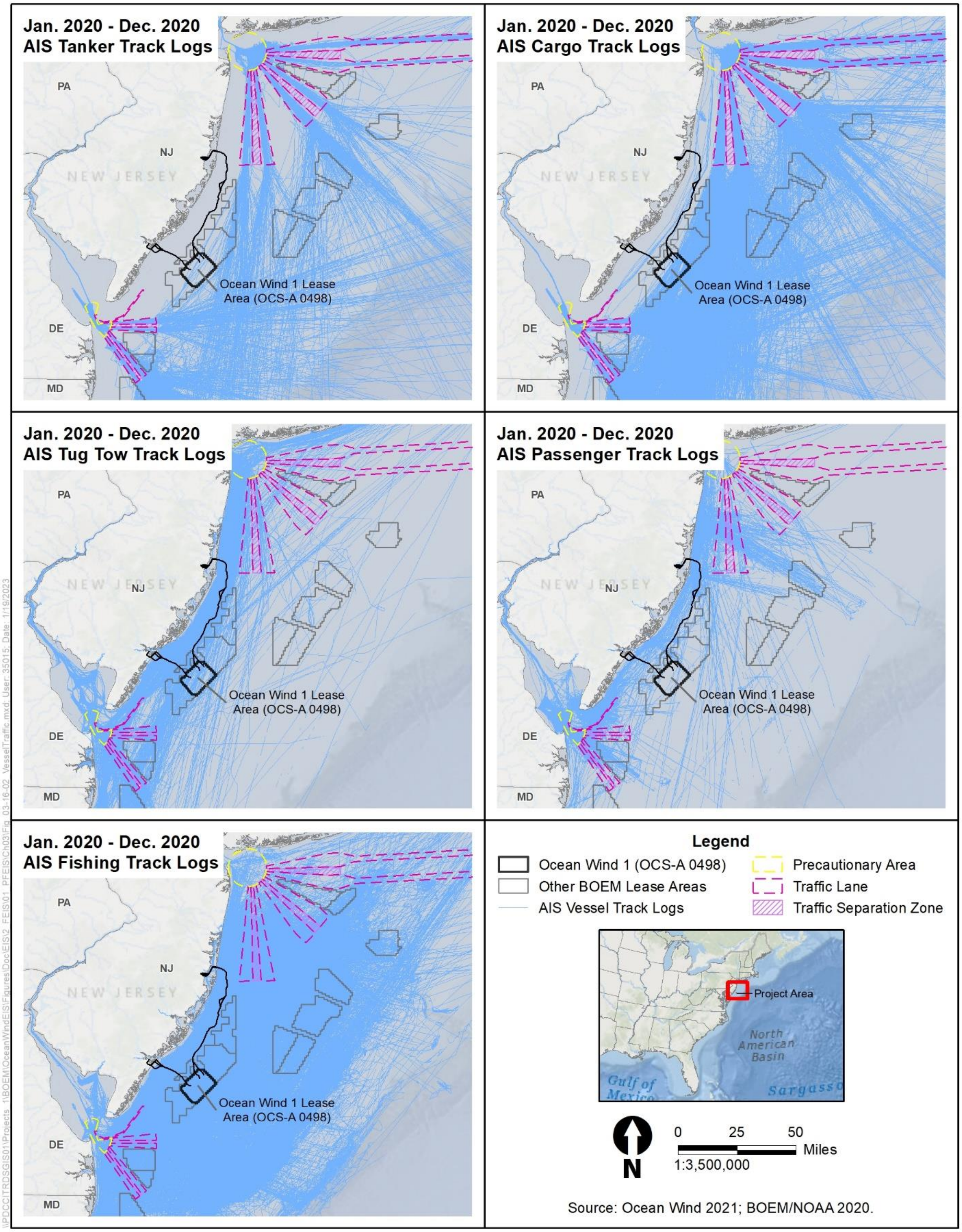


Figure 3.16-1 Navigation and Vessel Traffic Geographic Analysis Area



Note: AIS track counts for fishing and pleasure vessels underrepresent these vessel types, as not all of these vessel types are required to have AIS on board per USCG regulations.

Figure 3.16-2 Vessel Traffic in the Vicinity of the Lease Area

In June 2020 (USCG 2020a), USCG sought comments regarding the possible establishment of shipping safety fairways ("fairways") along the Atlantic Coast identified in the *Atlantic Coast Port Access Route Study* (USCG 2016) and related port access route studies such as the *Port Access Route Study: Seacoast of New Jersey Including Offshore Approaches to the Delaware Bay, Delaware* (draft, USCG 2021a; final, USCG 2022a).[3] Figure 2.3.6-4 (p. 347) in the COP, Volume II (Ocean Wind 2023), shows these fairways, which avoid the Ocean Wind 1 Lease Area OCS-A 0498 and a significant portion of the offshore wind lease areas OCS-A 0532, OCS-A 0499, and OCS-A 0549. On April 5, 2017, USCG announced the completion of the *Atlantic Coast Port Access Route Study*. The *Atlantic Coast Port Access Route Study* analyzed predominantly north/south vessel transit routes along the Atlantic Coast. USCG announced new studies focused on port approaches and international entry and departure areas along the Atlantic Coast to supplement the *Atlantic Coast Port Access Route Study* on March 15, 2019. While these supplemental PARS were ongoing, USCG published the Advanced Notice of Proposed Rulemaking on June 19, 2020. On September 9, 2022, USCG published on the federal notice (87 *Federal Register* 55449) the availability of the *Consolidated Port Approaches and International Entry and Departure Transit Areas Port Access Route Studies*. The *Consolidated Port Approaches and International Entry and Departure Transit Areas Port Access Route Studies* summarizes the findings of four regional port access route studies, two of which provide approved recommendations and alternatives. These approved recommendations and alternatives will be included in a subsequent rulemaking proposal.

Existing lease areas (Garden State, Skipjack, and Empire) and recent lease sales (New York Bight Lease Areas: Mid-Atlantic, Ocean Winds East, Attentive Energy, Bight Wind Holdings, Atlantic Shores, and Invenergy), although outside of the navigation and vessel traffic geographic analysis area, could contribute to increased vessel traffic within the navigable waterways and approaches to New Jersey ports within the geographic analysis area (i.e., Paulsboro, Hope Creek, Port Elizabeth, and Atlantic City).

Lease Area

Vessel Traffic

Table 3.16-1 summarizes the distribution (represented by vessel tracks), type of vessel, average length, average width (beam), and average deadweight tonnage of vessels recorded within 5 miles (8 kilometers) of the Lease Area from March 1, 2019, through February 29, 2020.

The NSRA reported data on vessels using AIS, which is only required on commercial vessels with a length of 65 feet (19.8 meters) or longer. As shown in Table 3.16-1, some smaller recreational and fishing vessels carry AIS; however, the NSRA data likely exclude most vessels less than 65 feet (19.8 meters) long that traverse the Lease Area (COP Volume III, Appendix M, NSRA, pp. 8–9; Ocean Wind 2023). Therefore, AIS tracks for fishing and pleasure vessels in Table 3.16-1 are underrepresented. Section 3.9 discusses commercial fisheries and for-hire recreational fishing and Section 3.18 discusses recreation and tourism. "Other/undefined" vessel types include research, military, law enforcement, and unspecified vessels (COP Volume III, Appendix M, NSRA, Section 2.1.1.6, p. 37; Ocean Wind 2023).

[3] Although the *Port Access Route Study: Seacoast of New Jersey Including Offshore Approaches to the Delaware Bay, Delaware*, Final Report was released to the public in March 2022, the study began in May 2020 and, along with other port access route studies under development for ports along the Atlantic Coast, informed the recommendations within the *Atlantic Coast Port Access Route Study*. This analysis and preparation of recommendations for proposed Atlantic Coast Routing Measures continues with the *Consolidated Port Approaches and International Entry and Departure Transit Areas Port Access Route Studies* described in this same paragraph.

Table 3.16-1 Vessels within 5 Miles (8 Kilometers) of Lease Area[1]

Vessel Type	Count of AIS Tracks	Average Length	Average Width (Beam)	Average Dead-weight Tonnage
Cruise Ships and Large Ferries	33	968 ft (295 m)	132 ft (40 m)	9,141 metric tons
Cargo/Carrier	639	789 ft (241 m)	113 ft (34 m)	51,138 metric tons
Tanker/Tanker-Oil	65	573 ft (175 m)	94 ft (29 m)	38,589 metric tons
Other/Undefined	2,169	205 ft (63 m)	43 ft (13 m)	1,033 metric tons
Tug	324	123 ft (38 m)	37 ft (11 m)	495 metric tons
Tug with Towline	8	121 ft (37 m)	37 ft (11 m)	538 metric tons
Fishing	901	102 ft (31 m)	29 ft (9 m)	Insufficient data
Pleasure	262	69 ft (21 m)	18 ft (6 m)	154 metric tons

Source: Table 2-2, NSRA, Ocean Wind 2023 citing MarineTraffic 2020
[1] AIS track counts for fishing and pleasure vessels underrepresent these vessel types, as not all of these vessel types are required to have AIS on board per USCG regulations.
ft = feet; m = meters

The NSRA analyzed vessel traffic activity as transit counts per transect (COP Volume III, Appendix M, NSRA, pp. 40–45; Ocean Wind 2023). Transect locations were selected to evaluate the areas of heaviest vessel traffic in the vicinity of the Lease Area. Only three transects have more than 10 transits per day, according to the AIS data (3,650 transits per year):

- The entrance to Delaware Bay with an average of about 18 transits per day
- Barnegat Inlet with an average of 16 transits per day
- The eastern end of Delaware Bay with an average of 11 transits per day

The coastal traffic west of the Lease Area is predominantly tug transits,[4] while the coastal traffic farther south is predominantly pleasure and fishing vessels (COP Volume III, Appendix M, NSRA, p. 41; Ocean Wind 2023). Some deep-draft vessel traffic (cruise ships, cargo and carrier ships, and tankers) occurs within the Lease Area but most of the deep-draft vessels in the vicinity of the Lease Area pass to the east (COP Volume III, Appendix M, NSRA, p. 12; Ocean Wind 2023).[5] No ferry routes are identified within the Lease Area. The closest ferry route (Cape May to Lewes) is 29 nm (54 kilometers) from the Lease Area (COP Volume III, Appendix M, NSRA, p. 65; Ocean Wind 2023). Additional information and datasets, tables, and figures related to vessel traffic can be found in COP Volume II, Section 2.3.6, and COP Volume III, Appendix M, NSRA (Ocean Wind 2023).

Aids to Navigation

The closest federal aid to navigation is Avalon Shoal Lighted Buoy 2, which is 9.1 nm (17 kilometers) from the Project. There is one private buoy (PATON) within the Lease Area and another 3.8 nm from the Lease Area. USCG administers the permits for PATONs on structures positioned in or near navigable waters of the United States.

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[4] Less than 1 percent of the tracks are from tugs self-identified as “Pusher tug.” Tug data include tug-with-tow, Articulated Tug Barges, and Integrated Tug/Barges (COP Volume III, Appendix M, NSRA p. 35; Ocean Wind 2023).
[5] AIS data for March 2019 to February 2020 (Ocean Wind 2023 citing MarineTraffic 2020) show that about five transits per day enter the Wind Farm Area, 1,632 per year in total, including some minor double-counting (COP, Volume II, p. 344; Ocean Wind 2023).

Ports, Harbors, and Navigation Channels

The major navigable waterway within the analysis area is Delaware Bay and River. Delaware Bay and River offer access to several ports of call (such as Wilmington, Philadelphia, and Trenton) for large commercial deep-draft ships and tug/barge units as well as smaller commercial and non-commercial shallower-draft vessels. Most of the traffic to or from other ocean access ports in the vicinity of the Lease Area consists of transits of fishing and pleasure vessels (COP Volume III, Appendix M, NSRA, p. 42; Ocean Wind 2023). North of the Lease Area is the outer portion of the approach to New York Harbor, Ambrose Channel, and the AIS data show a large distribution of deep-draft ships within this passage. Although most of the deep-draft vessels in the vicinity of the Lease Area pass to the east, a fraction of them pass through the Lease Area while transiting between the Ambrose to Barnegat Traffic Lane and the Five Fathom Bank to Cape Henlopen Traffic Lane (COP Volume III, Appendix M, NSRA, p. 12; Ocean Wind 2023). Other ports within the geographic analysis area include Atlantic City, Paulsboro, Hope Creek, and Port Elizabeth, New Jersey; Norfolk, Virginia; and Charleston, South Carolina (COP Volume I, Section 4.1.1, p. 53; Ocean Wind 2023).

The NSRA analyzed vessel incidents using AIS data from March 1, 2019, through February 29, 2020, plus additional transits for commercial fishing vessels[6] (COP Volume III, Appendix M, NSRA, pp. E-20–E-21; Ocean Wind 2023). Accident frequencies in the Lease Area for allision and grounding are zero (currently, there are no wind turbines and no grounding locations in the Lease Area that present a risk for allisions and groundings). The accident frequency for collisions in the Lease Area is 0.0004, or four accidents in 10,000 years; the vessel types that contributed to collisions are cargo, fishing, and pleasure. The accident frequency for other ship types, including tug, tug-with-tow, passenger, and tanker, is zero. Over an 11-year period (2008 through 2018), USCG executed five missions in the Lease Area, all of which were search and rescue (SAR) missions (COP Volume III, Appendix M, NSRA, p. 148; Ocean Wind 2023).

3.16.2 Environmental Consequences

3.16.2.1. Impact Level Definitions for Navigation and Vessel Traffic

Definitions of impact levels are provided in Table 3.16-2. There are no beneficial impacts on navigation and vessel traffic.

Table 3.16-2 Impact Level Definitions for Navigation and Vessel Traffic

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
Minor	Adverse	Impacts would be avoided. Normal or routine functions associated with vessel navigation would not be disrupted.
Moderate	Adverse	Impacts would be unavoidable. Vessel traffic would have to adjust somewhat to account for disruptions due to impacts of the Project.
Major	Adverse	Vessel traffic would experience unavoidable disruptions to a degree beyond what is normally acceptable, including potential loss of vessels and life.

[6] To account for commercial fishing vessel activity not fully captured in the AIS data, 344 additional commercial fishing vessel transits from ports to or through the Lease Area and 344 return trips were included in the base case for modeling (COP Volume III, Appendix M, NSRA, p. 15 and Section E.2.5; Ocean Wind 2023).

3.16.3 Impacts of the No Action Alternative on Navigation and Vessel Traffic

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on navigation and vessel traffic, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for navigation and vessel traffic. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.16.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for navigation and vessel traffic described in Section 3.16.1, *Description of the Affected Environment for Navigation and Vessel Traffic*, would continue to follow regional current trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities.

There are no ongoing offshore wind activities within the geographic analysis area for navigation and vessel traffic.

Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on navigation and vessel traffic are generally associated with marine transportation, military use, NMFS activities and scientific research, and fisheries use and management. Impacts from these activities increase vessel traffic in the area, adding to congestion in waterways and increasing the potential for maritime accidents. Impacts associated with global climate change have the potential to require modifications to existing port infrastructure and aids to navigation, with the former adding to port congestion and limited berths during construction activities.

3.16.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities that may affect navigation and vessel traffic in the geographic analysis area include port improvement projects, dredging projects, and installation of new structures on the OCS (see Section F.2 in Appendix F for a description of ongoing and planned activities). These activities may result in a moderate increase in port maintenance activities, port upgrades to accommodate larger deep-draft vessels, and temporary increases in vessel traffic for offshore cable emplacement and maintenance. Planned offshore wind projects include Ocean Wind 2, Atlantic Shores South, and Atlantic Shores North. In addition, USCG is planning to establish shipping safety fairways or other vessel-routing measures along the Atlantic Coast of the United States as referenced in Section 3.16.1. The purpose of the fairways is to protect maritime commerce and safe navigation amidst the non-offshore wind activities described in this section. See Table F1-14 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for navigation and vessel traffic.

BOEM expects planned offshore wind activities to affect navigation and vessel traffic through the following primary IPFs.

Anchoring: Offshore wind developers are expected to coordinate with the maritime community and USCG to avoid laying export cables through any traditional or designated lightering/anchorage areas, meaning that any risk for deep-draft vessels would come from anchoring in an emergency scenario, specifically near the Delaware Bay TSS or in the approach to New York Harbor. Generally, larger vessels accidentally dropping anchor on top of an export cable (buried or mattress protected) to prevent drifting in the event of vessel power failure would result in damage to the export cable, damage to the vessel anchor or anchor chain, and risks associated with an anchor contacting an electrified cable (see the *Anchoring* IPF in Section 3.16.5 for additional information).

Smaller commercial or recreational vessels anchoring in the offshore wind lease areas may have issues with anchors failing to hold near foundations and any scour protection. Considering the small size of the geographic analysis area compared to the remaining area of open ocean, as well as the low likelihood that any anchoring risk would occur in an emergency scenario, it is unlikely that offshore wind activities would affect vessel-anchoring activities. Impacts on navigation and vessel traffic would likely be minor because impacts would be temporary and localized, and navigation and vessel traffic would be expected to fully recover following the disturbance.

Port utilization: As described in Appendix F, Section F.2.13, offshore wind development would support planned expansions and modifications at ports in the geographic analysis area for navigation and vessel traffic, including the ports of Hope Creek and Paulsboro, New Jersey and Norfolk, Virginia. Simultaneous construction or decommissioning (and, to a lesser degree, operation) activities for multiple offshore wind projects in the geographic analysis area could stress port capacity and resources and could concentrate vessel traffic in port areas. Such concentrated activities could lead to increased risk of allision, collision, and vessel delay.

Under the No Action Alternative, three offshore wind projects in the analysis area, Ocean Wind 2, Atlantic Shores South, and Atlantic Shores North, would generate vessel traffic during construction. Only one of these projects, Atlantic Shores South, has a published COP with estimated vessel trip numbers. The Atlantic Shores South project may generate a maximum of 51 vessels at any given time during construction (Atlantic Shores 2021). For the other two projects, BOEM assumed vessel traffic would be similar to that of the Proposed Action: between 20 and 65 vessels operating simultaneously during construction, depending upon the activity (COP, Volume I, Section 6.1, pp. 110–111 and 115–117; Ocean Wind 2023). Atlantic Shores South is estimated to be under construction between 2025 and 2027, and Ocean Wind 2 and Atlantic Shores North are estimated to be under construction between 2026 and 2030. In 2026–2027, when all three projects would be under construction at the same time, a maximum of 181 vessels could be operating simultaneously.

The increase in port utilization due to this vessel activity would vary across ports and would depend on the specific port or ports supporting each offshore wind project. It is unlikely that all projects would use the same ports; therefore, the total increase in vessel traffic would be distributed across multiple ports in the region. Port utilization in the geographic analysis area would occur primarily during construction. As discussed in Section 3.11, offshore wind construction activities may result in competition for scarce berthing space and port services, potentially causing short- to medium-term adverse impacts on commercial shipping. During peak activity, impacts on port utilization would be moderate, short term, and continuous at the ports and their maritime approaches.

After offshore wind projects are constructed, related port utilization would decrease. During operations, project-related port utilization would have minor, long-term, intermittent, localized impacts on overall vessel traffic and navigation. Port utilization would increase again during decommissioning at the end of the operating period of each project, which BOEM anticipates to be approximately 35 years, with magnitudes and impacts similar to those described for construction.

Presence of structures: Under the No Action Alternative, approximately 468 WTGs and 15 OSS would be constructed in the geographic analysis area. Structures in this area would pose navigational hazards to vessels transiting within and around areas leased for offshore wind projects. Offshore wind projects would increase navigational complexity and ocean space use conflicts, including the presence of WTG and OSS structures in areas where no such structures currently exist, potential compression of vessel traffic both outside and within offshore wind lease areas, and potential difficulty seeing other vessels due to a cluttered view field. Another potential impact of offshore wind structures is interference with marine vessel radars. USCG noted in its final *Areas Offshore of Massachusetts and Rhode Island Port Access Route Study* (USCG 2020b) that various factors play a role in potential marine radar interference by offshore wind infrastructure, stating that "the potential for interference with marine radar is site specific and depends on many factors including, but not limited to, turbine size, array layouts, number of turbines, construction material(s), and the vessel types." In the event of radar interference, other navigational tools are available to ship captains. See the *Presence of Structures* IPF in Section 3.16.5 for additional information drawn from *Wind Turbine Generator Impacts to Marine Vessel Radar* (National Academies of Science 2022).

The fish aggregation and reef effects of offshore wind structures would also provide new opportunities for recreational fishing. The additional recreational vessel activity focused on aggregation and reef effects would incrementally increase vessel congestion and the risk of allision, collision, and spills near WTGs. Overall, the impacts of this IPF on navigation and vessel traffic would be moderate, long term (as long as structures remain, approximately 35 years), regional (throughout the entire geographic analysis area for navigation and vessel traffic), and continuous.

Cable emplacement and maintenance: Based on the assumptions in Table F2-2 in Appendix F, the 483 foundations (468 WTGs and 15 OSS) would require about 1,567 miles (2,510.6 kilometers) of inter-array and offshore export cables. Emplacement and maintenance of cables for these offshore wind projects would generate vessel traffic and would specifically add slower-moving vessel traffic above cable routes. Vessels not involved in cable emplacement or maintenance would need to take additional care when crossing cable routes during installation and maintenance activities. BOEM anticipates that there would likely be simultaneous cable-laying activities from multiple projects based on the estimated construction timeline. While simultaneous cable-laying activities may disrupt vessel traffic over a larger area than if activities occurred sequentially, the total time of disruption would be less than if each project were to conduct cable-laying activities sequentially. The impacts of this IPF on vessel traffic and navigation under the No Action Alternative would be minor to moderate because impacts would be short term, localized, and most disruptive during peak construction activity of the offshore wind projects from 2026 through 2027.

Traffic: Offshore wind projects would generate vessel traffic during construction, operation, and decommissioning within the navigation and vessel traffic geographic analysis area. Other vessel traffic in the region (e.g., from commercial fishing, for-hire and individual recreational use, shipping activities, military uses) would overlap with offshore wind-related vessel activity in the open ocean and near ports supporting the offshore wind projects. BOEM anticipates that the total increase in vessel traffic would be distributed across multiple ports in the region.

As shown in Table F2-1 in Appendix F, the increase in vessel traffic and navigation risk due to offshore wind projects would be at its peak in 2026 to 2027, when 468 WTGs and 15 OSS associated with three offshore wind projects other than the Proposed Action (Ocean Wind 2, Atlantic Shores South, and Atlantic Shores North) would be under simultaneous construction. During this peak construction period for the three planned offshore wind projects, a maximum of 181 vessels could be operating simultaneously in the geographic analysis area at any given time. The presence of offshore wind project vessels would add to the Atlantic Coast vessel traffic levels as each offshore wind farm area is developed, leading to increased congestion and navigational complexity, which could result in crew fatigue, damage to vessels, injuries to crews, engagement of USCG SAR, and vessel fuel spills. Increased offshore wind-related vessel traffic during construction would have moderate, short-term, constant, localized impacts on overall (wind and non-wind) vessel traffic and navigation.

After offshore wind projects are constructed, related vessel activity would decrease. Vessel activity related to the operation of offshore wind facilities would consist of scheduled inspection and maintenance activities with corrective maintenance as needed. As noted above under *Port Utilization*, only the Atlantic Shores South project in the geographic analysis area has a published COP with estimated vessel numbers. The Atlantic Shores South project would have up to 11 vessels in operation at any given time during normal O&M activities (Atlantic Shores 2021). For Ocean Wind 2 and Atlantic Shores North, BOEM assumed operations-related vessel traffic would be the same as the Proposed Action estimates of 10 vessels per day. Combined, the three offshore wind projects in the geographic analysis area would generate 31 vessels at any given time during normal O&M. During operations, project-related vessel traffic would have minor, long-term, intermittent, localized impacts on overall vessel traffic and navigation. Vessel activity would increase again during decommissioning at the end of the operating period of each project, which BOEM anticipates to be approximately 35 years, with magnitudes and impacts similar to those described for construction.

3.16.3.3. Conclusions

Impacts of the No Action Alternative. BOEM expects ongoing activities, including other offshore wind activities, to have continuing short- and long-term impacts on navigation and vessel traffic, primarily through the presence of structures, port utilization, and vessel traffic. BOEM anticipates that the impacts of ongoing activities, especially port utilization and vessel traffic, would be moderate. The No Action Alternative would result in **moderate** impacts on navigation and vessel traffic.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and activities would continue, and navigation and vessel traffic would continue to be affected by natural and human-caused IPFs. Planned activities other than offshore wind such as oil and gas activities, dredging projects, offshore cable emplacement and maintenance, and onshore development activities would contribute to impacts on navigation and vessel traffic. BOEM anticipates that the impacts of planned activities other than offshore wind would be minor because while impacts would be measurable, they would not disrupt navigation and vessel traffic. Other offshore wind projects would increase vessel activity, which could lead to congestion at affected ports, the possible need for port upgrades beyond those currently envisioned, and an increased likelihood of collisions and allisions, with resultant increased risk of accidental releases. In addition, the offshore wind projects other than the Proposed Action would lead to the construction of approximately 468 WTGs and 14 OSS in areas where no such structures currently exist, also increasing the risk for collisions, allisions, and resultant accidental releases and threats to human health and safety. While non-routine events such as collisions and allisions (and resulting spills or personal injury) have the potential to occur during construction, O&M, and decommissioning of offshore wind projects, BOEM anticipates that these events would be unlikely to occur given requirements for lighting and marking, vessel speed restrictions, and inclusion of project components on navigation charts as outlined in Section 2.2. BOEM expects other offshore wind projects to result in long-term, regional, and moderate impact on navigation and vessel traffic. BOEM anticipates that cumulative impacts of the No Action Alternative in the geographic analysis area would be **moderate** primarily due to the presence of structures.

3.16.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternative

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on navigation and vessel traffic characteristics:

- The Project layout including the number, type, and placement of the WTGs and OSS including the location, width, and orientation of the Wind Farm Area rows and columns;
- The number of vessels utilized for construction and installation;
- The offshore electric cable corridor routes/locations;
- Time of year of construction;
- Ports selected to support construction and installation; and
- Ports selected to support O&M.

Variability of the proposed Project design within the PDE that could affect navigation and vessel traffic includes the number of vessels that would be used during construction; the ports used to support Project construction, installation, and decommissioning; the exact placement and number of WTGs; and the construction schedule, as outlined in Appendix E. Variances in these factors could affect vessel traffic and navigation choices. This section has assessed the maximum-case scenario, so variances from this scenario should lead to similar or reduced impacts.

Ocean Wind has committed to measures to minimize impacts on navigation and vessel traffic, such as equipping select structures within the Wind Farm Area with strategically located AIS transponders (NAV-03) and arranging WTGs in equally spaced rows in a northwest to southeast orientation to aid safe navigation (NAV-04) (COP Volume II, Table 1.1-2; Ocean Wind 2023). Ocean Wind is also developing a Navigational Safety and Training program. The program would provide eligible commercial, charter, and for-hire fishing vessels operating in and near the Ocean Wind 1 wind farm with reimbursement for new radar equipment and training courses. Ocean Wind will finance the program and provide grants (vouchers) to eligible applicants to provide navigation equipment including pulse compression radar systems/AIS transceivers and professional training and experiential learning for fishers, which can include a captain course, license upgrade, radar course, or rules-of-the-road refresher. The program would be implemented during the construction phase of the Project. A similar program is being developed for other Ørsted-sponsored projects in New England, which has included strong input from New Jersey fisheries groups. To implement the program specifically focused on Ocean Wind 1, feedback is being sought from stakeholder groups, including the New Jersey Offshore Wind Environmental Resources Working Group, to reach a consensus on the issues of (1) fisheries eligibility, (2) program timing, and (3) program roll-out (including the potential for third-party administrative involvement).

3.16.5 Impacts of the Proposed Action on Navigation and Vessel Traffic

3.16.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.16.8, *Impacts of Alternative E on Navigation and Vessel Traffic*.

Impacts from the Proposed Action alone would include increased vessel traffic in and near the Wind Farm Area and on the approach to ports used by the Proposed Action, as well as obstructions to navigation caused by Proposed Action activities. COP Volume I, Section 6.1, Tables 6.1.2-1 to 6.1.2-5 (Ocean Wind 2023) summarize the anticipated Project-related vessel traffic during Proposed Action construction. Construction vessel trips could originate or terminate at Atlantic City, Paulsboro, Hope Creek, and Port Elizabeth, New Jersey; Norfolk, Virginia; and Charleston, South Carolina.

Anticipated changes in traffic from the Project were estimated to include:

1. Project-related vessel traffic related to construction, O&M, and decommissioning activities
2. Additional non-Project traffic that might be generated by the presence of the wind farm, for example, pleasure vessel trips for sight-seeing or recreational fishing
3. The modification of usual traffic routes for some ship types due to the presence of wind farm structures

Impacts on navigation and vessel traffic would also include changes to navigational patterns and the effectiveness of marine radar and other navigation tools. This could result in delays within or approaching ports, increased navigational complexity, detours to offshore travel or port approaches, or increased risk of incidents such as collision and allision, which could result in personal injury or loss of life from a marine casualty, damage to boats or turbines, and oil spills. Section 3.18 addresses the Proposed Action's impacts on recreation, while Section 3.9 addresses the Proposed Action's impacts on commercial fisheries and for-hire recreational fishing.

The NSRA marine risk analysis modeled the frequency of non-Project vessel accidents that could result from installation of the Proposed Action wind farm structures.[7] The model estimates frequencies for marine accidents accounting for Project- and location-specific environmental, traffic, and operational parameters. Baseline vessel traffic data used in the model are described in Section 3.16.1. Detailed information about the risk analysis is included in COP Volume III, Appendix M, NSRA (Ocean Wind 2023). The risk analysis calculated the frequency of accidents due to the following navigation hazards:

- Collision between two ships underway
- Powered grounding, where a ship grounds due to human error (steering and propulsion not impaired)
- Drift grounding, where a ship strikes the ground line due to mechanical failure (steering or propulsion failed)
- Powered allision, where a ship strikes a human-made structure (e.g., WTG) due to human error (steering and propulsion not impaired)
- Drift allision, where a ship strikes a human-made structure (e.g., WTG) due to mechanical failure (steering or propulsion failed)

Results of the NSRA risk modeling are described below under the IPF headings for *Presence of Structures* and *Traffic*.

Anchoring: The nearest established anchorage is Big Stone Beach Anchorage Ground, 38 nm (70 kilometers) from the Project. USCG has proposed the establishment of three new anchorage areas in the vicinity of the Cape Henlopen to Delaware Traffic Lane to provide additional usable grounds to support port demands and enhance navigational safety in the area (84 *Federal Register* 65727[8]). If established, proposed anchorage areas notionally referred to as Anchorage B – Breakwater Anchorage and Anchorage C – Cape Henlopen would be slightly closer to the Project area than Big Stone Beach Anchorage Ground. The Project is not anticipated to affect routine vessel anchorage operations within the existing anchorage areas or the additional proposed anchorage grounds (COP Volume III, Appendix M, NSRA, p. 96; Ocean Wind 2023). Smaller vessels anchoring in the Wind Farm Area may have issues with anchors failing to hold near foundations and any associated scour protection, or, alternately, where the anchors may become

[7] Project traffic is not explicitly included in the NSRA risk model; however, it appears to be more than offset in the AIS data by Project-related vessel traffic performing site surveys and other site characterization studies (COP, Volume III, Appendix M, NSRA, p. 72; Ocean Wind 2023).
[8] https://www.govinfo.gov/content/pkg/FR-2019-11-29/pdf/2019-25854.pdf.

snagged and potentially lost. During construction, installation, and decommissioning operations, smaller recreational and fishing vessels would most likely not transit the Wind Farm Area and therefore not anchor within the Project area. Consequently, any potential impacts from smaller vessels anchoring within the Wind Farm Area would primarily occur during the O&M phase. These impacts would be minor, localized, and temporary to short term.

Deviations from “normal” anchorage activities, such as vessels anchoring in an emergency scenario, pose a potential hazard to subsea cables. Depending upon the anchor weight, vessels with a tonnage greater than 10,000 deadweight tonnage would be the most likely to carry anchors that could penetrate to the Project cable burial depth if anchoring in an emergency scenario in the vicinity of the export cable corridor (Sharples 2011:96). However, anchor penetration is dependent upon factors other than ship size and anchor weight such as the type of soil on the seabed and whether the anchor is dragged after the initial drop (Sharples 2011:94–97). If BOEM approves the COP, Ocean Wind would be required to develop a CBRA (refer to COP Volume I, Section 6.1.1.5; Ocean Wind 2023) that will incorporate relevant information including seabed conditions and risks associated with fishing gear and vessel anchors to determine target burial depth.[9]

If sufficient burial depth cannot be achieved, armoring or other cable protection would be used to protect cables from external damage. Cable protection methods may include rock placement, concrete mattresses, frond mattresses, rock bags, and seabed spacers (COP Volume I, pp. 89–96; Ocean Wind 2023).[10] In the event an anchor does make contact with a buried export cable, impacts could include damage to the export cable and potential damage to the vessel anchor or anchor chain. Depending upon the extent of the damage to the export cable, the risks associated with an anchor contacting an electrified cable can pose issues to Project equipment (an overload and shut-down of converter or transformer stations) but is not anticipated to cause electrical shock to the ship involved because seawater is a good conductor of electricity (Sharples 2011:111). If the export cable is damaged to the point of requiring repair, there could be impacts associated with additional vessel activity to conduct damage assessment and repair. Secondary impacts would be repercussions on the vessel operator’s liability and insurance. Combined with the low likelihood that any anchoring risk would occur in an emergency scenario, impacts on navigation and vessel traffic would be minor, localized, and temporary to short term.

Port utilization: The Proposed Action would generate vessel traffic at the Port of Atlantic City, New Jersey (the construction management base) during construction as well as potentially at Norfolk, Virginia; Paulsboro, Hope Creek, and Port Elizabeth, New Jersey; and Port Charleston, South Carolina. An onshore O&M facility in or near Atlantic City, New Jersey (COP, Volume I, p. 117; Ocean Wind 2023) would be used to support O&M activities. The construction phase of the Proposed Action would generate trips by jack-up vessels to provide a stable platform on site. In addition, support vessels such as crew transport vessels, hotel vessels, tugs, and miscellaneous vessels (such as for security) would be used. Vessels would transport components from Europe either directly to the Wind Farm Area or first to a U.S. port for staging before being transported to the Wind Farm Area. For example, monopiles and transition pieces are expected to be manufactured in Europe and transported across the Atlantic Ocean to a U.S. port where their assembly would be completed (COP, Volume I, p. 100; Ocean Wind 2023). The construction phase

[9] According to the historical (2017, 2018, and 2019) vessel traffic patterns presented in the New Jersey Port Access Route Study and tow track logs for the Project analysis (Table 3.16-1), tug traffic has generally followed a coastwise traffic path. This same coastwise pattern is expected to continue during Project operations (COP Volume III, NSRA, pp. E-13 and E-14; Ocean Wind 2023). Therefore, the most likely large commercial vessel to be transiting over proposed export cable corridors would be tugs or tugs with tows.

[10] According to survey participants drawn from the New York state maritime community, marine mattresses are not a desirable cable protection strategy in areas where vessel anchoring could potentially take place because the marine mattress creates an obstruction that vessel anchors could grab onto, potentially causing breaking the anchor cable/ line, damaging the vessel, or damaging the cable (New York Department of State 2020:23).

of the Proposed Action would generate 20 to 65 vessels operating in the Wind Farm Area or over the offshore export cable corridor route at any given time (COP Volume I, Section 6.1.2.6.5; Volume III, NSRA, Section 5; Ocean Wind 2023). In total, the Proposed Action would generate approximately 3,847 vessel trips during the construction and installation phase (COP Volume I, Section 6.1, Tables 6.1.2-1 through 6.1.2-5; Ocean Wind 2023). On average, the Proposed Action would generate approximately 10 vessel trips per day during regular operations. The presence of these vessels could cause delays for non-Proposed Action vessels and could cause some fishing or recreational vessel operators to change routes or use an alternative port. The Proposed Action's impacts on vessel traffic due to port utilization would be moderate, short term, and continuous through construction and installation. During O&M, impacts would be minor, long term, and intermittent. Impacts would increase to moderate for decommissioning, comparable to construction and installation impacts.

Presence of structures: The Proposed Action would include up to 98 WTGs and 3 OSS, operating for approximately 35 years, within the Wind Farm Area where no such structures currently exist. Presently there are no formal routing measures within the proposed Project area that would be altered by the presence of structures (NAV-02, which states that Project facilities will be placed to avoid unreasonable interference with major ports and USCG-designated TSS). Predominant vessel traffic patterns within the Lease Area for commercial fishing vessels (as shown with polar histograms in Section 3.9) and other vessel types, as discussed in Section 3.16.1 (and in greater detail in the NSRA), informed the Proposed Action structure orientation (southeast-northwest). Proposed Action structures would increase the risk of allision as well as collision with other vessels navigating through WTGs and could interfere with marine radars (although other navigational tools are available to ship captains). The increased risk of allisions and collisions would, in turn, increase the risk of spills (refer to Section 3.21, *Water Quality*, for a discussion of the likelihood of spills), vessel foundering, engagement of USCG SAR activities, injuries, and loss of life.

Nearly all vessels that travel through the Wind Farm Area where no structures currently exist would need to navigate with greater caution under the Proposed Action to avoid WTGs and OSS; however, there would be no restrictions on use or navigation in the Wind Farm Area. WTGs with lighting and marking (GEN-07, which cites lighting, marking, and signage requirements to aid navigation) could serve as additional aids to navigation. Many vessels that currently navigate that area would continue to be able to navigate through the Wind Farm Area between the WTGs and OSS. Vessels that exceed a height of 66 feet (20 meters) would be at risk of alliding with WTG blades at mean high water, and would need to navigate around the Wind Farm Area or navigate with caution through the Wind Farm Area to avoid the WTGs, although vessels of this size are unlikely to transit close enough to the WTGs to be affected by the blade sweep (COP Volume III, Appendix M, NSRA, p. 81; Ocean Wind 2023). Tug and tow vessels would also need to make relatively minor deviations farther west to avoid the turbine array (COP Volume III, Appendix M, NSRA, p. E-13; Ocean Wind 2023).

While some non-Project vessel traffic may navigate through the Wind Farm Area, many vessels would most likely choose not to pass through the area during construction (due to the presence of construction-related activities and the emergence of fixed structures), during the life of the Project (due to the presence of fixed structures), and during decommissioning. The NSRA modeled the frequency of marine accidents under the Proposed Action assuming there would be a rerouting of common vessel traffic routes around the Wind Farm Area for cargo, passenger, tankers, and tugs (see COP Volume III, Appendix M, NSRA, Figure E-7, p. E-14 [Ocean Wind 2023]), for an example of how one route was modified). Navigating around the Wind Farm Area would allow these vessels to avoid the navigational risks and delays of transiting through the WTGs and OSS in the Wind Farm Area.

The NSRA assumed that other vessel types, including fishing, pleasure and other vessels, would not reroute around the Wind Farm Area. The primary increase in marine accidents (derived by comparing future-case with base-case vessel traffic conditions) related to the presence of Proposed Action structures for all vessel types would be due to powered allision, resulting in an increase of 0.066 accident per year, and drift allision, resulting in an increase in 0.019 accident per year (COP Volume III, Appendix M, NSRA, Table 11-4, p. 132, and Table E-38, p. E-35; Ocean Wind 2023). The estimated increase in powered allision accident frequency is attributed to those vessel types that would not reroute around the Project (fishing, other, and pleasure). Pleasure ships would dominate the increase in total powered allision frequency. This is largely because the NSRA assumed there would be an increase in the number of recreational and pleasure vessels that would visit the Wind Farm Area under the Proposed Action, such as for sightseeing of the wind farm and recreational fishing, compared to baseline conditions without the Project. Tugs would experience a minor increase in drift allision frequency (COP Volume III, Appendix M, NSRA, Table E-38, p. E-35; Ocean Wind 2023).[11]

Smaller static and mobile gear fishing vessels, like all vessels, would not be prohibited from transiting or fishing within the array; however, vessel operators would need to take the WTGs and OSS into account as they set their courses through the Wind Farm Area and would need to take care when fishing near the WTGs and OSS to avoid snagging fishing equipment on underwater WTG components (COP Volume III, Appendix M, NSRA, Section 2.3.6.1.2; Ocean Wind 2023). Vessels that could continue to navigate within the Wind Farm Area would still need to navigate with more caution than is currently necessary to avoid WTGs and OSS, as well as other vessel traffic, especially during inclement weather. Increased navigational awareness while navigating through WTGs could lead to increased crew fatigue, which could also increase the risk of allision or collision and resultant injury or loss of life.

O&M of the Proposed Action would likely affect marine vessel radar performance near or within the Wind Farm Area. The National Academy of Sciences report titled *Wind Turbine Generator Impacts to Marine Vessel Radar* notes that WTG interference decreases the effectiveness of marine vessel radar mounted on all vessel classes (National Academies of Science 2022:5). Larger vessels may have more experienced bridge personnel; however, there is no requirement, domestic or international, for training to include specifics on WTGs and there is currently no standard system of active radar tailored to a WTG environment (National Academies of Science 2022:21–25, 66). Smaller vessels operating in the vicinity of the Project may experience the same challenges as larger vessels if equipped with marine vessel radar, such as clutter due to the WTGs or ambiguous detections, and may also be harder to identify as distinct targets or become lost contacts by larger vessels while in the proximity of WTGs (National Academies of Science 2022:38–48). The purchase of more sophisticated radar equipment and additional training (GEN-16, which states that equipment upgrades and training will be available for eligible commercial, charter, and for-hire fishing vessels operating in or near the Wind Farm Area) would mitigate this impact. While radar is one of several navigational tools available to vessel captains, including navigational charts, global positioning system, and navigation lights mounted on the WTGs (COP Volume III, Appendix M, NSRA, Section 11.3; Ocean Wind 2023), radar is the main tool used to help locate other nearby vessels that are not otherwise visible, particularly in adverse weather when visibility is limited. The navigational complexity of transiting through the Wind Farm Area, including the potential effects of WTGs and OSS on marine radars, would increase risk of collision with other vessels (including non-Project vessels and Proposed Action vessels).

Furthermore, the presence of the WTGs could complicate offshore SAR operations. USCG SAR activities could be hindered within the Wind Farm Area due to navigational complexity and safety concerns of operating among WTGs. Changing navigational patterns could also concentrate vessels within and around the outsides of the Project area, potentially causing space-use conflicts in these locations or reducing the efficiency of SAR operations, resulting in moderate, adverse impacts on SAR operations. USCG may

[11] The NSRA also modeled a future case (case 3) that was like case 2, but 50 percent of the coastal tugs were modeled as tugs-with-tows. The comparative results were mostly similar to Table E-38 but drift allision results were higher by a factor of 2.2 due to the tug-with-tow analysis (COP Volume III, NSRA, Table E-39, p. E-36; Ocean Wind 2023).

need to adjust its SAR planning and search patterns to accommodate the WTG layout, leading to a less optimized search pattern and a lower probability of success. This could lead to increased loss of life due to maritime incidents (see Section 3.17.5).

When adjacent offshore wind projects share borders, USCG recommends a common WTG spacing and layout across the projects to provide a consistent straight-line orientation through the adjoining areas. A common WTG spacing and layout facilitates predictable navigation patterns, navigational safety, consistent and continuous marking and lighting, SAR, and other uses such as commercial fishing. In the absence of a common spacing and orientation between adjacent wind projects, USCG recommends setbacks from the shared border to create a separation between projects. A change in orientation or spacing without this separation will increase risk for surface and aerial navigation through the wind farms and could make it more difficult for SAR aircraft to perform operations in the geographic analysis area, leading to a less optimized search pattern and a lower probability of success. The space between projects should be greater than the WTG spacing within either wind farm to provide a clear visual reference to easily distinguish separate projects (USCG 2021b).

Unique structure orientation patterns are planned within Atlantic Shores South and the Proposed Action to accommodate different traffic patterns in each lease area and, although BOEM lease agreements for Atlantic Shores South and Ocean Wind 1 do not require setbacks from adjoining borders, the Proposed Action WTG layout does include an agreed-upon separation of a minimum distance of 1,500 meters (0.8 nm) from any WTGs within the adjacent Atlantic Shores South Lease Area. With Ocean Wind 1's adoption of an agreed-upon separation with Atlantic Shores South, impacts on navigation and vessel traffic under the Proposed Action would be reduced from major to moderate.

APM GEN-07 (and NAV-01, continued engagement with FAA and the Department of Defense [DOD] with regard to potential effects on aviation) will implement ADLS on WTGs to mitigate this risk. Nevertheless, this added complexity to SAR operations could lead to increased possibility for loss of life due to maritime incidents. The proposed setback area defining a minimum spacing distance between the Ocean Wind 1 and Atlantic Shores South WTGs will facilitate navigation safety and improve the likelihood of effective SAR operations.

Cable emplacement and maintenance: The Proposed Action would require the installation of offshore export cables and inter-array and substation interconnector cables. The presence of slow-moving (or stationary) installation or maintenance vessels would increase the risk of collisions and spills. Offshore export cable installation activities include site preparation such as sand wave and boulder clearance. In areas where sand waves are present, multiple passes may be required. Vessels engaged in cable emplacement are, by definition, restricted in their ability to maneuver and other power-driven vessels must give way.[12] Cable-laying vessels would display lights at nighttime or day shapes during the daytime to communicate to other vessels that they are restricted in their ability to maneuver. USCG's local notice to mariners may also include information affecting local waterways such as cable emplacement activity. Vessels not involved in cable emplacement or maintenance would need to take additional care when crossing cable routes or avoid installation or maintenance areas entirely during installation and maintenance activities. The presence of installation or maintenance vessels would have minor to moderate, localized, short-term, intermittent impacts on navigation and vessel traffic.

Traffic: Construction of the Proposed Action would generate between 20 and 65 vessels operating in the Wind Farm Area or over the offshore export cable route at any given time (COP Volume I, Section 6.1; Ocean Wind 2023). Various vessel types (scour protection, installation, cable-laying, support, transport/feeder, and crew vessels) would be deployed throughout the Offshore Project area during the construction and installation phase (COP Volume I, Section 6.1, Tables 6.1.2-1 through 6.1-2-5; Ocean

[12] International Regulations for Preventing Collisions at Sea, 1972 (72 COLREGS), rules 3, 18, and 27.

Wind 2023). The presence of these vessels would increase the risk of allisions, collisions, and spills (refer to Section 3.21, *Water Quality*, for a discussion of the likelihood of spills). During offshore export cable route construction, non-Project vessels required to travel a more restricted (narrow) lane could potentially experience greater delays waiting for cable-laying vessels to pass. Proposed Action vessel traffic in ports could result in vessel traffic congestion, limited maneuvering space in navigation channels, and delays in ports and could also increase the risk of collision, allision, and resultant spills in or near ports. Non-Project vessels transiting between the Proposed Action ports and the Wind Farm Area would be able to avoid Proposed Action vessels, components, and any safety zones (where USCG is authorized and elects to establish such zones)[13] through routine adjustments to navigation. The Proposed Action's construction and installation vessel traffic would have moderate, localized, short-term impacts on overall navigation and vessel traffic in open waters and near ports (including but not limited to the Port of Atlantic City, New Jersey).

Operation of the Proposed Action would generate approximately 10 trips per day from ports used for O&M and the Wind Farm Area. Annually, the Proposed Action would generate a maximum of 3,392 total vessel trips consisting of service operation vessels, jack-up, crew, and supply vessel trips, with a majority of the trips consisting of service operation vessels or crew transfer vessels (COP Volume I, Table 6.1.2-11; Ocean Wind 2023). Vessel traffic generated by Proposed Action could restrict maneuvering room and cause delays accessing the port. Although vessel traffic within the Lease Area is expected to decrease once the WTGs and OSS are in place, O&M of the Proposed Action would result in the same types of vessel traffic and navigation impacts as those described during construction (COP, Volume II, Section 2.3.6.2.1, p. 348; Ocean Wind 2023). Operation of the Proposed Action would have minor, long-term, intermittent, and localized impacts on overall navigation and vessel traffic near ports and in open waters.

The NSRA risk modeling suggests that under the Proposed Action, accident frequency would increase by 0.403 accident per year (Table 3.16-3). The greatest increase in accident frequency would be as a result of groundings (a modeled increase of 0.148 powered grounding and 0.144 drift grounding per year) followed by powered allisions (an increase of 0.066 accident per year).[14] The increased risk of vessel grounding is to the northwest of the Project area and not within the Project area whereas the increase in frequency of powered allisions, the striking of a stationary object such as a WTG by a vessel transiting at cruising speed within the WTG array, is identified exclusively within the Project area. Collision frequencies are also anticipated to increase (increase of 0.027 accident per year), which would be largely a result of the 23-percent increase in ship-miles due to vessels transiting around the Project Wind Farm Area and the adjacent Atlantic Shores Wind Farm Lease Areas (OCS-A-0499 and OCS-A-0549). Although the risk of drift allisions may increase slightly (increase of 0.019 accident per year within the Project area) with the Proposed Action, drift allisions are typically of low consequence (COP Volume III, Appendix M, NSRA, p. 89 and Table 11-3, p. 129; Ocean Wind 2023).

Table 3.16-3 NSRA Modeled Change in Accident Frequencies from the Proposed Action

Accident Type	Increase in Frequency (number per year)	Percentage of Total (%)
Powered Grounding	0.148	36.8
Drift Grounding	0.144	35.6
Powered Allision	0.066	16.3
Drift Allision	0.019	4.6

[13] Under the current captain of the Port authority, USCG does not regulate the safety and security risks associated with the construction and operation of Offshore Renewable Energy Installations beyond 12 nm (USCG 2021c).
[14] An assessment within the NSRA focusing on a powered allision accident concludes that it is unlikely that smaller vessels transiting or operating within the Project area would damage a structure to the extent that it may collapse (COP Volume III, Appendix M, NSRA, Section 3.5; Ocean Wind 2023).

Accident Type	Increase in Frequency (number per year)	Percentage of Total (%)
Collision	0.027	6.7
Total	**0.403**	**100**

Source: COP Volume III, Appendix M, NSRA, Table 11-3, p. 129; Ocean Wind 2023

Chapter 2 describes the non-routine activities associated with Proposed Action. Examples of such activities or events that could affect navigation and vessel traffic include non-routine corrective maintenance activities, collisions or allisions between vessels or vessels and WTGs or OSS, cable displacement or damage by anchors or fishing gear, chemical spills or releases, and severe weather and other natural events. These activities, if they were to occur, would generally require intense, temporary activity to address emergency conditions. The occasional increased vessel activity in offshore locations near the offshore export cable route or within the Wind Farm Area working on individual WTGs or OSS could temporarily prevent or deter navigation and vessel traffic near the site of a given non-routine event. In addition, severe weather could temporarily prevent or deter vessel operators from approaching or crossing the Wind Farm Area. Impacts on navigation and vessel traffic would be temporary, lasting only as long as severe storms or repair or remediation activities necessary to address these non-routine events.

3.16.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities.

Anchoring: The Proposed Action would contribute an undetectable increment to the cumulative anchoring impacts, which would be short term and minor due to the small size of the offshore wind lease areas in the geographic analysis area compared to the remaining area of open ocean, as well as the low likelihood that any anchoring risk would occur in an emergency scenario. In addition, the establishment of the anchorage areas described above would limit the potential impacts on routine anchorage operations across the geographic analysis area.

Port utilization: Other offshore wind projects would generate comparable types and volumes of vessel traffic in ports and would require similar types of port facilities as the Proposed Action. Within the geographic analysis area, the Proposed Action is anticipated to overlap in construction with the Atlantic Shores South project for 1 year in 2025. The increase in port utilization due to other offshore wind project vessel activity would be limited during construction and installation of the Proposed Action. The total increase in vessel traffic would likely be distributed across multiple ports in the region; however, there could be delays for vessels using those ports if two or more projects are under construction at the same time. Accordingly, the Proposed Action would contribute a noticeable increment to the cumulative port utilization impacts on navigation and vessel traffic, which would be continuous and moderate.

Presence of structures: The Proposed Action would contribute an appreciable increment to the cumulative impacts from the presence of structures. Structures from other offshore wind activities would generate comparable types of impacts as under the Proposed Action across the entire geographic analysis area. A total of 566 WTGs and 18 OSS would be constructed under the Proposed Action and the other offshore wind projects in the geographic analysis area. The presence of structures from all offshore wind projects in the geographic analysis area would further increase the navigational complexity in the region, resulting in an increased risk of collisions and allisions, which would result in impacts, potentially including personal injury or loss of life from a marine casualty, damage to boats or turbines, and oil spills. The presence of neighboring offshore wind projects could also affect demand for and resources associated with USCG SAR operations by changing vessel traffic patterns and densities.

Cable emplacement and maintenance: The Proposed Action would contribute a noticeable increment to the cumulative impacts from cable emplacement and maintenance, which would be localized, intermittent, and minor to moderate. Cable installation and maintenance for other offshore wind activities would generate comparable types of impacts to those of the Proposed Action for each offshore export cable route and inter-array and interconnector cable system. As shown in Table F2-1 in Appendix F, offshore export cable and inter-array/interconnector cables for up to three other offshore wind projects could be under construction simultaneously while the Proposed Action is in operation. Simultaneous construction of inter-array and interconnector cables for adjacent projects could have a combined effect, although it is assumed that installation vessels would only be present above a portion of a project’s inter-array/interconnector system at any given time. Substantial areas of open ocean are likely to separate simultaneous offshore export cable and inter-array/interconnector installation activities for other offshore wind projects.

Traffic: The three other offshore wind projects in the geographic analysis area would generate amounts of vessel traffic comparable to that of the Proposed Action. One of the three projects, Atlantic Shores South, is anticipated to overlap construction with the Proposed Action for 1 year in 2025. During that year, the two projects may generate up to 116 vessel trips at any given time within the geographic analysis area. The three other wind projects would be under construction between 2025 and 2030, and construction on all three would occur simultaneously in 2026 to 2027. Following construction, all four offshore wind projects would be operating simultaneously and could generate up to 41 vessel trips to support O&M activities at any given time. Because the ports to be used by other offshore wind projects have not been determined, the overlap of vessel activity at any single port cannot be predicted. Traffic from these projects would likely be spread among multiple ports within and outside the geographic analysis area for navigation and vessel traffic, thus potentially moderating the effect of offshore wind-related vessel traffic at any single location. The Proposed Action would contribute a noticeable increment to cumulative vessel traffic impacts during peak construction and installation activity, which would be moderate, localized, short term, and intermittent.

3.16.5.3. Conclusions

Impacts of the Proposed Action. In summary, construction and installation, O&M, and conceptual decommissioning of the Proposed Action would have adverse impacts on navigation and vessel traffic. The impacts of the Proposed Action on navigation and vessel traffic would be **moderate**. Impacts on non-Project vessels would include changes in navigation routes, delays in ports, degraded communication and radar signals, and increased difficulty of offshore SAR or surveillance missions within the Wind Farm Area, all of which would increase navigational safety risks. Some commercial fishing, recreational, and other vessels would choose to avoid the Wind Farm Area altogether, leading to some potential congestion of vessel traffic along the Wind Farm Area borders. In addition, the increase in potential for marine accidents, which may result in injury, loss of life, and property damage, could produce disruptions for ocean users in the geographic analysis area. While non-routine events such as collisions and allisions (and resulting spills or personal injury) have the potential to occur during Project construction, O&M, and decommissioning, BOEM anticipates that these events would be unlikely to occur given requirements for lighting and marking, vessel speed restrictions, and inclusion of Project components on navigation charts as outlined in Section 2.2.

Cumulative Impacts of the Proposed Action. The incremental impacts contributed by the Proposed Action to the cumulative impacts on navigation and vessel traffic would be appreciable. The main IPF from which impacts are contributed is the presence of structures, which increase the risk of collision/allision and navigational complexity, particularly when adjoining offshore wind projects do not share a common WTG layout or spacing and do not include a separation between adjoining lease areas. Considering all the IPFs together, BOEM anticipates that the cumulative impacts associated with the

Proposed Action would be **moderate**, due primarily to the increased navigational complexity, which could produce disruptions for ocean users in the geographic analysis area.

3.16.6 Impacts of Alternatives B and D on Navigation and Vessel Traffic

Impacts of Alternatives B and D. The impacts on navigation and vessel traffic from Alternatives B-1, B-2, and D would be similar but slightly less than the impacts from the Proposed Action. These action alternatives would also not address USCG's recommendation to include a common WTG spacing and layout across adjoining projects or include a separation between adjoining projects to facilitate safe navigation (USCG 2021b). Alternatives B-1 and B-2 would exclude up to 9 WTG positions or up to 19 WTG positions, respectively, in the rows nearest to coastal communities. The WTG locations in Alternatives B-1 or B-2 would incrementally decrease impacts on vessel traffic compared to the Proposed Action by providing additional space closer to coastal areas more frequently used by recreational vessels. It would also produce a greater buffer between the Wind Farm Area and the USCG-proposed fairways for towing vessel traffic discussed in Section 3.16.3.2 and, in the case of Alternative B-2, a slight reduction in the shared border with the Atlantic Shores South lease area. These changes notwithstanding, the overall impacts of Alternatives B-1 or B-2 on navigation and vessel traffic would be substantially similar, but not identical, to those of the Proposed Action.

Alternative D would exclude up to 15 WTG positions in the northeast corner of the proposed Wind Farm Area. As discussed in Section 3.16.1, deep-draft vessel traffic generally maintains a course well to the east of the Lease Area, although a small fraction passes through the Project area. Alternative D would provide additional area between the easternmost portion of the WTG array and the usual deep-draft vessel transit routes. Also, the exclusion of the three WTG positions (A07, A08, and A09) closest to the Atlantic Shores South Lease Area would result in a reduced shared border between the two wind farm areas. Both of these outcomes of Alternative D would incrementally decrease impacts on navigation and vessel traffic safety, compared to the Proposed Action, but would not change the overall impact magnitudes described for the Proposed Action.

Cumulative Impacts of Alternatives B and D. Incremental impacts contributed by Alternatives B-1, B-2, and D to cumulative impacts would be similar to those of the Proposed Action.

3.16.6.1. Conclusions

Impacts of Alternatives B and D. Construction of Alternatives B-1, B-2, and D alone would have the same **moderate** impact on navigation and vessel traffic as described under the Proposed Action. While Alternatives B-1, B-2, and D may slightly reduce impacts due to the reduction in WTG positions, the magnitude of impacts would not be materially different from that of the Proposed Action.

Cumulative Impacts of Alternatives B and D. The incremental impacts contributed by Alternatives B-1, B-2, and D to the cumulative impacts on navigation and vessel traffic would be appreciable. Considering all the IPFs together, BOEM anticipates that the cumulative impacts associated with Alternatives B-1, B-2, and D would be similar to those of the Proposed Action: **moderate**.

3.16.7 Impacts of Alternative C on Navigation and Vessel Traffic

Impacts of Alternative C. Alternative C was developed in response to public scoping comments to address concerns regarding the different layouts between the Ocean Wind 1 and Atlantic Shores South projects and the need for a buffer for each of the two projects in the adjacent lease areas (refer to Section 2.1.3). USCG recommends that, when multiple lease areas share borders, there is a common WTG spacing and layout throughout all adjoining wind projects; additionally, in the absence of the common spacing and orientation between adjacent wind projects, a setback from the shared border is recommended (USCG 2021b). Alternatives C-1 and C-2 encompass wind turbine layout modifications that would result in an 0.81- to 1.08-nm buffer between WTGs in the Ocean Wind 1 Lease Area (OCS-A 0498) and WTGs in the Atlantic Shores South Lease Area (OCS-A 0499) (BOEM 2022). Alternative C-1 would accomplish the buffer with the removal of eight WTG positions from Row A of the WTG layout and Alternative C-2 would retain all 98 WTG positions but compress the WTG layout from 1 nm between rows to no less than 0.99 nm between rows to achieve up to an 0.81- to 1.08-nm buffer between WTGs in the Lease Area and WTGs in the Atlantic Shores South Lease Area.

The proposed buffer (0.81 to 1.08 nm) would be an improvement to vessel navigation and SAR considerations over no separation between lease areas, particularly as there is a lack of common WTG spacing and layout throughout. The separation would provide a clear visual reference for each project to mariners within the area and to USCG aviators on SAR missions that the operators will need to adjust their course, as well as provide the sea and air space to conduct that course adjustment. Under both Alternatives C-1 and C-2, an 0.81- to 1.08-nm separation width between bordering WTGs (taking into account the Atlantic Shores South buffer distance) would allow for the transit of larger fishing vessels or survey vessels between the Ocean Wind 1 and Atlantic Shores South WTG arrays when vessel captains do not want to transit directly through the WTG array due to maneuverability concerns or operate within the array due to fishing equipment integrity concerns.

The compression of the WTG layout (Alternative C-2) could have an impact on the sea room for a vessel actively fishing within the WTG array depending upon the type of gear used and the turning circle of the vessel. Using a generic evaluation of turning radius, the NSRA established that the Project layout with a minimum of 0.8 nm between offshore structures "is estimated to provide sufficient sea room for safe navigation of vessels engaged in fishing within the Wind Farm Area; however, depending upon the exact gear length and the type that is utilized, the distances between the structures may limit safe fishing patterns" within the Wind Farm Area (COP Volume III, Appendix M, NSRA, p. 80; Ocean Wind 2023). USCG has preliminarily reviewed the reduced spacing between WTG rows (from 1 nm to no less than 0.99 nm between rows) under Alternative C-2 and has informed BOEM this spacing for WTGs would still be within the 0.80- to 1.1-nm preferred range for the safe navigation of vessels less than 200 feet in length (West pers. comm. 2022).

Overall, Alternatives C-1 and C-2 would have slightly reduced impacts on navigation and vessel traffic compared to the Proposed Action.

Cumulative Impacts of Alternative C. The incremental impacts contributed by Alternative C on navigation and vessel traffic to the combined impacts from ongoing and planned activities including offshore wind would be less than those described under the Proposed Action.

3.16.7.1. Conclusions

Impacts of Alternative C. With Ocean Wind 1's adoption of an agreed-upon separation with Atlantic Shores South, impacts on navigation and vessel traffic under Alternatives C-1 and C-2 would be the same as those of the Proposed Action: **moderate**. The proposed distance between WTGs of each project (from 0.81 to 1.08 nm) would improve vessel navigation and SAR by providing additional space for transiting between the two adjacent wind projects, as well as the visual reference and sea space to adjust course when moving from one project to another. While Alternative C-2 would compress the WTG layout, the spacing between structures would be within USCG's preferred range for safe navigation of vessels less than 200 feet in length, and would not have a substantive change in impacts on navigation and vessel traffic. As with the Proposed Action, impacts from Alternatives C-1 and C-2 would either be measurable but would not disrupt navigation and vessel traffic, or would be notable but vessels would be able to adjust to account for disruptions. With consideration of Alternatives C-1 and C-2 alone, the magnitude of impacts would not be materially different than that of the Proposed Action.

Cumulative Impacts of Alternative C. The incremental impacts contributed by Alternatives C-1 and C-2 to the cumulative impacts on navigation and vessel traffic would be appreciable. The incremental impacts would be reduced compared to the Proposed Action due to WTG layout modifications to address navigational safety concerns as recommended by USCG. Considering all the IPFs together, BOEM anticipates that the cumulative impact of Alternative C-1 or C-2 in combination with other ongoing and planned activities including offshore wind would be **moderate**, primarily due to the presence of structures, which increases the likelihood of allisions and complicates SAR activities.

3.16.8 Impacts of Alternative E on Navigation and Vessel Traffic

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. Under Alternative E, the Oyster Creek export cable route would be modified to avoid impacts on SAV. Because the Proposed Action's PDE also includes the route proposed under Alternative E, there would be no meaningful differences in impacts. The rerouting of the Oyster Creek export cable for Alternative E would relocate a 4-mile section of the buried cable in Barnegat Bay north of the route under the Proposed Action, but this would not result in a discernable difference in impacts on any smaller vessel emergency anchoring activities Barnegat Bay.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to cumulative impacts would be similar to those described under the Proposed Action.

3.16.8.1. Conclusions

Impacts of Alternative E. Construction of Alternative E alone would likely have the same **moderate** impact on navigation and vessel traffic as under the Proposed Action. The rerouting of the Oyster Creek export cable in Barnegat Bay would not result in a discernable difference in impacts on navigation and vessel traffic.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on navigation and vessel traffic would be the same as under the Proposed Action—appreciable. BOEM anticipates that the cumulative impact associated with Alternative E would be **moderate**, due primarily to the increased possibility for marine accidents, which could produce significant disruptions for ocean users in the geographic analysis area.

3.16.9 Potential Mitigation Measures

Several measures are proposed to minimize impacts on navigation and vessel traffic (Appendix H, Table H-2). If the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced.

Table 3.16-4 Additional Proposed Measures Identified in Appendix H, Table H-3: Navigation and Vessel Traffic

Measure	Description	Effect
Navigation safety plan	BOEM would ensure that Ocean Wind coordinates with USCG in advance of export cable installation to develop a navigation safety plan, which may include establishing a safety zone around the cable-laying vessel(s), a monitoring plan, a mitigation plan, a schedule, PATONs, and a local notice to mariners.	The presence of a navigation safety plan would ensure that USCG has advance notice of Project vessel activities. Although the measures within a navigation safety plan, if implemented, would potentially reduce the risk of vessel collisions and resultant oil spills, vessel traffic would still have to adjust by giving a wide berth for slow-moving or stationary Project vessels conducting cable emplacement. Therefore, impacts would remain minor to moderate for the Proposed Action and other action alternatives.
Safety zones	Establishing safety zones should not be used as the key mitigating factor when considering risks and impacts. Commander, USCG Fifth District, may consider safety zones in the lease area, but safety zones will not be granted for the sole purpose of keeping project construction on track.	
Cable maintenance and monitoring plan	BOEM would ensure that Ocean Wind develops a cable maintenance and monitoring plan that outlines a process for identifying when cable burial depths reach unacceptable risks, requires prompt remediation of exposed and shallow-buried cable segments, and includes review to address repeat exposures. The cable maintenance and monitoring plan would also describe methods for providing an accessible graphic/geo-referenced repository of locations where target burial depths were not achieved and/or cable protection was installed, and mariner notification for monitoring and remedial burial activities.	The presence of a cable maintenance and monitoring plan would ensure that a methodology is outlined for monitoring cables and identifying appropriate remediation, and that timeframes for monitoring and remediation are determined so that risks to transiting vessels are minimized to the extent possible. BOEM's requirement for the development of a cable maintenance and monitoring plan would help ensure that Ocean Wind adheres to commitments; however, impacts would remain minor to moderate for the Proposed Action and other action alternatives.

3.16.9.1. Measures Incorporated in the Preferred Alternative

BOEM has identified the additional measures in Table 3.16-4 as incorporated in the preferred alternative: navigation safety plan, safety zones, and cable maintenance and monitoring plan. These measures, if adopted, would reduce the potential for conflicts with other transiting vessels during export cable installation by establishing a navigation safety plan and cable maintenance and monitoring plan. However, overall impacts on navigation and vessel traffic would remain minor to moderate.

3.17. Other Uses (Marine Minerals, Military Use, Aviation)

This section discusses potential impacts on other uses not addressed in other portions of the EIS, including marine minerals, military use, aviation, cables and pipelines, radar systems, and scientific research and surveys, that would result from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis areas for these topics are described below and shown on Figure 3.17-1.

- Aviation and air traffic, military and national security, and radar systems: Areas within 10 miles (16.1 kilometers) of the export cable route corridor and Wind Farm Area and the Ocean Wind 1 and Atlantic Shores South Lease Areas as well as Atlantic City International Airport, Ocean City Municipal Airport, Woodbine Municipal Airport, Cape May County Airport, and Warren Grove Range Airport (Figure 3.17-1)
- Cables and pipelines: Areas within 1 mile (1.6 kilometers) of the export cable route corridor and Wind Farm Area that could affect future siting or operation of cables and pipelines (Figure 3.17-1)
- Scientific research and surveys: Same analysis area as finfish, invertebrates, and EFH (Figure 3.13-1)
- Marine minerals: Areas within 0.25 mile (0.4 kilometer) of the export cable route corridor and Wind Farm Area that could affect marine minerals extraction (Figure 3.17-1)

These areas encompass locations where BOEM anticipates direct and indirect impacts associated with Project construction, O&M, and conceptual decommissioning.

3.17.1 Description of the Affected Environment for Other Uses (Marine Minerals, Military Use, Aviation)

Marine Mineral Extraction

BOEM's Marine Mineral Program manages non-energy minerals (primarily sand and gravel) on the OCS and leases access to these resources to target shoreline erosion, beach renourishment, and restoration projects. At this time, there are no active or requested BOEM leases in the geographic analysis area. The closest previous lease in BOEM's Marine Minerals Program is known as the D2 borrow area, offshore New Jersey near Harvey Cedars, Surf City, Long Beach Township, Ship Bottom, and Beach Haven (Lease Number OCS-A-0505; executed 7/1/2014), which was approved through September 30, 2018, for the use of up to 10,000,000 cubic yards of material. Periodic nourishment for this project has been authorized in a 7-year cycle, with an estimated final nourishment year of 2055 (Cresitello 2020).

Due to the depletion of sand sources in state waters, it is highly likely that OCS material will be sought for future nourishment cycles on Long Beach Island, for projects to the south on Absecon Island, along beaches stretching from Great Egg Harbor Inlet to Townsends Inlet, and to the north along beaches stretching from Barnet Inlet to Sandy Hook (Cresitello 2020).

Several sand and gravel borrow areas and ocean disposal sites designated by USACE in partnership with NJDEP are mapped in the vicinity of the Wind Farm Area and offshore export cable corridors. However, none of these sites is within the geographic analysis area.

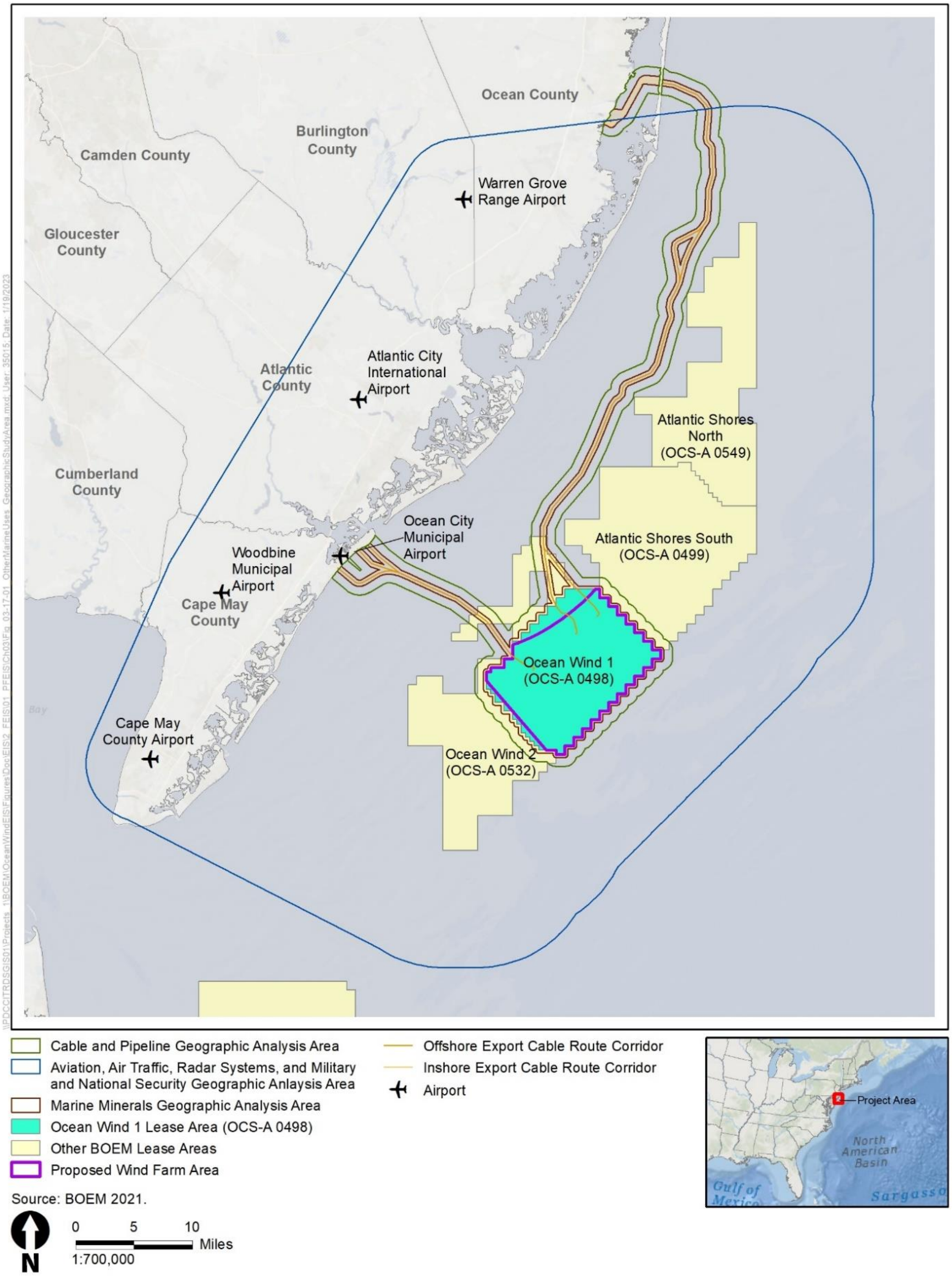

Figure 3.17-1 Other Uses Geographic Analysis Area

National Security and Military Uses

DOD operates in the airspace over and adjacent to the Wind Farm Area. Portions of the Wind Farm Area are within or in the vicinity of the Atlantic City Range Complex and the Atlantic City at-sea operating area (OPAREA), which extends from the shoreline seaward and is approximately 100 nm from land at its farthest point (Ocean Wind 2023). The range complex and Atlantic City OPAREA are primarily used by the U.S. Atlantic Fleet and the U.S. Air Force for test and training exercises. Warning Area W-107 is the block of special-use airspace over the Atlantic City OPAREA. It is designated for aircraft activity that may be hazardous for nonparticipating aircraft and is typically used for surface and surface-to-air exercises (Ocean Wind 2023). Additionally, the U.S. Marine Corps uses a military flight route (VR-1709) that crosses the western portion of the Wind Farm Area.

Major onshore regional military facilities include Naval Weapons Station Earle, Joint Base McGuire-Dix-Lakehurst, and the Manasquan Inlet USCG station (Ocean Wind 2023). Naval Weapons Station Earle in Colts Neck, New Jersey provides all the ordnance for the Atlantic Fleet Carrier and Expeditionary Strike Groups and supports strategic ordnance requirements. Joint Base McGuire-Dix-Lakehurst is a military installation approximately 18 miles south of Trenton, New Jersey. The Manasquan Inlet USCG station is approximately 60 miles north of Oyster Creek in Point Pleasant. Military activities at the Manasquan Inlet Station could include various vessel training exercises, submarine and antisubmarine training, and U.S. Air Force exercises. Even though this installation is north of the Lease Area, vessel training exercises may be conducted closer to the Project (Ocean Wind 2023). DOD also operates the North American Aerospace Defense Command national defense radar in the Project vicinity.

Military activities are anticipated to continue to use onshore and offshore areas in the vicinity of the Project area into the future and may involve routine and non-routine activities.

Aviation and Air Traffic

Multiple public and private-use airports serve the region surrounding the Project area including Atlantic City International Airport, Ocean City Municipal Airport, Woodbine Municipal Airport, Cape May County Airport, and Warren Grove Range Airport. Atlantic City International Airport is also the base for the New Jersey Air National Guard’s 177th Fighter Wind and the USCG Air Station Atlantic City (Ocean Wind 2023).

Air traffic is expected to continue at current levels in and around the Wind Farm Area.

Cable and Pipelines

The onshore export cable corridors for BL England and Oyster Creek are within developed areas of New Jersey that overlap multiple utilities including electric and gas distribution and transmission lines, communications cables, and water and sewer pipelines. Additionally, there are a number of sewer and stormwater pipelines and intake structures along the coast of New Jersey that begin onshore and extend offshore in the vicinity of the Project area.

Offshore, there are no pipelines within the Wind Farm Area; however, there is a submarine pipeline present within the BL England offshore export cable corridor. There are at least four in-service submarine telecommunications cables and six out-of-service cables in the vicinity of the Wind Farm Area that would cross the Oyster Creek export cable corridor. There are no sewer or stormwater outfalls in navigable waters near Oyster Creek or BL England (Ocean Wind 2023).

BOEM has not identified any publicly noticed plans for additional submarine cables or pipelines in the geographic analysis area.

Radar Systems

Commercial air traffic control, national defense, and weather radar systems currently operate in the region. Four DOD national defense and FAA air traffic control radar sites are in the vicinity of the Project area:

- Atlantic City Airport Surveillance Radar-9 (ASR-9) and co-located Air Traffic Control Beacon Interrogator-5
- Dover Air Force Base (AFB) Digital Airport Surveillance Radar (DASR) and co-located Monopulse Surveillance Secondary Surveillance Radar
- Gibbsboro Air Route Surveillance Radar-4 (ARSR-4) and co-located Air Traffic Control Beacon Interrogator-6
- McGuire AFB DASR and co-located Monopulse Surveillance Secondary Surveillance Radar

One DOD and one National Weather Service weather radar sites are in the vicinity of the Project area:

- Weather Surveillance Radar-1988 Doppler (WSR-88D)
- National Weather Service Philadelphia WSR-88D

In addition to onshore facilities, several high-frequency radar stations are along the New Jersey Continental Shelf as part of regional and local high-frequency radar networks to make coastal observations (Ocean Wind 2023). The high-frequency radars are used by the NOAA Integrated Ocean Observing System as part of its Surface Currents Program. Surface current data collected are used by USCG's Search and Rescue Optimal Planning System, a decision-support tool that uses ocean observations to narrow search areas. These offshore high-frequency radar stations provide coverage from Cape Cod to Cape Hatteras:

- Seaside Park SeaSonde Oceanographic High-Frequency Radar
- Brant Beach SeaSonde Oceanographic High-Frequency Radar
- Holgate SeaSonde Oceanographic High-Frequency Radar
- Strathmere SeaSonde Oceanographic High-Frequency Radar
- North Wildwood SeaSonde Oceanographic High-Frequency Radar
- Hempstead SeaSonde Oceanographic High-Frequency Radar
- Loveladies SeaSonde Oceanographic High-Frequency Radar
- Brigantine SeaSonde Oceanographic High-Frequency Radar
- Wildwood SeaSonde Oceanographic High-Frequency Radar

Existing radar systems will continue to provide weather, navigational, and national security support to the region. The number of radars and their coverage area are anticipated to remain at current levels for the foreseeable future.

Scientific Research and Surveys

Research in the geographic analysis area includes oceanographic, biological, geophysical, and archaeological surveys focused on the OCS and nearshore environments, and resources that may be affected by offshore wind development. Federal and state agencies, educational institutions, and environmental non-governmental organizations participate in ongoing offshore research in the Wind Farm Area and surrounding waters.

Current fisheries management and ecosystem monitoring surveys conducted by or in coordination with the NMFS NEFSC would overlap with offshore wind lease areas in the Mid-Atlantic and Southern New England region. Surveys include (1) the NEFSC Bottom Trawl Survey, a more than 50-year multispecies stock assessment tool using a bottom trawl; (2) the NEFSC Sea Scallop/Integrated Habitat Survey, a sea scallop stock assessment and habitat characterization tool, using a bottom dredge and camera tow; (3) the NEFSC Surfclam/Ocean Quahog Survey, a stock assessment tool for both species using a bottom dredge; (4) the NEFSC Ecosystem Monitoring Program, a more than 40-year shelf ecosystem monitoring program using plankton tows and conductivity, temperature, and depth units; (5) AMAPPS shipboard and aerial surveys; (6) NARW aerial surveys; and (7) the large coastal shark long-line survey. These surveys support management of more than 40 fisheries in the region, more than 30 marine mammal species, and 14 threatened and endangered species (Hare et al. 2022). Additionally, these surveys support numerous other science products produced by NOAA Fisheries, including ecosystem and climate assessments. Additionally, NJDEP has conducted the New Jersey Ocean Trawl Program annually for over 30 years to document the occurrence, distribution, and relative abundance of marine recreational and non-recreational fish species in New Jersey coastal waters. Similarly, the NJDEP surfclam surveys were performed annually from 1988–2019 to document the occurrence, distribution, and abundance of surfclams in New Jersey coastal waters. Nearshore survey activities associated with the NEAMAP overlap with the western edge of the Project area. As offshore wind development continues, alternative platforms, sampling designs, and sampling methodologies would be needed to maintain surveys conducted in or near the Project.

BOEM is committed to working with NOAA toward a long-term regional solution to account for changes in survey methodologies because of offshore wind farms. On December 4, 2022, NOAA Fisheries and BOEM published a Federal Survey Mitigation Strategy for the Northeast U.S. Region to address anticipated impacts of offshore wind energy development on NOAA Fisheries' scientific surveys (Hare et al. 2022). This implementation strategy also defines stakeholders, partners, and other ocean users that will be engaged throughout the process and identifies potential resources for successful implementation. Activities described in the implementation strategy are designed to mitigate the effect of offshore wind energy development on NOAA surveys and is referred to as the Federal Survey Mitigation Program. The mitigation program will include survey-specific mitigation plans for each affected survey including both vessel and aerial surveys. The implementation strategy is intended to guide the implementation of the mitigation program through the duration of wind energy development in the Northeast U.S. region.

3.17.2 Environmental Consequences

3.17.2.1. Impact Level Definitions for Other Uses (Marine Minerals, Military Use, Aviation)

Definitions of impact levels are provided in Table 3.17-1. There are no beneficial impacts on other uses.

Table 3.17-1 Impact Level Definitions for Other Uses (Marine Minerals, Military Use, Aviation)

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
Minor	Adverse	Impacts on the affected activity would be avoided, and impacts would not disrupt the normal or routine functions of the affected activity. Once the Project is decommissioned, the affected activity would return to a condition with no measurable effects.

Impact Level	Impact Type	Definition
Moderate	Adverse	Impacts on the affected activity would be unavoidable. The affected activity would have to adjust to account for disruptions due to impacts of the Project, or, once the Project is decommissioned, the affected activity could return to a condition with no measurable effects if proper remedial action is taken.
Major	Adverse	The affected activity would experience unavoidable disruptions to a degree beyond what is normally acceptable, and, once the Project is decommissioned, the affected activity could retain measurable effects indefinitely, even if remedial action is taken.

3.17.3 Impacts of the No Action Alternative on Other Uses (Marine Minerals, Military Use, Aviation)

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on other uses, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for other uses. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.17.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, marine minerals, military and national security uses, aviation and air traffic, offshore cables and pipelines, radar systems, and scientific research and surveys described in Section 3.17.1, *Description of the Affected Environment for Other Uses (Marine Minerals, Military Use, Aviation)*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities.

There are no ongoing offshore wind activities within the geographic analysis area for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, or radar systems. Within the geographic analysis area for scientific research and surveys, the following offshore wind activities are ongoing: Block Island Wind Farm offshore Rhode Island, the Coastal Virginia Offshore Wind pilot project offshore Virginia, Vineyard Wind 1 offshore Massachusetts, and South Fork Wind Farm offshore Rhode Island.

Ongoing activities within the geographic analysis area that would contribute to impacts on other uses would generally be associated with offshore developments and climate change. Impacts on the marine environment associated with ongoing offshore wind activity have the potential to affect ongoing research and surveys within the geographic analysis area.

3.17.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned activities (without the Proposed Action). No planned activities related to other uses in the offshore environment, such as the installation of new structures on the OCS outside of planned offshore wind projects, were identified (see Section F.2 in Appendix F for a complete description of ongoing and planned activities). See Tables F1-15 through F1-19 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for other uses. BOEM expects planned offshore wind development to primarily affect other uses through the following IPFs.

Marine Mineral Extraction

Presence of structures: The demand for sand and gravel resources is expected to grow with increasing trends in coastal erosion, storm events, and sea level rise. Within the geographic analysis area, there are no mineral leases, borrow sites, or ocean disposal sites. Offshore wind project infrastructure, including WTGs and transmission cables, could prevent future marine mineral extraction activities where the project footprint overlaps with the extraction area. Marine mineral extraction typically occurs within 8 miles of the shoreline, limiting adverse impacts on the offshore export cable routes. Additionally, other offshore wind projects would be able to avoid existing and proposed borrow areas through consultation with the BOEM Marine Minerals Program, USACE, and relevant state agencies before an offshore wind cable route is approved. The adverse impacts on sand and marine mineral extraction of offshore wind activities are anticipated to be negligible.

National Security and Military Uses

The offshore wind lease area geographic boundaries were developed through coordination with stakeholders to address concerns surrounding overlapping military and security uses. BOEM continues to coordinate with stakeholders to minimize these concerns, as needed.

Presence of structures: Existing stationary facilities within the geographic analysis area are limited to meteorological buoys operated for offshore wind farm site assessment. Dock facilities and other structures are concentrated along the coastline. Installation of up 468 WTGs as part of other offshore wind projects in the geographic analysis area would affect military and national security, including USCG SAR operations, primarily through increased risk of allision with foundations and other stationary structures. Generally, deep-draft military vessels are not anticipated to transit outside of navigation channels unless necessary for SAR operations or other non-typical activities. Smaller-draft vessels moving within or near the wind installation have a higher risk of allision with offshore wind structures. Wind energy facility structures would be lighted according to USCG and BOEM requirements at sea level to decrease allision risk. Allision risk would be further mitigated through coordination with stakeholders on WTG layouts to allow for safe navigation through the offshore wind lease areas in the analysis area.

The construction of offshore wind projects in the geographic analysis area would incrementally change navigational patterns and would increase navigational complexity for vessels and military aircraft operating in the region around the wind energy projects. The structures associated with offshore wind energy may necessitate route changes to navigate around the offshore wind lease areas and vessels associated with the construction of a project. Military and national security aircraft would be affected by the presence of tall equipment necessary for offshore wind facility construction, such as stationary lift vessels and cranes, which would increase navigational complexity in the area. Additionally, military and security operations conducted within Warning Area W-107 would be affected during the construction and operation periods of offshore wind activities. It is assumed, however, that all offshore wind energy projects would coordinate with relevant agencies during the COP development process to identify and minimize conflicts with military and national security operations. Refer to Section 3.16, *Navigation and Vessel Traffic*, for additional discussion of navigation impacts in the offshore wind lease areas.

Once the WTGs are operational, the artificial reef effect created by the offshore structures could attract commercial and recreational fishing vessels farther offshore than currently, possibly leading to use conflicts. An increase in commercial and recreational vessels in and around offshore wind projects could increase the risk of vessel collisions with military and national security vessels and may lead to an increased demand for USCG SAR operations.

Potential measures mitigating risks that offshore wind projects could implement include operational protocols to stop WTG rotation during SAR aircraft operations and implementation of FAA- and BOEM-recommended navigational lighting and marking to reduce the risk of aircraft collisions. Wind energy structures would be visible on military and national security vessel and aircraft radar. Even if these mitigation measures were implemented, the presence and layout of large numbers of WTGs could make it more difficult for SAR aircraft to perform operations, leading to less effective search patterns or earlier abandonment of searches. This could result in otherwise avoidable loss of life due to maritime incidents.

Navigational hazards would be eliminated as structures are removed during decommissioning. Due to anticipated coordination with agencies and the mitigation measures described above, the overall impacts on military and national security uses from offshore wind energy activities are anticipated to be minor, except for USCG SAR operations, which would have moderate adverse impacts.

Traffic: Impacts on military operations from vessel traffic related to the construction and operation of offshore wind activities on the OCS are expected to be short term, localized, and minor. Vessel traffic is expected to increase during construction. While construction periods of various offshore wind energy projects are expected to be staggered, there would be an overlap in construction between the three offshore wind projects in the geographic analysis area (Ocean Wind 2, Atlantic Shores South, and Atlantic Shores North) in 2026–2027, which would result in a cumulative impact on traffic volumes. Military and national security vessels may experience congestion and delays in ports due to the increase in offshore wind facility vessels.

Aviation and Air Traffic

Presence of structures: Other offshore wind development could add up to 468 WTGs to the offshore environment in the nearby OCS. WTGs could have a maximum blade tip height of 1,049 feet (320 meters) AMSL. As these structures are built, aircraft navigational patterns and complexity would incrementally increase in the region around the offshore wind lease areas, along transit routes between ports and construction sites, and locally around ports. These changes could compress lower-altitude aviation activity into more limited airspace in these areas, leading to airspace conflicts or congestion and increasing collision risks for low-flying aircraft. After all foreseeable offshore wind energy projects are built, there would still be open airspace available over the open ocean. Navigational hazards and collision risks in transit routes would be reduced as construction is completed, and would be gradually eliminated during decommissioning as offshore WTGs are removed.

All stationary structures would have aviation and navigational marking and lighting in accordance with FAA, USCG, and BOEM requirements and guidelines to minimize and mitigate impacts on air traffic. BOEM assumes that offshore wind projects would coordinate with aviation interests through the planning, construction, operations, and conceptual decommissioning processes to avoid or minimize impacts on aviation activities and air traffic. For this reason, the adverse impacts on aviation and airports are anticipated to be minor.

Cables and Pipelines

Presence of structures: At least four in-service submarine telecommunications cables, six abandoned cables, and one near-shore submarine pipeline are present within the geographic analysis area. Installed WTGs and OSS, and the stationary lift vessels used during construction of offshore wind energy project infrastructure, may pose allision/collision risks and navigational hazards to vessels conducting maintenance activities on these existing cables and pipelines. Risk to cable maintenance vessels during construction and operations of nearby offshore wind projects would be limited due to the infrequent submarine cable maintenance required at any single location along existing cable routes. Allision risks would be mitigated by navigational hazard markings per FAA, BOEM, and USCG requirements and guidelines. Risk of allision by cable maintenance vessels would decrease to zero after project decommissioning as structures are removed.

Up to 1,560 miles of submarine cables are expected to be installed for the Ocean Wind 2, Atlantic Shores South, and Atlantic Shores North projects. The installation of WTGs and OSS could preclude future submarine cable placement within the foundation footprint, which would cause future cables to route around these areas. However, the presence of existing submarine cables would not prohibit the placement of additional cables and pipelines. Following standard industry procedures, cables and pipelines can be crossed without adverse impact. Impacts on submarine cables would be eliminated during decommissioning of offshore wind farms when foundations are removed and if the export and inter-array cables associated with those projects are removed. Minor adverse impacts on existing cables and pipelines due to anticipated offshore wind projects are expected.

Radar Systems

Presence of structures: WTGs that are near to or in the direct line of sight of land-based radar systems can interfere with the radar signal, causing shadows or clutter in the received signal. Construction of other wind energy projects would add up to 468 WTGs with a maximum blade tip height of up to 1,049 feet (320 meters) AMSL in the geographic analysis area. The presence of these wind energy structures could lead to localized, long-term, moderate impacts on radar systems. Development of offshore wind projects could incrementally decrease the effectiveness of individual radar systems if the field of WTGs expands within the radar system’s coverage area. In addition, large areas of installed WTGs could create a large geographic area of degraded radar coverage that could affect multiple radars. Most offshore wind structures would be sited at such a distance from existing and proposed land-based radar systems to minimize interference to most radar systems, but some impacts are anticipated.

For radar structures with a co-located secondary surveillance radar (including the Dover AFB DASR and McGuire AFB DASR), the secondary surveillance radar is the main source of aircraft identification and positional data for air traffic control. A Department of Homeland Security–funded study found that secondary radar tracks were rarely affected by wind turbines (Ocean Wind 2023). Additional flight trials by the Department of Energy, Department of Homeland Security, DOD, and FAA found that while primary surveillance radars were affected by wind turbines, beacon transponder-based secondary surveillance radars were not affected (Ocean Wind 2023).

BOEM assumes that project proponents would conduct an independent radar analysis and coordinate with FAA to identify potential impacts and any mitigation measures specific to aeronautical, military, and weather radar systems. BOEM would continue to coordinate with the Military Aviation and Installation Assurance Siting Clearinghouse to review each proposed offshore wind project on a project-by-project basis, and would attempt to resolve project concerns identified through such consultation related to military and national security radar systems with COP approval conditions. Refer to Section 3.16, *Navigation and Vessel Traffic*, for discussion of impacts on marine vessel radar.

Scientific Research and Surveys

Presence of structures: Construction of other wind energy projects between 2023 and 2030 in the geographic analysis area would add up to 2,946 WTGs, associated cable systems, and associated vessel activity that would present additional navigational obstructions for sea- and air-based scientific studies. Collectively, these developments would prevent NOAA from continuing scientific research surveys or protected species surveys under current vessel capacities, would affect monitoring protocols in the geographic analysis area, could conflict with state and nearshore surveys, and may reduce opportunities for other NOAA scientific research studies in the area. This EIS incorporates by reference the detailed summary of and potential impacts on NOAA's scientific research provided in the Vineyard Wind 1 Final EIS in Section 3.12.2.5, *Scientific Research and Surveys* (BOEM 2021a). In summary, offshore wind facilities actuate impacts on scientific surveys and advice by preclusion of NOAA survey vessels and aircraft from sampling in survey strata; impacts on the random-stratified statistical design that is the basis for assessments, advice, and analyses; alteration of benthic and pelagic habitats and airspace in and around the wind energy development, which would require new designs and methods to sample new habitats; and reduced sampling productivity through navigation impacts of wind energy infrastructure on aerial and vessel surveys. NOAA has determined that survey activities within offshore wind facilities are outside of safety and operational limits. Survey vessels would be required to navigate around offshore wind projects to access survey locations, leading to a decrease in survey precision and operational efficiency. The height of turbines would affect aerial survey design and protocols, requiring flight altitudes and transects to change. Scientific survey and protected species survey operations would therefore be reduced or eliminated as offshore wind facilities are constructed. If stock or population changes, biomass estimates, or other environmental parameters differ within the offshore wind lease areas but cannot be observed as part of surveys, resulting survey indices could be biased and unsuitable for monitoring stock status. Offshore wind facilities will disrupt survey sampling statistical designs, such as random stratified sampling. Impacts on the statistical design of region-wide surveys violate the assumptions of probabilistic sampling methods. Development of new survey technologies, changes in survey methodologies, and required calibrations could help to mitigate losses in accuracy and precision of current practices caused by the impacts of wind development on survey strata.

Other offshore wind projects could also require implementation of mitigation and monitoring measures identified in records of decision. Identification and analysis of specific measures are speculative at this time; however, these measures could further affect NOAA's ongoing scientific research surveys or protected-species surveys because of increased vessel activity or in-water structures from these other projects. BOEM is committed to working with NOAA toward a long-term regional solution to account for changes in survey methodologies as a result of offshore wind farms.

Overall, reasonably foreseeable offshore wind energy projects in the area would have major effects on NOAA's scientific research and protected-species surveys, potentially leading to impacts on fishery participants and communities; as well as potential major impacts on monitoring and assessment activities associated with recovery and conservation programs for protected species.

3.17.3.3. Conclusions

Impacts of the No Action Alternative. Ongoing activities in the geographic analysis area would likely result in negligible impacts for marine mineral extraction, marine and national security uses, aviation and air traffic, cables and pipelines, and radar systems. Currently, offshore structures in the geographic analysis area are limited to meteorological buoys associated with planned offshore wind activities. Military and national security use, aviation and air traffic, vessel traffic, commercial fishing, and scientific research and surveys are expected to continue in the geographic analysis area. Ongoing activities would likely result in major impacts on scientific research and surveys due to the impacts from ongoing offshore wind activity including the Block Island Wind Farm, the Coastal Virginia Offshore Wind pilot project, Vineyard Wind 1, and the South Fork Wind Farm. The No Action Alternative would result in **negligible** impacts for marine mineral extraction, marine and national security uses, aviation and air traffic, cables and pipelines, and radar systems and **moderate** impacts on scientific research and surveys.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and activities would continue, and other uses would continue to be affected by natural and human-caused IPFs. Planned activities expected to occur in the geographic analysis area include increasing vessel traffic; continued residential, commercial, and industrial development onshore and along the shoreline; and continued development of FAA-regulated structures including cell towers and onshore wind turbines. BOEM anticipates that any issues with aviation routes or radar systems would be resolved through coordination with DOD or FAA, as well as through implementation of aviation and navigational marking and lighting of structures according to FAA, USCG, and BOEM requirements and guidelines. There are no planned non-offshore activities anticipated to affect marine mineral extraction or cable and pipeline infrastructure.

BOEM anticipates that offshore wind activities in the geographic analysis area would result in negligible to minor impacts for marine mineral extraction, aviation and air traffic, and cables and pipelines; moderate for radar systems due to WTG interference; minor for military and national security uses except for USCG SAR operations, which would have moderate adverse impacts; and major for scientific research and surveys. The presence of stationary structures associated with offshore wind energy projects could prevent or impede continued NOAA scientific research surveys using current vessel capacities and monitoring protocols or reduce opportunities for other NOAA scientific research studies in the area. Coordinators of large-vessel survey operations or operations deploying mobile survey gear have determined that activities within offshore wind facilities would not be within current safety and operational limits. In addition, changes in required flight altitudes due to the proposed WTG height would affect aerial survey design and protocols.

BOEM anticipates that the cumulative impacts of the No Action Alternative in the geographic analysis area would be **negligible** to **minor** for marine mineral extraction, aviation and air traffic, and cables and pipelines; **moderate** for radar systems due to WTG interference; **minor** for military and national security uses except for USCG SAR operations, which would be **moderate**; and **major** for scientific research and surveys.

3.17.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix E) would influence the magnitude of the impacts on other uses:

- The number, size, location, and spacing of WTGs;
- Timing of offshore construction and installation activities; and
- Location and route of offshore export cable corridor.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- WTG size and location: larger turbines closer to shore could increase impacts on land-based radar systems, movements of civilian and military aircraft, and military vessels.
- WTG spacing: Removal of groups of WTGs, creating spacing of greater than 1 nm, could allow for scientific research and surveys in those areas, decreasing the impact.
- Timing of construction: Construction could affect submarine or surface military vessel activity during typical operations and training exercises.
- Offshore cable route options: The route chosen (including variants within the general route) could conflict with marine mineral extraction or cables and pipelines.

Ocean Wind has committed to avoiding other marine uses to the extent practicable and to coordinating with other users where avoidance is not practicable (OUSE-01) (COP Volume II, Table 1.1-2; Ocean Wind 2023).

3.17.5 Impacts of the Proposed Action on Other Uses (Marine Minerals, Military Use, Aviation)

3.17.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.17.8, *Impacts of Alternative E on Other Uses (Marine Minerals, Military Use, Aviation).*

Marine Mineral Extraction

Presence of structures: While there are several borrow areas and ocean disposal sites in the vicinity of the Project, none of these areas occur within the geographic analysis area for marine mineral extraction. Offshore wind project infrastructure, including WTGs and transmission cables, has the potential to prevent future marine mineral extraction activities where the footprint of the structures and cable corridors overlaps with the extraction area.

Beach replenishment activities routinely occur within the geographic analysis area to replace sediment lost due to erosion. There are multiple planned or proposed beach replenishment projects within Berkeley and Upper Townships (Press of Atlantic City 2022; Patch 2022). Depending on the landfall locations selected and location of the proposed beach replenishment projects, the proposed offshore export cable landfall locations for the Oyster Creek and BL England cable corridors may be near or overlapping with these activities. As more information on these planned beach replenishment activities is made available, Ocean Wind will coordinate with USACE, non-federal sponsor, and local owner as necessary to avoid conflicts.

Because the Project would avoid mineral leases, sand and gravel leases and borrow areas, and ocean disposal areas, negligible impacts associated with construction, O&M, and decommissioning are anticipated.

National Security and Military Uses

Presence of structures: The addition of up to 98 WTGs and up to 3 OSS would increase the risk of allisions for military vessels during Project operations, particularly in bad weather or low visibility, resulting in minor impacts on most military and national security uses. The presence of structures could also change navigational patterns and add to the navigational complexity for military vessels and aircraft operating in the Project area during construction and operation of the Proposed Action. Project structures would be marked as a navigational hazard per FAA, BOEM, and USCG guidelines and WTGs would be visible on military and national security vessel and aircraft radar, minimizing the potential for allision and increased navigational complexity. Additional navigational complexity would increase the risk of collision and allisions for military and national security vessels or aircraft within the Project area.

The U.S. Marine Corps uses a military flight route (VR-1709) that crosses the western portion of the Wind Farm Area. Ocean Wind has coordinated with the Marine Corps, which indicated that, while its primary interest is in keeping VR-1709 as free from obstruction as possible, it is not seeking to impose any requirements on the Project (Ocean Wind 2023). Ocean Wind has agreed to continue to coordinate with the Marine Corps as design progresses. In addition, Ocean Wind is coordinating with DOD regarding military exercises within the special-use airspace Warning Area 107 to inform turbine layout and design (Ocean Wind 2023). These coordination activities would ensure the Project is designed and operated in a manner that would minimize impacts on military use in the Project area to the extent feasible. Potential impacts on military operations from the permanent placement of structures within the water column and above the sea surface within the Wind Farm Area are expected to be long term and localized.

The Military Aviation and Installation Assurance Siting Clearinghouse coordinated a review of the COP within the DOD and this review identified minimal impacts on DOD's mission. The Department of the Navy requested that BOEM include a provision for distributed fiber-optic sensing technology that could be used as part of the wind energy project or associated transmission cables as terms of COP approval. The provision language is being developed by the Department of the Navy in coordination with BOEM and aims to mitigate potential impacts on the Department of the Navy's operations in the area (Sample 2021).

USCG SAR activities could be hindered within the Wind Farm Area due to navigational complexity and safety concerns of operating among WTGs. Changing navigational patterns could also concentrate vessels within and around the outsides of the Project area, potentially causing space use conflicts in these locations or reducing the efficiency of SAR operations, resulting in moderate, adverse impacts on SAR operations. USCG may need to adjust its SAR planning and search patterns to accommodate the WTG layout, leading to a less optimized search pattern and a lower probability of success. This could lead to increased loss of life due to maritime incidents.

Construction of the Proposed Action would add up to 98 WTGs and up to 3 OSS that could create an artificial reef effect, attracting species of interest to recreational fishing or sightseeing, which would attract additional recreational vessels in addition to existing vessel traffic in the area. The presence of additional recreational vessels would add to the space use conflict and collision risks for military and national security vessels.

Traffic: Increased vessel traffic in the Project area during construction, operations, and decommissioning could result in an increased risk of vessel collisions with military and national security vessels, cause military and national security vessels to change routes, and result in congestion and delays in ports. Impacts are anticipated to be minor and would be greatest during construction when vessel traffic is greatest and would be reduced during operations. Vessel traffic and navigation impacts are summarized in Section 3.16, *Navigation and Vessel Traffic*.

Aviation and Air Traffic

Presence of structures: The Proposed Action would install up to 98 WTGs with maximum blade tip heights of up to 906 feet (276 meters) above MLLW in the Wind Farm Area. The addition of these structures would increase navigational complexity and change aircraft navigational patterns around the Wind Farm Area. WTGs would be constructed under the listed FAA flight level ceiling designated within the Wind Farm Area and, therefore, would not affect commercial or military flight operations; however, low-level flights would be affected throughout the duration of the Proposed Action's operational timeframe (Ocean Wind 2023).

WTGs and OSS would comply with lighting and marking regulations and be marked per FAA and USCG rules to minimize and mitigate impacts on air traffic. Due to their size, WTGs would also be visible on aircraft radars. Navigational hazards and collision risks in transit routes would be reduced as construction is completed, and would be gradually eliminated during decommissioning as offshore WTGs are removed. Adverse impacts on air traffic are anticipated to be localized, long term, and minor.

Cables and Pipelines

Presence of structures: Several in-service and abandoned submarine telecommunication cables are present in the offshore export cable corridor and in the vicinity of the Lease Area.

Installation of the offshore export cables to Oyster Creek would cross four active and six inactive undersea telecommunication cables. Ocean Wind would follow standard industry procedures for crossing utility lines and avoid adverse impacts on these existing lines. The presence of future offshore wind energy structures could preclude future submarine cable placement within any given development footprint, requiring future cables to route around these areas. However, the placement and presence of the Proposed Action's offshore export cables would not prohibit the placement of additional cables and pipelines because these could be crossed following standard industry protection techniques. Impacts on submarine cables and pipelines are anticipated to be negligible and would be eliminated during decommissioning of the Project as the export and inter-array cables are removed.

Project structures including WTGs and OSS, and the stationary lift vessels used during Project construction and installation, may pose allision risks and navigational hazards to vessels conducting maintenance activities on existing submarine telecommunication cables. However, FAA, USCG, and BOEM navigational hazard marking as well as the relative infrequency of maintenance activities would minimize the risk of allision. Risk of vessel collision between cable maintenance vessels and vessels associated with the Project would be limited to the construction and installation phase and during planned maintenance activities during the operational phase.

Radar Systems

Presence of structures: Air traffic control and national defense radar within the line of sight of the offshore infrastructure associated with the Proposed Action may be affected by the O&M phase of the Project. Ocean Wind conducted an analysis of the impact on radar systems from the Proposed Action and found that either portions or the entire Project Area are within the line of sight of and would affect the following radar systems: Atlantic City ASR-9, Dover AFB DASR, Gibbsboro ARSR-4, and the following SeaSonde High-Frequency Radar systems: Seaside Park, Brant Beach, Strathmere, North Wildwood, Hempstead, Loveladies, Brigantine, and Wildwood (Ocean Wind 2023 citing Westlope Consulting 2019; BOEM 2020). The entire Proposed Action is within the line of sight of the Atlantic City ASR-9, which is expected to affect the radar system's ability to identify aircraft within the 40- to 60-kilometer range from Atlantic City (BOEM 2020). For Gibbsboro ARSR-4, only the tips of a small number of WTGs are within the line of sight, resulting in minimal interference (BOEM 2020). Impacts on the McGuire AFB DASR, Dover AFB WSR-88D, and National Weather Service Philadelphia WSR-88D are not expected, as the WTGs in the Project area would not be within the line of sight.

Potential impacts for radar operations over and in the immediate vicinity of the Project area include unwanted radar returns (clutter) resulting in a partial loss of primary target detection and a number of false primary targets, and partial loss of weather detection including false weather indications (Ocean Wind 2023). Based on review of the COP, the North American Aerospace Defense Command identified minor but acceptable impacts on their radar operations (Sample 2021).

Several options are available to minimize and mitigate impacts. Ocean Wind's radar line-of-sight study recommended a Clear Day Map update to reduce false weather indications at Atlantic City ASR-9. For impacts on the Dover AFB DASR, the study noted that the Range-Azimuth Gate mapping should remove false primary targets in the small area affected. Geocensoring in the Gibbsboro ARSR-4 should remove false primary targets. The Ocean Wind 1 COP, Volume II, Section 2.3.7 provides additional information on the radar line-of-sight study (Ocean Wind 2023). Ocean Wind has committed to continued coordination with FAA, DOD, and NOAA to assess and mitigate impacts on radar operations.

Scientific Research and Surveys

Presence of structures: Scientific research and surveys, particularly for NOAA surveys supporting commercial fisheries and protected-species research programs, could be affected during the construction and operations of the Proposed Action; however, research activities may continue within the proposed Project area, as permissible by survey operators. The Proposed Action would affect survey operations by excluding certain portions of the Lease Area occupied by Project components from sampling, affecting the statistical design of surveys, reducing survey efficiency, and causing habitat alteration within the Wind Farm Area that cannot be monitored. This Final EIS incorporates by reference the detailed analysis of potential impacts on scientific research and surveys provided in the Vineyard Wind 1 Final EIS (BOEM 2021a). The analysis in the Vineyard Wind 1 Final EIS is summarized above under the discussion of the No Action Alternative in Section 3.17.3.2, *Future Offshore Wind Activities (without Proposed Action)*.

The Proposed Action would install up to 98 WTGs with a maximum blade tip of 906 feet (276 meters) above MLLW. Aerial survey track lines for cetacean and sea turtle abundance surveys could not continue at the current altitude (600 feet AMSL) within the Project area because the planned maximum-case scenario for WTG blade tip height would exceed the survey altitude. The increased altitude necessary for safe survey operations could result in lower chances of detecting marine mammals and sea turtles, especially smaller species. Agencies would need to expend resources to update scientific survey methodologies due to construction and operation of the Proposed Action, as well as to evaluate these changes on stock assessments and fisheries management, resulting in major impacts for scientific research and surveys.

3.17.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities.

Marine Mineral Extraction

Presence of structures: The Proposed Action would contribute an undetectable increment to the cumulative impacts on marine mineral extraction, which would be negligible. BOEM anticipates that other offshore wind projects would be designed to avoid existing and proposed mineral extraction areas through consultation with BOEM, USACE, and relevant state and local agencies; therefore, there would be negligible impacts on future mineral extraction activity.

National Security and Military Uses

Presence of structures and traffic: Ongoing and planned activities, including the Proposed Action, would create navigational complexity within the geographic analysis area through the construction and operation of offshore structures. While potential impacts on most military and national security uses are anticipated to be minor, installation of WTGs throughout the geographic analysis area would hinder USCG SAR operations across a larger area, resulting in a moderate impact on SAR operations, potentially leading to increased loss of life. Additionally, the Proposed Action would contribute a noticeable increment to the cumulative vessel traffic impacts, which are most likely to occur during the construction and decommissioning timeframes. This would result in localized, temporary, and minor impacts on military and national security uses.

Aviation and Air Traffic

Presence of structures: Open airspace around the offshore wind lease areas in the geographic analysis area would still exist after all reasonably foreseeable future offshore wind energy projects are built.

BOEM assumes that offshore wind project operators would coordinate with aviation interests throughout the planning, construction, operations, and conceptual decommissioning processes to avoid or minimize impacts on aviation activities and air traffic. The Proposed Action would contribute a noticeable increment to the minor cumulative impacts.

Cables and Pipelines

Presence of structures: The Proposed Action would contribute an undetectable increment to the cumulative impacts from cables and pipelines, which would be localized and long term. However, these impacts would be negligible because they can be avoided by standard protection techniques.

Radar Systems

Presence of structures: Development of offshore wind projects could incrementally decrease the effectiveness of individual radar systems if the field of WTGs expands within the radar system's coverage area. In addition, large areas of installed WTGs could create a large geographic area of degraded radar coverage that could affect multiple radars. Cumulative impacts of the Proposed Action would be moderate, primarily due to the presence of WTGs within the line of sight causing interference with radar systems.

Scientific Research and Surveys

Presence of structures: Cumulative impacts of the Proposed Action would be long term and major on scientific research and surveys, particularly for NOAA surveys that support commercial fisheries and protected-species research programs. The entities conducting scientific research and surveys would have to make significant investments to change methodologies to account for areas occupied by offshore energy components, such as WTGs and cable routes, that are no longer able to be sampled.

3.17.5.3. Conclusions

Impacts of the Proposed Action. Under the Proposed Action, up to 98 WTGs with a maximum blade tip of 906 feet (276 meters) above MLLW would be installed, operate, and eventually be decommissioned within the Project area. The presence of these structures would introduce navigational complexity and increased vessel traffic in the area that would continue to have temporary to long-term impacts that range from **negligible** to **major** on marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, radar systems, and scientific research and surveys.

- <u>Marine Mineral Extraction</u>: The Wind Farm Area and offshore export cable routes for the Proposed Action would avoid sand, gravel borrow, and ocean disposal areas, resulting in **negligible** potential impacts.
- <u>Military and National Security Uses</u>: The installation of WTGs in the Project area would result in increased navigational complexity and increased allision risk, creating potential **moderate** adverse impacts on USCG SAR operations and potential **minor** impacts on all other military and national security uses.
- <u>Aviation and Air Traffic</u>: Potential **minor** impacts on low-level flights would occur, primarily due to the installation of WTGs in the Project area and changes in navigation patterns. Potential impacts on commercial and military flight operations are not anticipated, as WTGs would be constructed under the listed FAA flight level ceiling.
- <u>Cables and Pipelines</u>: Potential impacts on cables and pipelines would be **negligible** due to the use of standard protection techniques to avoid impacts.

- Radar: Potential **minor** adverse impacts on radar systems would primarily be caused by the presence of WTGs within the line of sight causing interference with radar systems. Options are available to minimize or mitigate impacts and Ocean Wind would continue to coordinate with the FAA, DOD, and NOAA on impacts.
- Scientific Research and Surveys: Potential impacts on scientific research and surveys would be **major**, particularly for NOAA surveys supporting commercial fisheries and protected-species research programs. The presence of structures would exclude certain areas within the Project area occupied by Project components (e.g., WTG foundations, cable routes) from potential vessel and aerial sampling, and by affecting survey gear performance, efficiency, and availability.

Cumulative Impacts of the Proposed Action. The incremental impacts contributed by the Proposed Action to the cumulative impacts on other uses would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts associated with the Proposed Action would range from **negligible** to **minor** for aviation and air traffic, cables and pipelines, marine mineral extraction, and most military and national security uses; **moderate** for radar systems and USCG SAR operations; and **major** for NOAA's scientific research and surveys. The presence of structures associated with the Proposed Action and increased risk of allisions are the primary drivers for impacts on other marine uses. Impacts on NOAA scientific research and surveys would qualify as major because entities conducting surveys and scientific research would have to make significant investments to change methodologies to account for unsampleable areas, with potential long-term and irreversible impacts on fisheries and protected-species research as a whole, as well as on the commercial fisheries community.

3.17.6 Impacts of Alternative B, C-1, and D on Other Uses (Marine Minerals, Military Use, Aviation)

Impacts of Alternative B, C-1, and D. The impacts resulting from individual IPFs associated with the construction and installation, O&M, and conceptual decommissioning under Alternatives B-1, B-2, C-1, and D would be similar to those described under the Proposed Action. Construction of Alternatives B and D would install fewer WTGs (9 fewer WTGs for B-1; up to 19 fewer WTGs for B-2; up to 15 fewer for D) and associated inter-array cables, which would slightly reduce the construction impact footprint and installation period. Alternative C-1 would exclude 8 WTGs along the northeastern boundary of the Lease Area or relocate them to the northern portion of the Lease Area. All other design parameters and potential variability in the design would be the same as under the Proposed Action.

Impacts of Alternatives B-1 and B-2 would be similar to those of the Proposed Action for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, and scientific research and surveys. Alternatives B-1 and B-2 could potentially decrease impacts on radar systems by removing the WTGs closest to the shore, which would possibly reduce line-of-sight impacts; however, localized, long-term impacts on radar systems are still anticipated.

Impacts of Alternative C-1 would be similar to those of the Proposed Action for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, and scientific research and surveys. Alternative C-1 could potentially increase adverse impacts on radar systems by adding an additional 8 WTGs to the northern portion of the Lease Area closest to the shore, which would possibly increase line-of-sight impacts; however, localized, long-term impacts on radar systems are still anticipated.

Impacts of Alternative D would be similar to the Proposed Action for cables and pipelines, marine mineral extraction, military and national security uses, radar, aviation and air traffic. Alternative D could potentially reduce localized impacts on scientific research and surveys by avoiding placing structures in sand ridges and troughs; however, the structures present throughout the remainder of the Lease Area would exclude certain portions of the Project area from potential vessel and aerial sampling.

Cumulative Impacts of Alternative B, C-1, and D. The incremental impacts contributed by Alternatives B, C-1, and D to the combined impacts from ongoing and planned activities including offshore wind would be similar to those of the Proposed Action.

3.17.6.1. Conclusions

Impacts of Alternative B, C-1, and D. Implementation of Alternatives B, C-1, and D would not result in meaningfully different types or magnitudes of impacts on other uses as compared to the Proposed Action. The overall level of impact would remain similar to that of the Proposed Action, and the impacts of each alternative alone resulting from individual IPFs associated with these alternatives would be **negligible** for marine mineral extraction, cables and pipelines; **minor** for aviation and air traffic and for radar systems; **minor** for most military and national security uses, but **moderate** for USCG SAR operations; and **major** for scientific research and surveys.

Cumulative Impacts of Alternative B, C-1, and D. The incremental impacts contributed by Alternatives B, C-1, and D to the cumulative impacts on other uses would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts associated with Alternatives B, C-1, and D would range from **negligible** to **minor** for aviation and air traffic, cables and pipelines, marine mineral extraction, and most military and national security uses; **moderate** for radar systems and for USCG SAR operations; and **major** for scientific research and surveys. These impact ratings are primarily driven by the presence of offshore structures such as WTGs in the offshore wind lease areas.

3.17.7 Impacts of Alternative C-2 on Other Uses (Marine Minerals, Military Use, Aviation)

Impacts of Alternative C-2. Construction of Alternative C-2 would create an 0.81-nm to 1.08-nm buffer from WTS in the Ocean Wind 1 Lease Area and WTGs in the Atlantic Shores South Lease Area by compressing the WTG array layout to allow for a full build of up to 98 WTGs. All other design parameters and potential variability in the design would be the same as under the Proposed Action.

Impacts of Alternative C-2 would be similar to those of the Proposed Action for marine mineral extraction, aviation and air traffic, cables and pipelines, and radar. The reduction of the Project’s WTG array spacing to no less than 0.92 nm between rows is not expected to increase impacts on military and national security uses, as deep-draft military vessels are not anticipated to transit outside of navigation channels unless necessary for SAR operations and the separation would still be wide enough for safe navigation for smaller-draft military vessels moving within the WTG array (see Section 3.16, *Navigation and Vessel Traffic*). Although Alternative C-2 would reduce the array spacing to no less than 0.92 nm between rows, the overall magnitude of impacts on scientific research and surveys would remain similar to those described for the Proposed Action, as the area would still likely be excluded from survey operations because the spacing between WTGs would be less than 1 nm.

Cumulative Impacts of Alternative C-2. The incremental impacts contributed by Alternative C-2 to cumulative impacts would be similar to those of the Proposed Action.

3.17.7.1. Conclusions

Impacts of Alternative C-2. The overall level of impact from Alternative C-2 would remain similar to that of the Proposed Action. The impacts of Alternative C-2 alone resulting from individual IPFs would be **negligible** for marine mineral extraction and cables and pipelines; **minor** for aviation and air traffic;

and for radar systems; **minor** for most military and national security uses, but **moderate** for USCG SAR operations; and **major** for scientific research and surveys.

Cumulative Impacts of Alternative C-2. The incremental impacts contributed by Alternative C-2 to the cumulative impacts on other uses would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts associated with Alternative C-2 would range from **negligible** to **minor** for aviation and air traffic, cables and pipelines, and marine mineral extraction; **minor** for most military and national security uses; **moderate** for radar systems and USCG SAR operations; and **major** for scientific research and surveys. These impact ratings are primarily driven by the presence of offshore structures such as WTGs in the offshore wind lease areas.

3.17.8 Impacts of Alternative E on Other Uses (Marine Minerals, Military Use, Aviation)

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. Alternative E would modify the Oyster Creek export cable route to minimize impacts on SAV in Barnegat Bay. Impacts of Alternative E would be similar to those of the Proposed Action for marine mineral extraction, military and national security uses, aviation and air traffic, cables and pipelines, radar, and scientific research and surveys. While Alternative E would slightly increase the length of the export cable, there are no mapped mineral extraction areas or pipelines reasonably close to the offshore export cable route that could be affected by this alternative. Because Alternative E would not result in a change to the WTG array compared to the Proposed Action, there would be no change in impacts for military and national security uses, aviation and air traffic, radar, and scientific research and surveys.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts would be similar to those of the Proposed Action.

3.17.8.1. Conclusions

Impacts of Alternative E. Implementation of Alternative E would not result in meaningfully different types or magnitudes of impacts on other uses as compared to the Proposed Action. The overall level of impact would remain similar to that of the Proposed Action. The impacts of Alternative E alone resulting from individual IPFs would be **negligible** for marine mineral extraction and cables and pipelines; **minor** for aviation and air traffic and for radar systems; **minor** for most military and national security uses, but **moderate** for USCG SAR operations; and **major** for scientific research and surveys.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on other uses would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts from Alternative E would range from **negligible** to **minor** for aviation and air traffic, cables and pipelines, marine mineral extraction, and most military and national security uses; **moderate** for radar systems and USCG SAR operations; and **major** scientific research and surveys. These impact ratings are primarily driven by the presence of offshore structures such as WTGs in the offshore wind lease areas.

3.17.9 Proposed Mitigation Measures

In the Draft EIS, BOEM analyzed general radar systems mitigations as outlined in the BOEM OCS Study 202-039. After publication of the Draft EIS, BOEM coordinated with radar system operating agencies to identify Ocean Wind 1-specific proposed mitigation measures, which are analyzed below and in

Appendix H, Table H-2 and Table H-3. Several measures proposed to minimize impacts on scientific research and surveys and military and national security uses are also analyzed below. If these measures are adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced.

Table 3.17-2 Measures Resulting from Consultations (Also Identified in Appendix H, Table H-2): Other Uses

Measure	Description	Effect
Fiber-optic sensing technology	Distributed fiber-optic sensing (DOFS) technology proposed for the wind energy project or associated transmission cables would be reviewed by the DOD to ensure that DOFS is not used to detect sensitive data from DOD activities, conduct any other type of surveillance of U.S. Government operations, or to otherwise pose a threat to national security.	The mitigation measure would ensure that DOD activities could continue within the Lease Area, as possible while avoiding structures, without the risk of DOFS inadvertently capturing sensitive information from DOD activities. However, the overall Project impact on military and national security uses would remain minor, as the primary cause of the impact level is the presence of WTG structures within the Lease Area.

Table 3.17-3 Additional Proposed Measures (Also Identified in Appendix H, Table H-3): Other Uses

Measure	Description	Effect
Mitigation for oceanographic high frequency radars	BOEM will require that Ocean Wind coordinates with the radar operators and the Surface Currents Program of NOAA Integrated Ocean Observing System (IOOS) Office to assess if the Project causes radar interference to the degree that radar performance is no longer within the specified radar system's operation parameters or fails to meet mission objectives. If either is the case, the lessee must notify BOEM, make publicly available via NOAA IOOS the near real-time accurate numerical telemetry of surface current velocity, wave height, wave period, wave direction, and other oceanographic data measured at Project locations selected by the Lessee in coordination with the affected radar operators and the NOAA IOOS Surface Currents Program; and, if requested by the affected radar operators or the NOAA IOOS Surface Currents Program, share with them accurate numerical time-series data of blade rotation rates, nacelle bearing angles, and other information about the operational state of each turbine in the wind development area to aid interference mitigation.	The proposed mitigation measure would reduce some of the impacts of the Project on oceanographic high-frequency radars and would ensure that the Surface Currents Program could continue to meet its mission objectives. However, the overall impact rating would remain minor, as the mitigation measures are not able to fully eliminate the potential line-of-sight impacts of the WTGs on radar systems.

3.17.9.1. Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.17-2 and Table H-2 in Appendix H, *Mitigation and Monitoring*, are incorporated in the Preferred Alternative. BOEM has identified the following additional measures in Table 3.17-3 as incorporated in the Preferred Alternative: fiber-optic sensing technology and mitigation for oceanographic high-frequency radars. These measures, if adopted, would have the effect of reducing some of the impacts on radar systems and military and national security uses. Identified as a result of Military Aviation and Installation Assurance Siting Clearinghouse reviews, the fiber-optic sensing technology mitigation measure would enable DOD to review the distributed fiber-optic sensing technology proposed for the Project and associated transmission cables to ensure the DOFS are not being used to detect sensitive data from DOD activities. The mitigation measure would ensure that DOD activities could continue within the Lease Area without the risk of distributed fiber-optic sensing inadvertently capturing sensitive information from DOD activities, which could pose a risk to national security. However, the overall Project impact on military and national security uses would remain minor, as the primary cause of the impact level is the presence of WTG structures creating increased navigational complexity within the Lease Area. The mitigation measure for oceanographic high-frequency radars was developed through coordination with the NOAA Integrated Ocean Observing System Office. This mitigation measure would de-conflict Ocean Wind 1 development and the ability of this office to meet mission objectives and would reduce impacts; however, the overall Project impact on radar systems would remain minor.

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3.18. Recreation and Tourism

This section discusses potential impacts on recreation and tourism resources and activities from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area, as shown on Figure 3.18-1, includes the 40-mile (64.4-kilometer) visual analysis area measured from the borders of the Wind Farm Area. The geographic analysis area encompasses Cape May County entirely and parts of Atlantic, Burlington, Cumberland, and Ocean Counties. Other offshore wind activities in the recreation and tourism geographic analysis area includes Ocean Wind 1, Ocean Wind 2, Atlantic Shores South, Atlantic Shores North, Garden State Offshore Energy, Skipjack, Hudson South A, Hudson South E, and Hudson South F. Section 3.11, *Demographics, Employment, and Economics*, discusses the economic aspects of recreation and tourism in the Project area.

3.18.1 Description of the Affected Environment for Recreation and Tourism

Regional Setting

Proposed Project facilities would be within and off the coast of New Jersey. The coastal areas support ocean-based recreation and tourist activities that include boating, swimming, surfing, scuba diving, sailing, and paddle sports. As indicated in Section 3.11, *Demographics, Employment, and Economics*, recreation and tourism contribute substantially to the economies of New Jersey's coastal counties. More than 96 million people visited New Jersey in 2021, with $37.3 billion in visitor spending in the state (Tourism Economics 2021). Tourism in New Jersey's coastal communities is a multibillion-dollar industry. Approximately 42.9 million people visited Cape May, Atlantic, Burlington, and Ocean Counties in 2021, or 44 percent of the total visitors to the state (Tourism Economics 2021). More than 1.8 million people visited Island Beach, Barnegat Lighthouse, and Cape May Point state parks in 2016, while over 688,000 used the state's marinas (NJDEP 2018a).

Coastal New Jersey has a wide range of visual characteristics, with communities and landscapes ranging from large cities to small towns, suburbs, rural areas, and wildlife preserves. As a result of the proximity of the Atlantic Ocean, as well as the views associated with the shoreline, the New Jersey shore has been extensively developed for water-based recreation and tourism.

The scenic quality of the coastal environment is important to the identity, attraction, and economic health of many of the coastal communities. Additionally, the visual qualities of these historic coastal towns, which include marine activities within small-scale harbors, and the ability to view birds and marine life are important community characteristics.

Project Area

Recreational and tourist-oriented activities are concentrated in the coastal communities in Atlantic, Cape May, and Ocean Counties, which are some of the most densely populated coastal communities in the U.S. Coastal communities provide hospitality, entertainment, and recreation for hundreds of thousands of visitors each year. Although many of the coastal and ocean amenities, such as beaches, that attract visitors to these regions are accessible to the public for free and thus do not directly generate employment, these nonmarket features function as key drivers for recreation and tourism businesses.

Water-oriented recreational activities in the Project area include boating, visiting beaches, hiking, fishing, shellfishing, and bird and wildlife viewing. Boating covers a wide range of activities, from ocean-going vessels to small boats used by residents and tourists in sheltered waters, and includes sailing, sailboat races, fishing, shellfishing, kayaking, canoeing, and paddleboarding.

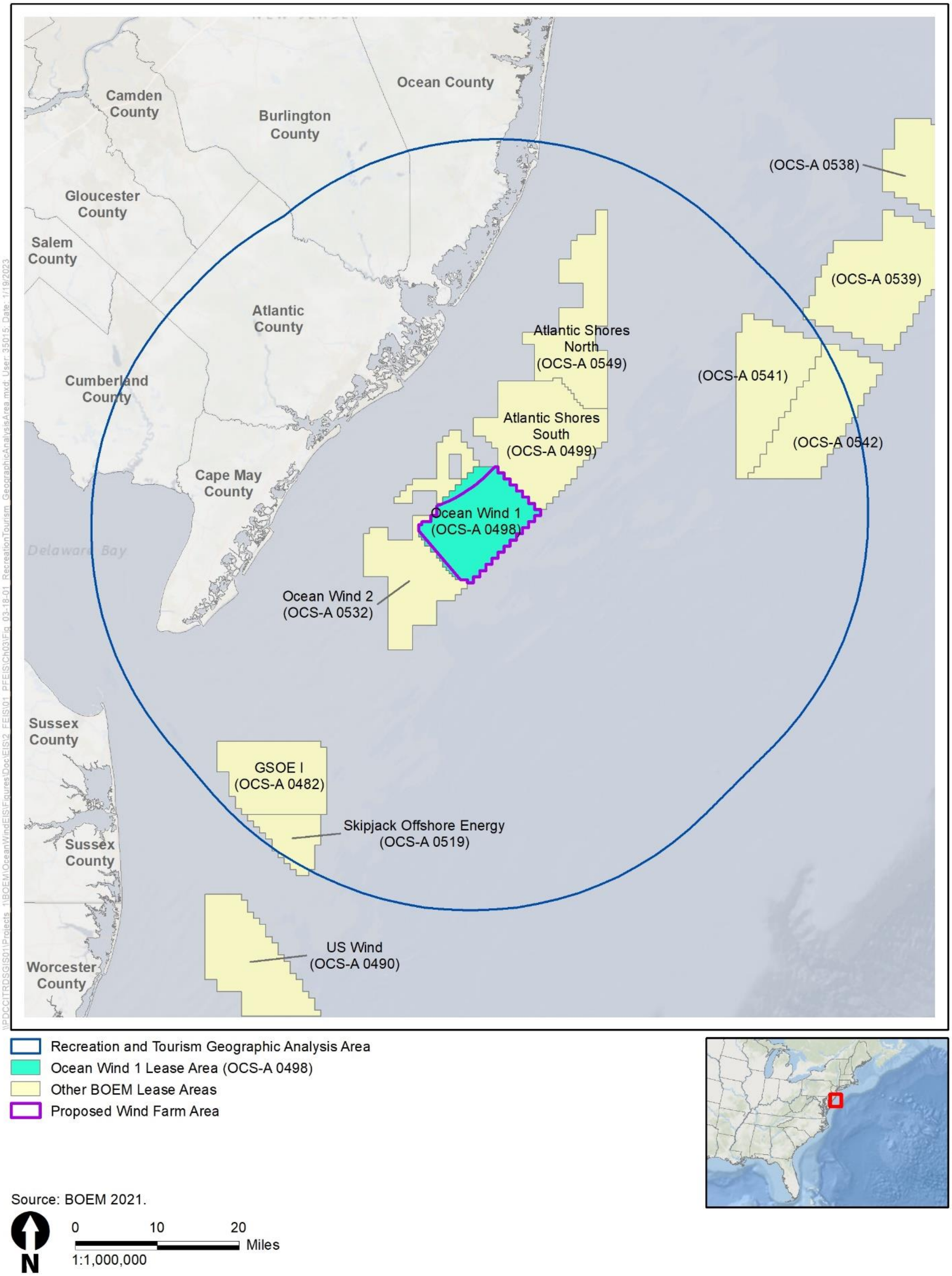

Figure 3.18-1 Recreation and Tourism Geographic Analysis Area

Commercial businesses offer boat rentals, private charter boats for fishing, whale watching and other wildlife viewing, and tours with canoes and kayaks. As discussed in Section 3.11 (*Demographics, Employment, and Economics*), recreation and hospitality are major sectors of the economy in Atlantic, Cape May, and Ocean Counties, supported by the ocean-based recreation uses.

Inland recreational facilities are also popular but bear less of a relationship to possible impacts of the Project; this section does not address them in detail. These include inland waters such as ponds and rivers, wildlife sanctuaries, golf courses, athletic facilities, parks, and picnic grounds.

Coastal and Offshore Recreation

Recreational boating activities occur along the coastline, especially during the summer months (MARCO 2018). Swimming is also popular during the summer months along the miles of white sand beaches in New Jersey (COP Volume II, Section 2.3.3; Ocean Wind 2023). Surfing can occur year-round, with the prime season in the fall. Surfers frequent several towns and cities along the coastline, including Ocean City and Atlantic City (New Jersey Department of State 2021a). Scuba diving and snorkeling are identified as dominant uses offshore from approximately Atlantic City south through the coastline of Cape May County (COP Volume II, Section 2.3.3; Ocean Wind 2023) with dive sites that include shipwrecks, artificial reefs, beach dives, and various inland sites. The sailing season typically runs from May to October in New Jersey (New Jersey Department of State 2021b) and primarily occurs in relatively small areas within the bays and inlets and just along the coastline (COP Volume II, Section 2.3.3; Ocean Wind 2023).

There is a large and robust recreational fishing industry in New Jersey. The *Fisheries Economics of the United States Report of 2019* estimates that recreational fishing had a $3.88 million impact on New Jersey's economy in 2019 (NOAA 2022c). Collectively, there were over 117 million recreational angler trips (i.e., party boats, rental/private boats, and shore) made in New Jersey from 2012 to 2019 (NOAA 2022c). There are several areas classified as Prime Fishing Areas by NJDEP, which are areas that have a history of supporting a significant local quantity of recreational and commercial fishing activity (see Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*). The popular recreational saltwater species in New Jersey are primarily caught from May to October. There are also annual recreational fishing tournaments held in coastal towns in New Jersey. Saltwater fishing tournaments target a variety of fish including stripers, fluke, bluefish, black drum, weakfish, northern kingfish, sea bass, tautog, tuna, and shark (COP Volume II; Ocean Wind 2023). According to NOAA Fisheries One Stop Shop database, recreational anglers off the coast of New Jersey caught 27,884,119 pounds of fish in 2015; 36,790,649 pounds in 2016; 36,002,306 pounds in 2017; 27,819,980 pounds in 2018; and 21,344,901 pounds in 2019 (NOAA n.d.).

NOAA's social indicator mapping (NOAA 2022b) identifies the importance or level of dependence of recreational fishing to coastal communities. Several communities in the geographic analysis area have a high recreational fishing reliance, which measures the presence of recreational fishing in relation to the population size of a community, and high recreational fishing engagement, which measures the presence of recreational fishing through fishing activity estimates. The communities with the highest reliance on recreational fishing are Cape May and Barnegat Light; Atlantic City has a low reliance on recreational fishing. Communities with the highest recreational fishing engagement are Cape May, Atlantic City, Barnegat Light, and Ocean City; the rest of the New Jersey coast within the geographic analysis area has a low or medium recreational fishing engagement. The communities with the highest recreational fishing reliance and recreational fishing engagement would be most affected by impacts on recreational fishing from offshore wind development.

Recreational crabbing is important to the region and occurs primarily along the bays and creeks on the Jersey Shore, especially in the upper portion of Barnegat Bay, Little Egg Harbor, and the Maurice River estuary, which contribute 65 to 86 percent of the total recreational harvest (NJDEP 2018b). The peak crabbing season occurs from mid-June until early October and is especially good in August.

Atlantic County

Atlantic County lies in the southern peninsula of New Jersey and encompasses approximately 671 square miles (BOEM 2012a). There are nine harbors, 12 marinas/boatyards, and one yacht club (BOEM 2012a). The county is best known for its boardwalk along the beach of Atlantic City, which is the largest casino resort area on the East Coast, composed of twelve 24-hour/7-day-a-week casinos with restaurants, nightclubs, and game rooms. It has approximately 20 miles of shoreline with four public beaches, which collectively total over 14 miles (BOEM 2012a). There are several boat launches and marinas in the county, which have small recreational boat rentals. Recreational fishing is permitted on the beaches, outside of guarded areas, and from the jetties. There are also multiple fishing piers available to the public. The seawall is a popular area for fishing and crabbing (COP Volume II, Section 2.3.3; Ocean Wind 2023).

Cape May County

Cape May is New Jersey's southernmost county and encompasses 620 square miles, receiving millions of visitors annually. It has 30 miles of shoreline and is considered one of the premiere remote beach destinations along the Mid-Atlantic coast. The county has 14 beaches, six harbors, 32 marinas/boatyards, and six yacht clubs. It has two boardwalk beaches but the majority of oceanfront property is undeveloped, with few stores, beachside amenities, and amusement rides (BOEM 2012a). Popular activities at the boardwalks include shopping, dining, rides, and walking along the boardwalk. The more remote beaches are utilized for sunbathing, swimming, and beachcombing. Surfing, sailing, boating, fishing, diving, and kayaking are also popular offshore activities. Recreational fishing occurs along the back bays and from the surf, piers, and boats along the Jersey Cape (COP Volume II, Section 2.3.3; Ocean Wind 2023).

Cumberland County

Cumberland County's shore is along the Delaware Bay, which offers miles of undisturbed bay shore. Coastal recreation in Cumberland County includes boating, fishing, and bird watching. Cumberland County dining options for tourists feature local delicacies such as the sweet oysters found in the Delaware Bay (Cumberland County 2021).

Ocean County

Ocean County is in the center of the Jersey Shore region and is approximately 916 square miles. The county provides an array of recreational beaches, boardwalks, and wildlife areas. There are 19 beaches, six harbors, nearly 50 marinas/boatyards, and 25 yacht clubs (BOEM 2012a). The majority of tourism in Ocean County is focused on barrier beaches, such as Island Beach State Park, as well as the natural, shoreline areas. Island Beach State Park is a narrow barrier island stretching for 10 miles between the Atlantic Ocean and Barnegat Bay (COP Volume II, Section 2.3.3; Ocean Wind 2023). Island Beach State Park has received Land and Water Conservation Fund funding through the State and Local Assistance Program. The State and Local Assistance Program is administered by the National Park Service and provides matching grants to state, local, and tribal governments to create and expand their parks, develop recreational facilities, and further the local recreation (NPS 2021). The National Park Service will need to analyze potential conversion per 36 CFR 59.3, Conversion Requirements. Popular activities include sunbathing, swimming, and beachcombing. The shoreline is also popular for recreational fishing, with multiple bait and tackle shops, marinas, boat rentals, and public fishing piers (COP Volume II, Section 2.3.3; Ocean Wind 2023).

Onshore Recreation

Atlantic County

A majority of the Tuckahoe-Corbin City Fish and Wildlife Management Area is within the county and consists of approximately 17,500 acres of tidal marsh, woodlands, fields, and impoundments (NJDEP 2018c; COP Volume II, Figure 2.3.3-2; Ocean Wind 2023). Eight wildlife management areas totaling 35,613 acres also fall within Atlantic County: Absecon (3,946 acres), Great Egg Harbor River (6,825 acres), Hammonton Creek (5,720 acres), Makepeace Lake (11,737 acres), Malibu Beach (257 acres), Maple Lake (4,789 acres), Pork Island (867 acres), and Port Republic (1,471 acres) (NJDEP 2021a).

There were 827 accommodation and food service establishments in the county in 2019. Together, these generated over $1.2 billion in annual payroll. There were 113 arts, entertainment, and recreation establishments in Atlantic County, which bring in approximately $41 million in annual payroll. Approximately 13.4 percent of all housing units in Atlantic County are for seasonal, occupational, or occasional use (U.S. Census Bureau 2021a, 2021b).

Burlington County

Burlington County boarders Atlantic and Ocean Counties at the mouth of the Mullica River and stretches northwest to the Delaware River, which is the state border with Pennsylvania. The portion of Burlington County in the geographic analysis area is primarily state land, including parts of Wharton State Forest, Penn State Forest, Bass River State Forest, and Swan Bay Wildlife Management Area (NJDEP 2021b). Recreation activities in the area include hiking and biking (Burlington County n.d.).

Cape May County

There are many parks, state forests, and wildlife management areas in Cape May County. The Cape May National Wildlife Refuge encompasses 11,500 acres of grasslands, saltmarshes, and beachfront (BOEM 2012a; COP Volume II, Figure 2.3.3-2; Ocean Wind 2023). The Cape May Coastal Wetlands Wildlife Management Area extends along the coast of Cape May County and occupies approximately 17,800 acres (COP Volume II, Section 2.3.3; Ocean Wind 2023).

There were 917 accommodation and food service establishments in the county in 2019. Together, these generated over $240 million in annual payroll. There were 143 arts, entertainment, and recreation establishments in Cape May County, which bring in approximately $50 million in annual payroll. Approximately 50.9 percent of all housing units in Cape May County are for seasonal, occupational, or occasional use (U.S. Census Bureau 2021a, 2021b).

Cumberland County

Inland Cumberland County is home to wild and scenic rivers, which offer opportunities for boating, fishing, and birdwatching. Cumberland County also has golf courses, historic sites and tours, a performing arts center, a downtown arts district, museums, and a zoo (Cumberland County 2021).

Thirteen wildlife management areas totaling at least 50,872 acres fall within Cumberland County: Buckshutem (4,222 acres), Cedarville Ponds (42 acres), Clarks Pond (196 acres), Cohansey River (1,474 acres), Dix (5,408 acres), Egg Island (8,992 acres), Fortescue (1,951 acres), Heislerville (7,695 acres), Menantico Ponds (474 acres), Milville (16,403 acres), Nantuxent (1,144 acres), and New Sweden (2,871 acres). The 34,153-acre Peaslee Wildlife Management Area resides in both Cumberland and Cape May Counties (NJDEP 2021a).

Ocean County

Ocean County has 27 parks and conservation areas with over 40,000 acres of wildlife management areas. Twelve wildlife management areas fall within Ocean County: Butterfly Bogs (166 acres), Colliers Mills (12,968 acres), Forked River Mountain (2,121 acres), Great Bay Boulevard (5,982 acres), Manahawkin (1,791 acres), Manchester (3,802 acres), Oyster Creek Access (14 acres), Point Pleasant Fishing Access (7 acres), Sedge Islands (193 acres), Stafford Forge (12,592 acres), Upper Barnegat Bay (427 acres), and Whiting (1,212 acres) (NJDEP 2021a). The Edwin B. Forsythe National Wildlife Refuge consists of more than 47,000 acres of coastal habitats and provides wildlife viewing and nature trails (New Jersey Department of State 2021c). The Barnegat Lighthouse State Park is on the northern tip of Long Beach Island, includes provides panoramic views of Barnegat Inlet, and provides trails through maritime forests, birding sites for waterfowl, fishing sites, and nature walks (New Jersey Department of State 2021d). Other popular activities in the county include hiking, biking, kayaking, golfing, and sightseeing (Ocean County 2021).

There were 1,292 accommodation and food service establishments in the county in 2019. Together, these generated over $342 million in annual payroll. There were 272 arts, entertainment, and recreation establishments in Ocean County, which bring in approximately $116 million in annual payroll. Approximately 6.4 percent of all housing units in Ocean County are for seasonal, occupational, or occasional use (U.S. Census Bureau 2021a, 2021b).

3.18.2 Environmental Consequences

3.18.2.1. Impact Level Definitions for Recreation and Tourism

Definitions of impact levels are provided in Table 3.18-1.

Table 3.18-1 Impact Level Definitions for Recreation and Tourism

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on the recreation setting, recreation opportunities, or recreation experiences would be so small as to be unmeasurable.
	Beneficial	No effect or measurable impact.
Minor	Adverse	Impacts would not disrupt the normal functions of the affected activities and communities.
	Beneficial	A small and measurable improvement to infrastructure/facilities and community services, or benefit for tourism.
Moderate	Adverse	The affected activity or community would have to adjust somewhat to account for disruptions due to the Project.
	Beneficial	A notable and measurable improvement to infrastructure/facilities and community services, or benefit for tourism.
Major	Adverse	The affected activity or community would have to adjust to significant disruptions due to large local or notable regional adverse impacts of the Project.
	Beneficial	A large local, or notable regional improvement to infrastructure/facilities and community services, or benefit for tourism.

3.18.3 Impacts of the No Action Alternative on Recreation and Tourism

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on recreation and tourism, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for recreation and tourism. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.18.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, recreation and tourism in the geographic analysis area described in Section 3.18.1, *Description of the Affected Environment for Recreation and Tourism*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities.

Recreation and tourism would continue to be affected by ongoing activities, especially ongoing vessel traffic; noise and trenching from periodic maintenance or installation of piers, pilings, seawalls, and offshore cables; and onshore development activities. These activities would contribute to periodic disruptions to recreational and tourism activities but are a typical part of daily life along the New Jersey coastline and would not substantially affect recreational enjoyment in the geographic analysis area. Visitors would continue to pursue activities that rely on the area’s coastal and ocean environment, scenic qualities, natural resources, and establishments that provide services for tourism and recreation. The geographic analysis area has a strong tourism industry and abundant coastal and offshore recreational facilities, many of which are associated with scenic views. The beach, and by proxy the ocean, is a primary concern for the local jurisdictions’ tourism industry (NJCRDA 2012, Cape May County n.d.). See Table F1-20 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for recreation and tourism. There are no ongoing offshore wind activities within the geographic analysis area for recreation and tourism.

3.18.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned activities (without the Proposed Action). Planned non-offshore wind activities that may affect recreation and tourism include emplacement of submarine cables and pipelines, dredging and port improvements, marine mineral use, and military use (see Section F.2 in Appendix F for a description of ongoing and planned activities). Like ongoing activities, other planned non-offshore wind activities may result in periodic disruptions to recreation and tourism activities along the coast. However, visitors are expected to be able to continue to pursue activities that rely on other coastal and ocean environments, scenic qualities, natural resources, and establishments that provide services to recreation and tourism. BOEM expects planned offshore wind activities to affect recreation and tourism through the following primary IPFs.

Anchoring: This IPF would potentially affect recreational boating through both the presence of an increased number of anchored vessels within the geographic analysis area and the creation of offshore areas with cable hardcover or scour protection where recreational vessels may experience limitations or difficulty in anchoring.

Increased vessel anchoring during offshore wind development between 2023 and 2030 would affect recreational boaters. The greatest volume of anchored vessels would occur in offshore work areas during construction. The COP estimated there would be a maximum of 65 daily vessel trips generated during peak construction periods of the Proposed Action (Section 3.16, *Navigation and Vessel Traffic*). Offshore wind projects may generate similar numbers of active and anchored vessels, depending on project size and construction schedule. Anchored construction-related vessels may be within temporary safety zones established in coordination with USCG for active construction areas (COP Volume II, Section 2.3.6.2.1; Ocean Wind 2023). Offshore wind development in the geographic analysis area is anticipated to result in increased survey activity and overlapping construction periods between 2023 and 2030.

Vessel anchoring would also occur during maintenance and monitoring activities during operations. Following construction of other offshore projects (if approved), the presence of operating offshore wind projects in the geographic analysis area would result in a long-term increase in the number of vessels anchored during periodic maintenance and monitoring. Vessel anchoring during maintenance and monitoring would have moderate impacts on recreation and tourism.

Anchored construction, survey, or service vessels would have localized, temporary impacts on recreational boating. Recreational vessels could navigate around anchored vessels with only brief inconvenience. The temporary turbidity from anchoring would briefly alter the behavior of species important to recreational fishing (Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*) and sightseeing (primarily whales, but also dolphins and seals) (Section 3.15, *Marine Mammals*). Inconvenience and navigational complexity for recreational vessels would be localized, variable, and long term, with increased frequency of anchored vessels during surveying and construction and reduced frequency of anchored vessels during operations. Construction, survey, and service vessel anchoring would have moderate impacts on recreation and tourism.

Land disturbance: Other offshore wind development would require installation of onshore export cables and onshore substation infrastructure, which would cause temporary traffic delays and could temporarily affect access to adjacent properties, resulting in localized, temporary disturbances of recreational activity or tourism-based businesses near cable routes and construction sites for substations and other electrical infrastructure. These impacts would only last through construction and occasionally during maintenance events. The exact extent of impacts would depend on the locations of landfall and onshore transmission cable routes for offshore wind energy projects; however, the No Action Alternative would generally have localized, short-term minor impacts during construction or maintenance and no long-term impacts on recreation and tourism use.

Lighting: Construction-related nighttime vessel lighting would be used if offshore wind development projects include nighttime, dusk, or early morning construction or material transport. In a maximum-case scenario, lights could be active throughout nighttime hours for up to eight other offshore wind projects within the geographic analysis area simultaneously under active construction. Vessel lighting would enable recreational boaters to safely avoid nighttime construction areas. The impact on recreational boaters would be localized, sporadic, short term, and minimized by the limited offshore recreational activities that occur at night.

Permanent aviation warning lighting required on the WTGs would be visible from beaches and coastlines within the geographic analysis area and could have impacts on recreation and tourism in certain locations if the lighting influences visitor decisions in selecting coastal locations to visit. FAA hazard lighting systems would be in use for the duration of O&M for up to 761 WTGs. The amassing of these WTGs and associated synchronized flashing strobe lights affixed with a minimum of three red flashing lights at the mid-section of each tower and one at the top of each WTG nacelle within the offshore wind lease areas would have long-term minor to major impacts on sensitive onshore and offshore viewing locations, based on viewer distance and angle of view and assuming no obstructions. Atmospheric and environmental factors such as haze and fog would influence visibility and perception of hazard lighting from sensitive viewing locations (Section 3.20).

A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 miles from the viewer would have negligible impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018). The study participants viewed visual simulations of WTGs in clear, hazy, and nighttime conditions (without ADLS). A 2017 visual preference study conducted by North Carolina State University evaluated the impact of offshore wind facilities on vacation rental prices. The study found that nighttime views of aviation hazard lighting (without ADLS) for WTGs close to shore (5 to 8 miles [8 to 13 kilometers]) would adversely affect the rental price of properties with ocean views (Lutzeyer et al. 2017). It did not specifically address the relationship between lighting, nighttime views, and tourism for WTGs 15 or more miles (24.1 or more kilometers) from shore. More than 95 percent of the WTG positions likely to be present based on anticipated offshore wind lease area build-out in the geographic analysis area would be more than 15 miles (24.1 kilometers) from coastal locations with views of the WTGs.

The Jersey Shore is within the viewshed of the WTGs and has been extensively developed for recreation and tourism. Because of the high development density, existing nighttime lighting is prevalent. Elevated boardwalks, jetties, and seawalls afford greater visibility of offshore elements for viewers in tidal beach areas. Nighttime views toward the ocean from the beach and adjacent inland areas are diminished by ambient light levels and glare of shorefront developments. Visible aviation warning lighting would add a developed/industrial visual element to views that were previously characterized by dark, open ocean, broken only by transient lighted vessels and aircraft passing through the view.

In addition to recreational fishing, some recreational boating in the region involves whale watching and other wildlife-viewing activity. A 2013 BOEM study evaluated the impacts of WTG lighting on birds, bats, marine mammals, sea turtles, and fish. The study found that existing guidelines “appear to provide for the marking and lighting of [WTGs] that will pose minimal if any impacts on birds, bats, marine mammals, sea turtles or fish” (Orr et al. 2013). By extension, existing lighting guidelines or ADLS (if implemented) would impose a minimal impact on recreational fishing or wildlife viewing.

As a result, although lighting on WTGs would have a continuous, long-term, adverse impact on recreation and tourism, the impact in the geographic analysis area is likely to be limited to individual decisions by visitors to the Jersey Shore and elevated areas, with less impact on the recreation and tourism industry as a whole. Lighting impacts on recreation and tourism are anticipated to be negligible.

The implementation of ADLS would activate the hazard lighting system in response to detection of nearby aircraft. The synchronized flashing of the navigational lights, if ADLS is implemented, would result in shorter-duration night sky impacts on the seascape, landscape, and viewers. The shorter-duration synchronized flashing of the ADLS is anticipated to have reduced visual impacts at night as compared to the standard continuous, medium-intensity red strobe FAA warning system due to the duration of activation. Based on recent studies (Atlantic Shores 2021), activation of the Ocean Wind 1 ADLS, if implemented, would occur for less than 11 hours per year, as compared to standard continuous FAA hazard lighting. It is anticipated that the reduced time of FAA hazard lighting resulting from an implemented ADLS would reduce the duration of potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS.

Cable emplacement and maintenance: Under the No Action Alternative, other offshore wind export cables in the recreation and tourism geographic analysis area could total 961 miles, while inter-array cables could total 1,466 miles (excluding the Proposed Action). Cables for other offshore wind projects would likely be emplaced within the geographic analysis area between 2023 and 2030. Offshore cable emplacement for offshore wind development projects would have temporary, localized, adverse impacts on recreational boating while cables are being installed, because vessels would need to navigate around work areas and recreational boaters would likely prefer to avoid the noise and disruption caused by installation. Cable installation could also have temporary impacts on fish and invertebrates of interest for recreational fishing, due to the required dredging, turbulence, and disturbance; however, species would recover upon completion (Section 3.13). The degree of temporal and geographic overlap of each cable is unknown, although cables for some projects could be installed simultaneously. Active work and restricted areas would only occur over the cable segment being emplaced at a given time. Once installed, cables would affect recreational boating only during maintenance operations, except that the mattresses covering cables in hard-bottom areas could hinder anchoring and result in gear entanglement or loss.

Impacts of cable emplacement and maintenance on recreational boating and tourism would be short term, continuous, adverse, and localized. Disruptions from cable emplacement and maintenance are anticipated to have a minor impact of recreation and tourism.

Noise: Noise from construction, pile driving, HRG survey activities, trenching, O&M, and vessels could result in adverse impacts on recreation and tourism.

Onshore construction noise from cable installation at the landfall sites, and inland if cable routes are near parkland, recreation areas, or other areas of public interest, would temporarily disturb the quiet enjoyment of the site (in locations where such quiet is an expected or typical condition). Similarly, offshore noise from HRG survey activities, pile driving, trenching, and construction-related vessels would intrude upon the natural sounds of the marine environment. This noise could cause some boaters to avoid areas of noise-generating activity, although some of the most intense noise could be within safety zones that USCG may establish within 12 nm of the coast for areas of active construction, which would be off-limits to boaters. Noise from pile driving, the noisiest aspect of WTG installation, is estimated to be 101 A-weighted decibels (dBA) at 50 feet (COP Volume III, Appendix R-1, Section 2.5; Ocean Wind 2023). BOEM conducted a qualitative analysis of impacts on recreational fisheries for the construction phases of offshore wind development in the Atlantic OCS region. Results showed the construction phase is expected to have a slightly negative to neutral impact on recreational fisheries due to both direct exclusion of fishing activities and displacement of mobile target species by the construction noise (Kirkpatrick et al. 2017). The impact of noise on recreation and tourism during construction would be adverse, intense, and disruptive, but short term and localized.

Adverse impacts of noise on recreation and tourism would also result from the adverse impacts on species important to recreational fishing and sightseeing within the recreation and tourism geographic analysis area and along cable routes, as discussed in Sections 3.9, 3.13, and 3.15. HRG survey noise and pile driving would cause the most impactful noises (COP Volume III, Appendix R-2, Section C-3; Ocean Wind 2023). Because most recreational fishing takes place closer to shore, only a small proportion of recreational fishing would be affected by construction noise of WTGs, 15.3 miles (25.9 kilometers) offshore. Recreational fishing for highly migratory species, such as tuna, shark, and marlin, is more likely to be affected, as the highly migratory species fishery usually occurs farther offshore than most recreational fisheries and, therefore, is more likely to experience temporary impacts resulting from the noise generated by offshore wind construction. Construction noise could contribute to temporary impacts on marine mammals, with resulting impacts on marine sightseeing that relies on the presence of mammals, primarily whales. However, as noted in Section 3.15, other projects are expected to comply with mitigation measures (e.g., exclusion zones, protected species observers) that would avoid and minimize underwater noise impacts on marine mammals.

Offshore wind surveying and construction would occur within the geographic analysis area between 2023 and 2030. Based on the discussion above, offshore wind construction would result in short-term, localized, adverse impacts on recreational fishing and marine sightseeing related to fish and marine mammal populations. Multiple construction projects would increase the spatial and temporal extent of temporary disturbance to marine species within the geographic analysis area. BOEM’s assumed construction schedule for offshore wind projects in Table F2-1 in Appendix F indicates the possibility of up to eight (not including the Proposed Action) wind projects under development between 2024 and 2030 in the recreation and tourism geographic analysis area. As indicated in Appendix F, up to 851 offshore WTGs could be installed within a 6- to 10-year period within the recreation and tourism geographic analysis area, not including the Proposed Action. No long-term, adverse impacts are anticipated that would result in population-level harm to fish and marine mammal populations.

During operations, the continuous noise generated by WTG operation would occur at least 13 nm offshore and is not expected to produce sound in excess of background levels at any onshore locations (COP Volume III, Appendix R-1, Section 2.6; Ocean Wind 2023). Noise from operational WTGs would be expected to have little effect on finfish, invertebrates, and marine mammals and, therefore, little effect on recreational fishing or sightseeing. The impact of noise during O&M is anticipated to be negligible and localized, continuous, and long term, with brief, more-intensive noise during occasional repair activities.

Port utilization: Ports within the geographic analysis area for recreation and tourism that could be used for construction and O&M of offshore wind development include ports in Atlantic City and Port Elizabeth, New Jersey. These ports may also provide facilities for recreational vessels or may be on waterways shared with recreational marinas, and may experience increased activity, expansion, or dredging. The ports listed above and other regional ports suitable for staging and construction of other offshore wind development are primarily industrial in character, with recreational activity as a secondary use.

Port improvements could result in short-term delays and crowding during construction but could provide long-term benefits to recreational boating if the improvements result in increased berths and amenities for recreational vessels, or improved navigational channels. The impact of port utilization on recreation and tourism is anticipated to be negligible.

Presence of structures: The placement of 761 WTGs (excluding the Proposed Action) within the recreation and tourism geographic analysis area would contribute to impacts on recreational fishing and boating. The offshore structures would have long-term, adverse impacts on recreational boating and fishing through the risk of allision; risk of gear entanglement, damage, or loss; navigational hazards; space use conflicts; presence of cable infrastructure; and visual impacts. However, offshore wind structures could have beneficial impacts on recreation through fish aggregation and reef effects.

The WTGs installed for offshore wind development (excluding the Proposed Action) are expected to serve as additional artificial reef structures, providing additional locations for recreational for-hire fishing trips, potentially increasing the number of trips and revenue. The increased number of fishing trips out of nearby ports could also support increased angler expenditures at local bait shops, gas stations, and other shore-side dependents.

The presence of offshore wind structures would increase the risk of allision or collision with other vessels and the complexity of navigation within the recreation and tourism geographic analysis area. Generally, the vessels more likely to allide with WTGs or substations would be smaller vessels moving within and near wind installations, such as recreational vessels. USCG would need to adjust its SAR planning and search patterns to allow aircraft to fly within the geographic analysis area, leading to a less-optimized search pattern and a lower probability of success, as described in greater detail in Section 3.17, *Other Uses (Marine Minerals, Military Use, Aviation).*

Offshore wind development could require adjustment of routes for recreational boaters, anglers, sailboat races, and sightseeing boats, but the adverse impact of the offshore wind structures on recreational boating would be limited by the distance offshore. Recreational boating routes in the geographic analysis area are highly concentrated in Great Egg Harbor Bay and Great Egg Inlet, with mid-level concentrations in Absecon Inlet, far from offshore wind developments. In addition, sailing in the geographic analysis area primarily occurs in relatively small areas within the bays and inlets and just along the coastline (COP Volume II, Section 2.3.3.1; Ocean Wind 2023).

The recreation and tourism geographic analysis area would have an estimated 761 WTG foundations with scour protection and cable protection for export and inter-array cables, which results in an increased risk of entanglement. The cable protection would also present a hazard for anchoring, as anchors could have difficulty holding or become snagged and lost. Accurate marine charts could make operators of recreational vessels aware of the locations of the cable protection and scour protection. If the hazards are not noted on charts, operators may lose anchors, leading to increased risks associated with drifting vessels that are not securely anchored. Buried offshore cables would not pose a risk for most recreational vessels, as smaller-vessel anchors would not penetrate to the target burial depth for the cables. Because anchoring is uncommon in water depths where the No Action Alternative WTGs would be installed, anchoring risk is more likely to be an impact over export cables in shallower water closer to coastlines. The risk to recreational boating would be localized, continuous, and long term.

Offshore WTGs could provide new opportunities for offshore tourism by attracting recreational fishing and sightseeing. The structures could produce artificial reef effects. The “reef effect” refers to the introduction of a new hard-bottom habitat that has been shown to attract numerous species of algae, shellfish, finfish, and sea turtles to new benthic habitat (COP Volume II, Section 2.2.5; Ocean Wind 2023). The reef effect could attract species of interest for recreational fishing, including spearfishing, and result in an increase in recreational boaters traveling farther from shore to fish within the recreation and tourism geographic analysis area. The potential attraction of sea turtles to the structures may also attract recreational boaters and sightseeing vessels. Although the likelihood of recreational vessels visiting the offshore WTGs would diminish with distance from shore (Parsons et al. 2020), increasing numbers of offshore structures may encourage a greater volume of recreational vessels to travel to the offshore wind lease areas. Additional fishing and tourism activity generated by the presence of structures could also increase the likelihood of allisions and collisions involving recreational fishing or sightseeing vessels, as well as commercial fishing vessels (Section 3.9).

As it relates to the visual impacts of structures, the vertical presence of WTGs on the offshore horizon may affect recreational experience and tourism in the geographic analysis area. Section 3.20 describes the visual impacts from offshore wind infrastructure. If the purpose of the viewer’s sightseeing excursion is to observe the mass and scale of the WTGs’ offshore presence, then the increasing visual dominance would benefit the recreation/tourism experience as the viewer navigates toward the WTGs. However, if experiencing a vast pristine ocean condition is the purpose of the viewer’s sightseeing excursion, then the increasing visual dominance may detract from the viewer’s recreation/tourism experience.

Studies and surveys that have evaluated the impacts of offshore wind facilities on tourism found that established offshore wind facilities in Europe did not result in decreased tourist numbers, tourist experience, or tourist revenue, and that Block Island Wind Farm’s WTGs provide excellent sites for fishing and shellfishing (Smythe et al. 2018). A survey-based study found that, for prospective offshore wind facilities (based on visual simulations), proximity of WTGs to shore is correlated to the share of respondents who would expect a worsened experience visiting the coast (Parsons and Firestone 2018).

- At 15 miles (24.1 kilometers), the percentage of respondents who reported that their beach experience would be worsened by the visibility of WTGs was about the same as the percentage of those who reported that their experience would be improved (e.g., by knowledge of the benefits of offshore wind).
- About 68 percent of respondents indicated that the visibility of WTGs would neither improve nor worsen their experience.

- Reported trip loss (respondents who stated that they would visit a different beach without offshore wind development) averaged 8 percent when wind projects were 12.5 miles (20 kilometers) offshore, 6 percent when 15 miles (24.1 kilometers) offshore, and 5 percent when 20 miles (32 kilometers) offshore.
- About 2.6 percent of respondents were more likely to visit a beach with visible offshore wind facilities at any distance.

A study focused on the changes to the vacation rental market after the construction of Block Island Wind Farm found that Block Island Wind Farm led to significantly increased nightly reservations, occupancy rates, and monthly revenues for properties in Block Island during peak tourism season in July and August (Carr-Harris and Lang 2019). The study estimates that the Block Island Wind Farm caused a 7-night increase in reservations, a 19-percent increase in occupancy rates, and a $3,490 increase in rental property revenue during July and August. Outside of peak tourism season, the Block Island Wind Farm did not have an impact on the vacation rental market.

However, a 2003 survey focused on tourist feelings about potential offshore wind development in Cape Cod, Massachusetts found that, based on visual simulations of prospective offshore wind facilities, 3.2 percent of tourists said they would spend an average of 2.9 fewer days in Cape Cod, and a further 1.8 percent said they would not visit at all if the wind turbines were built (Haughton et al. 2003).

A 2019 survey of 553 coastal recreation users in New Hampshire included participants in water-based recreation activities such as fishing from shore and boats, motorized and non-motorized boating, beach activities, and surfing at the New Hampshire seacoast. Most (77 percent) supported offshore wind development along the New Hampshire coast, while 12 percent opposed it and 11 percent were neutral. Regarding the impact on their outdoor recreation experience, 43 percent anticipated that offshore wind development would have a beneficial impact, 31 percent anticipated a neutral impact, and 26 percent anticipated an adverse impact (BOEM 2021a).

It is important to note that the wind turbines used for the visual simulations in the studies above used smaller WTGs than are proposed for the planned offshore wind projects in the region, including the Proposed Action. At an eye level of 5.5 feet (1.7 meters) above sea level, the 579-foot (176.5-meter) WTGs used in the Parsons and Firestone 2018 study would be visible out to 32.4 miles (52.1 kilometers). The 906-foot (276-meter) Ocean Wind 1 WTGs would be visible out to 39.6 miles (63.7 kilometers). Greater eye-level heights would increase the visible distance in both cases. At Ocean Wind 1's distance from the nearest beach of 15.3 miles (24.6 kilometers), the upper 476 feet (145.1 meters) of the Delaware study's 579-foot (176.5-meter) WTG would be visible to viewers. At this distance, the upper 803 feet (245 meters) of Ocean Wind 1 WTGs would be visible. Therefore, in both the 2018 Parsons and Firestone study and Ocean Wind 1's cases, the WTGs' hubs, nacelles, navigation lights, and rotor blades would be visible to viewers on the nearest beach. The taller Ocean Wind 1 WTGs would result in increased numbers of WTGs visible in the wind farm. Such additional WTGs would be seen as lower than/below the tops of the forward row of WTGs and would be increasingly obscured by those intervening in the view. The wind farm would be perceived as a mass of WTGs, rather than as individual WTGs.

As described under the IPF for light, the Jersey Shore within the viewshed of the WTGs is highly developed. Public beaches and tourism attractions in this area are highly valued for scenic, historic, and recreational qualities and draw large numbers of daytime visitors during the summertime tourism seasons. When visible (i.e., on clear days, in locations with unobstructed ocean views), WTGs would add a developed/industrial visual element to ocean views that were previously characterized by open ocean, broken only by transient vessels and aircraft passing through the view.

Based on the currently available studies, portions of the 761 WTGs associated with the No Action Alternative could be visible from shorelines (depending on vegetation, topography, weather, atmospheric conditions, and the viewers' visual acuity). WTGs visible from some shoreline locations in the geographic analysis area would have adverse impacts on visual resources when discernable due to the introduction of industrial elements in previously undeveloped views. Based on the relationship between visual impacts and impacts on recreational experience, the impact of visible WTGs on recreation would be moderate, long term, continuous, and adverse. Seaside locations could experience some reduced recreational and tourism activity, but the visible presence of WTGs would be unlikely to affect shore-based or marine recreation and tourism in the geographic analysis area as a whole.

Traffic: Other offshore wind project construction and decommissioning and, to a lesser extent, offshore wind project operation would generate increased vessel traffic that could inconvenience recreational vessel traffic within the geographic analysis area. The impacts would occur primarily during construction, along routes between ports and the offshore wind construction areas.

Vessel traffic for each project is not known but is anticipated to be similar to that of the Proposed Action, which is projected to generate between 20 and 65 vessels operating in the Wind Farm Area or over the offshore export cable route at any given time. As shown in Table F-3 in Appendix F, between 2023 and 2030 as many as eight offshore wind projects (not including the Proposed Action) could be under construction. During periods of overlapping construction and assuming similar vessel counts as under the Proposed Action, construction of offshore wind projects would generate up to 520 vessels (either underway or at anchor) at any given time within the recreation and tourism geographic analysis area.

Establishment of up to eight offshore wind projects could occur within the recreation and tourism geographic analysis area between 2023 and 2030 (not including the Proposed Action). O&M activities for the Proposed Action are anticipated to generate an average of 10 vessel trips per day between a port and the Wind Farm Area. Based on the estimates for the Proposed Action, operation of the No Action Alternative would generate an average of 80 vessel trips per day associated with the recreation and tourism geographic analysis area.

Increased vessel traffic would require increased alertness on the part of recreational or tourist-related vessels and would result in minor delays or route adjustments. The likelihood of vessel collisions would increase as a result of the higher volumes of vessel traffic during construction. The possibility of delays and risk of collisions would increase if more than one offshore wind facility is under construction at the same time. Vessel traffic associated with offshore wind would have long-term, variable, adverse impacts on vessel traffic related to recreation and tourism. Higher volumes during construction would result in greater inconvenience, disruption of the natural marine environment, and risk of collision. Vessel traffic during operations would represent only a modest increase in the background volumes of vessel traffic, with minimal, minor impacts on recreational vessels.

EMF: Installation of other offshore wind export cables in the recreation and tourism geographic analysis area would generate EMF during operation of the wind farms. Where installation occurs near beaches, fishing sites, and other areas of recreational activity, visitors may be exposed to EMF. Common household items including television sets, hair dryers, and electric drills can emit magnetic fields similar to or higher in intensity than those emitted by undersea power cables (CSA Ocean Sciences, Inc. and Exponent 2019). Based on typical EMF values from submarine cables buried at a depth of 3 feet (1 meter), maximum emissions directly above the onshore export cable would not exceed 165 milliGauss. From 10 to 25 feet (3 to 7.5 meters) away from the onshore export cable, emissions values drop to less than 0.1 to 12 milliGauss. These values are below the reported human health reference levels of 2,000 and 9,040 milliGauss for the general population (BOEM 2021b). Even if other offshore wind export cables were of higher voltage or buried closer to the surface, EMF levels are still anticipated to be well below the human health reference levels and, therefore, EMF impacts on recreation and tourism would be long term but negligible.

3.18.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, current environmental trends and activities would continue, and recreation and tourism would continue to be affected by natural and human-caused IPFs. Recreation and tourism in the geographic analysis area would continue to be affected by ongoing activities, especially ongoing vessel traffic; noise and trenching from periodic maintenance or installation of piers, pilings, seawalls, and offshore cables; and onshore development activities. These activities would contribute to periodic disruptions to recreation and tourism activities but are typical of the New Jersey coastline and would not substantially affect recreational enjoyment in the geographic analysis area. The No Action Alternative would result in **negligible** impacts on recreation and tourism from ongoing activities

Cumulative Impacts of the No Action Alternative. Planned non-offshore wind activities that may affect recreation and tourism include emplacement of submarine cables and pipelines, dredging and port improvements, marine mineral use, and military use. Like ongoing activities, other planned non-offshore wind activities may result in periodic disruptions to recreation and tourism activities along the coast through the primary IPFs of vessel traffic, noise, and cable emplacement. Planned activities other than offshore wind would have localized, temporary impacts on recreational boating and would not affect the area's scenic quality. Other offshore wind activities are expected to contribute considerably to several IPFs, the most prominent being noise and vessel traffic during construction and the presence of offshore structures during operations. Noise and vessel traffic would have impacts on visitors, who may avoid onshore and offshore noise sources and vessels, and on recreational fishing and sightseeing as a result of the impacts on fish, invertebrates, and marine mammals. The long-term presence of offshore wind structures would result in increased navigational constraints and risks, potential entanglement and loss, and visual impacts from offshore structures. Offshore wind activities in the geographic analysis area would result in beneficial impacts due to the presence of offshore structures and cable hardcover, which could provide opportunities for fishing and sightseeing. The No Action Alternative combined with all planned activities in the geographic analysis area (including other offshore wind activities) would result in **moderate** adverse and **minor beneficial** impacts on recreation and tourism.

3.18.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on recreation and tourism:

- The Project layout including the number, type, height, and placement of the WTGs and OSS, and the design and visibility of lighting on the structures;
- Arrangement of WTGs and accessibility of the Wind Farm Area to recreational boaters; and
- The time of year during which onshore and nearshore construction occurs.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- WTG number, size, location, and lighting: More WTGs and larger turbine sizes closer to shore could increase visual impacts that affect onshore recreation and tourism as well as recreational boaters. Arrangement and type of lighting systems would affect nighttime visibility of WTGs onshore.

- WTG arrangement and orientation: Different arrangements of WTG arrays may affect navigational patterns and safety of recreational boaters.
- Time of construction: Tourism and recreational activities in the geographic analysis area tend to be higher from May through September, and especially from June through August (Parsons and Firestone 2018). Impacts on recreation and tourism would be greater if Project construction were to occur during this season.

Ocean Wind has committed to measure to minimize impacts on recreation and tourism, which include developing a construction schedule to minimize activities in the onshore export cable route during the peak summer recreation and tourism season, where practicable (REC-01) and coordinating with local municipalities to minimize impacts on popular events in the area during construction, to the extent practicable (REC-02) (COP Volume II, Table 1.1-2; Ocean Wind 2023).

3.18.5 Impacts of the Proposed Action on Recreation and Tourism

3.18.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.18.7, *Impacts of Alternative E on Recreation and Tourism*.

The Proposed Action would have long-term, moderate impacts on recreation and tourism in the geographic analysis area due to the visual impact of the 98 WTGs from coastal locations and the greater navigational risks for recreational vessels within the Wind Farm Area. It would also have long-term, minor beneficial impacts due to the fish aggregation and habitat conversion impacts of the WTGs and OSS, resulting in new fishing and sightseeing opportunities. The Proposed Action would have short-term, minor impacts during construction due to the temporary impacts of noise and vessel traffic on recreational vessel traffic, the natural environment, and species important for recreational fishing and sightseeing.

Anchoring: Anchoring by Proposed Action construction, O&M, and decommissioning vessels would contribute to disturbance of marine species and inconvenience to recreational vessels that must navigate around the anchored vessels. Construction of the Proposed Action would generate between 20 and 65 vessels operating in the Wind Farm Area or over the offshore export cable route at any given time (Section 3.16). BOEM anticipates that USCG may establish temporary safety zones around offshore wind construction areas within 12 nm of the coast, which would minimize the potential for recreational boater interaction with anchored construction vessels in these areas (Section 3.16). Vessel anchoring for construction of the Proposed Action would have localized, short-term, minor impacts on tourism and recreation due to the need to navigate around vessels and work areas and the disturbance of species important to recreational fishing (Section 3.13).

Land disturbance: Onshore construction and installation of the export cables would affect recreation and tourism where construction activity interferes with access to recreation sites or increases traffic, noise, or temporary emissions that degrade the recreational experience. Installation of the cables would occur within a 50-foot-wide temporary construction corridor. Based on the landfall options with the longest onshore cable routes, construction of the Oyster Creek onshore export cable could result in up to 32 acres of temporary disturbance, and construction of the BL England onshore export cable could result in up to 48 acres of temporary disturbance (COP Volume I, Table 6.2.1-1; Ocean Wind 2023). As discussed in Section 3.11, the employment and economic impact would be localized, short term, and minor. As discussed in Section 3.14, *Land Use and Coastal Infrastructure*, technologies may be used to minimize impacts on land disturbance, including using HDD to avoid surface disturbance for one of the routes crossing Island Beach State Park. Depending on the route selected for the Oyster Creek offshore export cable route across Island Beach State Park, Ocean Wind may use either HDD to cross the island or burying of the cables within an auxiliary parking lot of Swimming Area 2 and under Shore Road. Because Island Beach State Park has received Land and Water Conservation Fund funding, the National Park Service would need to assess impacts on the property to determine if there would be a conversion of the property from a use other than public outdoor recreation in accordance with 36 CFR 59.3, Conversion Requirements. In addition to impacts on Island Beach State Park, other recreational sites that may potentially be affected during cable placement activity and maintenance include shoreside recreational fishing sites. Recreational fishing and related sites in proximity to the Oyster Creek and BL England onshore export cable routes include Ocean City Fishing pier and All Seasons Marina in Cape May County and Holiday Harbor Marina and Oyster Creek Bridge in Ocean County (NOAA 2022a). Recreational anglers at these sites may experience elevated noise, increased vehicle traffic, and temporary disruptions due to nearby construction activity, although none of the sites would be permanently affected. The Ocean County Natural Lands Trust along Bay Parkway may be affected by landfall workspace and would include temporary ground disturbance and excavation of HDD pits associated with the landfall workspace; impacts would be temporary during construction and would be restored to preconstruction conditions after construction (COP Volume II, Section 2.3.3.2.1; Ocean Wind 2023).

Ocean Wind has committed to implementing a construction schedule to minimize activities in the onshore export cable route during the peak summer recreation and tourism season and to coordinate with local municipalities to minimize impacts on popular events in the area during construction, to the extent practicable (REC-01 and REC-02; COP Volume II, Table 1.1-2; Ocean Wind 2023). These APMs would minimize impacts on recreation and tourism from construction activities. The Proposed Action is anticipated to have short-term and minor impacts on recreation and tourism, primarily surrounding the onshore cable installation and maintenance.

Lighting: When nighttime construction occurs, the vessel lighting for vessels traveling to and working at the Proposed Action’s offshore construction areas may be visible from onshore locations depending upon the distance from shore, vessel height, and atmospheric conditions. Visibility would be sporadic and variable. Although most construction is expected to occur during daylight hours, construction vessels would use work lights to improve visibility during night or poor visibility, in accordance with USCG requirements.

During operations, the Proposed Action would have a discrete contribution to nighttime visibility of the WTGs due to required aviation hazard lighting. Hazard lighting from all of the Proposed Action’s WTGs could be visible up to 40.1 miles (64.5 kilometers) away (COP Volume III, Appendix L; Ocean Wind 2023) depending on weather and viewing conditions. Ocean Wind has committed to voluntarily implement ADLS as an APM that would activate the Proposed Action’s WTG lighting only when aircraft approach the WTGs. The implementation of ADLS would reduce the duration of the potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS. During times when the Proposed Action’s aviation warning lighting is visible, this lighting would add a developed/industrial visual element to views that were previously characterized by dark, open ocean. Due to the limited duration and frequency of such events and the distance of the Proposed Action’s WTGs from shore, visible aviation hazard lighting for the Proposed Action would result in a long-term, intermittent, negligible impact on recreation and tourism. Onshore, operational security lighting at substations and related onshore facilities would be down-shielded to mitigate light pollution (VIS-04; COP Volume II, Table 1.1-2; Ocean Wind 2023).

Cable emplacement and maintenance: The Proposed Action’s cable emplacement would generate vessel anchoring and dredging at the worksite, requiring recreational vessels to avoid and navigate around the worksites and resulting in short-term disturbance to species important to recreation and tourism. The Proposed Action would require export cables that would cross 143 miles (230 kilometers) for Oyster

Creek and 32 miles (51 kilometers) for BL England, while inter-array cables could cross a maximum total cable length of 190 miles (300 kilometers) (COP Volume I, Section 4.4, Table 4.4-1; Ocean Wind 2023). Array cable installation would require a maximum of 18 vessels (three main laying, three burial, and 12 support vessels) (COP Volume I, Table 6.1.2-3; Ocean Wind 2023). Offshore export cable installation would require a maximum of 24 vessels (three main laying, three main cable jointing, three burial, and 15 support vessels) (COP Volume I, Table 6.1.2-5; Ocean Wind 2023). While it is not specified how long vessels would be present at a given location, there would be at least one location where cable splicing is necessary, which could require a vessel to remain at the same location for several days (COP Volume I, Table 4.4-1; Ocean Wind 2023). Recreational vessels traveling near the offshore export cable routes would need to navigate around vessels and access-restricted areas associated with the offshore export cable installation. Ocean Wind has committed to developing a communication plan to inform recreational fishers, among others, of construction and maintenance activities and vessel movements, which would minimize potential adverse impacts associated with cable emplacement and maintenance activity (GEN-14; COP Volume II, Table 1.1-2; Ocean Wind 2023). The localized, temporary need for changes in navigation routes due to Proposed Action construction would constitute a minor impact.

Cable installation could also affect fish and marine mammals of interest for recreational fishing and sightseeing through dredging and turbulence, although species would recover upon completion (Section 3.19, Sea *Turtles*, and Section 3.15, *Marine Mammals*), resulting in localized, short-term, minor impacts on recreation and tourism. Cable emplacement and maintenance that occur near beaches, fishing sites, or nearshore recreational activities could contribute to recreational impacts due to temporary water quality impacts during construction and maintenance. As discussed in Section 3.21, *Water Quality*, impacts on water quality from cable installation and maintenance would be short term and minor and are therefore not anticipated to result in substantive impacts on recreation and tourism.

Noise: Noise from O&M, pile driving and trenching, and vessels could result in impacts on recreation and tourism. Temporary impacts on recreation and tourism would result from impacts within the Wind Farm Area and along the offshore export cable route on species important to recreational fishing and marine sightseeing. The temporary disruptions to or changes in offshore fish, shellfish, and whale populations (Sections 3.13 and 3.15) would have a moderate impact on recreational fishing or marine sightseeing.

In addition to the temporary disruption to fish and shellfish, noise generated by offshore construction and onshore cable installation would have impacts on the recreational enjoyment of the marine and coastal environments, with minor impacts on recreation and tourism. Offshore construction noise would occur from vessels, trenching, and pile driving along the offshore export cable route and within the Wind Farm Area. Noise from pile driving, the noisiest aspect of WTG installation, is estimated to be 101 dBA at a distance of 50 feet. Overwater, the piling noise would be barely audible at 7 miles downwind (COP Volume III, Appendix R-1; Ocean Wind 2023). Accordingly, even where areas within or near the offshore export cable route and Wind Farm Area are available for recreational boating during construction, increased noise from construction would temporarily inconvenience recreational boaters.

Overall, construction noise from the Proposed Action alone would have localized, short-term, minor to moderate impacts on recreation and tourism. Offshore operational noise from the WTGs would be similar to the noise described for other projects under the No Action Alternative, and would therefore have continuous, long-term, negligible impacts.

Port utilization: Within the geographic analysis area, the Proposed Action would use facilities at Atlantic City, New Jersey as a construction management base and for O&M and Port Elizabeth, New Jersey for cable staging during construction. At the O&M facility in Atlantic City, New Jersey, planned marina upgrades, namely dredging in the marina and at Absecon Inlet, would benefit multiple marina users (COP Volume I; Ocean Wind 2023). Most ports supporting Proposed Action construction would be outside the geographic analysis area, including Paulsboro, New Jersey or Europe for foundation scoping; Hope

Creek, New Jersey or Norfolk, Virginia for WTG scoping; and Charleston, South Carolina or Europe for cable staging. Increased vessel traffic and construction activity during marina upgrades at Atlantic City, New Jersey may result in short-term delays and crowding during construction. The Proposed Action would have a short-term, negligible impact on recreation and tourism due to port utilization within the geographic analysis area.

Presence of structures: The Proposed Action's 98 WTGs and three OSS would affect recreation and tourism through increased navigational complexity; risk of allision or collision; attraction of recreational vessels to offshore wind structures for fishing and sightseeing; the adjustment of vessel routes used for sightseeing and recreational fishing; the risk of fishing gear loss or damage by entanglement due to scour or cable protection; and potential difficulties in anchoring over scour or cable protection.

Construction and installation, expected to begin in 2023 and be completed in 2025, would affect recreational boaters. Risk of allision with anchored vessels would increase incrementally during construction, as more anchored vessels would be within the recreation and tourism geographic analysis area. Ocean Wind has committed to developing a communication plan to inform the public of construction and maintenance activities and vessel movements, which would minimize potential adverse impacts associated with structure construction activities (GEN-14; COP Volume II, Table 1.1-2; Ocean Wind 2023). Recreational boating routes in the geographic analysis area for recreation and tourism are highly concentrated in Barnegat Bay, Barnegat Inlet, Great Egg Harbor Bay, and Great Egg Inlet, with mid-level concentrations in Absecon Inlet (COP Volume II, Section 2.3.3.1.2; Ocean Wind 2023). Recreational boating activity within the Wind Farm Area, approximately 15 miles from Atlantic City, New Jersey, is much less frequent than in areas closer to the coast. Ocean Wind proposes to mitigate impacts through the navigation-related APMs listed in Section 3.16.

During O&M of the Proposed Action, the permanent presence of WTGs would create obstacles for recreational vessels. At their lowest point, WTG blade tips would be 70.8 feet (22 meters) above the surface (COP Volume I, Section 4.4, Table 4.4-1; Ocean Wind 2023). At this height, larger sailboats would need to navigate around the Wind Farm Area, while smaller vessels could navigate unobstructed (except for the WTG monopiles).

Outside of avoiding certain operations during the construction phase, there are no planned or enforceable restrictions to vessels operating within the Wind Farm Area (COP Volume III, Appendix M, Section 6.1; Ocean Wind 2023). USCG would need to adjust its SAR planning and search patterns to allow aircraft to fly within the geographic analysis area, leading to a less-optimized search pattern and a lower probability of success, as described in greater detail in Section 3.16. Over a 10-year period (2009 through 2018), USCG executed four SAR missions in the Wind Farm Area: three cases were responding to recreational vessels in distress and one case was responding to commercial fishing vessels in distress (COP Volume III, Appendix M, Section 11.1; Ocean Wind 2023).

Recreational anglers may avoid fishing in the Wind Farm Area due to concerns about their ability to safely fish within or navigate through the area. As noted in Section 3.9, navigational hazards and scour/cable protection due to the presence of structures from ongoing and planned activities, including the Proposed Action, would result in substantial adverse impacts on commercial fisheries and for-hire recreational fishing. Recreational fishing exposure quantifies the amount of recreational fishing that would occur in the Lease Area and represents the total recreational fishing activity that may be affected by the development if anglers opt to no longer fish in this area and cannot go to a different location. Recreational fishing was considered "exposed" to potential impact if at least part of the trip occurred within 1 nm (1.9 kilometers) of the New Jersey WEA during the study period (2007–2012). Angler trips from Cape May, New Jersey, and smaller ports in Atlantic County, New Jersey are most exposed to the New Jersey WEA, with 47,348 private angler trips, or 9.7 percent of total angler trips, originating from Cape May that would be exposed (Kirkpatrick et al. 2017). See Section 3.9.5 for more information on for-hire fishery exposure. Minimal beneficial impacts on recreational fishing due to the artificial reef effect are expected and would be long term. Noise from construction can lead to the disbursement of fish in and around the construction sites, which could then lead to spatial competition depending on migration patterns. Disruption of the seabed during construction, in addition to activities that reduce water quality, increase underwater noise, or introduce artificial lighting, causing changes to fish distribution and behaviors could result in decreased catchability for recreational anglers. However, BOEM does not anticipate that habitat conversion and fish aggregation due to the presence of structures would result in considerable changes in fish distributions across the geographic analysis area after construction. For-hire fishing operations are part of the recreation and tourism industry and are included in the impacts on recreational boating and fishing anticipated in this section. The detailed discussion of impacts on for-hire fishing activities provided in Section 3.9 may also be applicable to impacts on recreational fishing in general. Overall, the impacts on recreational fishing, boating, and sailing generally would be minor, while the impacts on for-hire fishing would be moderate because these enterprises are more likely to be materially affected by displacement.

Although some recreational anglers would avoid the Wind Farm Area, the scour protection around the WTG foundations would likely attract forage fish as well as game fish, which could provide new opportunities for certain recreational anglers. Evidence from Block Island Wind Farm indicates an increase in recreational fishing near the WTGs (Smythe et al. 2018). The fish aggregation and reef effects of the Proposed Action could also create foraging opportunities for seals, small odontocetes, and sea turtles, attracting recreational boaters and sightseeing vessels. In addition, future offshore wind development could attract sightseeing boats offering tours of the wind facilities. Based on the impacts of the WTGs and OSS on navigation and fishing, the potential reef effects of these structures, and the risks to anchoring and gear loss associated with scour or cable protection, the Proposed Action would have long-term, continuous, minor beneficial and minor adverse impacts on recreation and tourism.

As it relates to visual impacts of presence of structures, the Proposed Action's WTGs would also affect recreation and tourism through visual impacts. During construction, viewers on the Jersey Shore would see the upper portions of tall equipment such as mobile cranes. These cranes would move from turbine to turbine as construction progresses, and thus would not be long-term fixtures. Based on the duration of construction activity, visual contrast associated with construction of the Proposed Action would have a temporary, negligible impact on recreation and tourism.

The WTGs would be in open ocean approximately 15 miles east of Atlantic City, New Jersey. As described in Section 3.20 (Table 3.20-16), the maximum-case WTGs would have a height of 906 feet at the tip of the rotor blade, a navigation light height of 531 feet, and a mid-tower light at 256 feet. At maximum vertical extension, the blade tips of the WTGs would be theoretically visible to a viewer at the ocean surface or at beach elevations at distances up to 39.6 miles with clear-day conditions. Between 39.6 miles and 31 miles, only the WTG blades would be potentially visible above the horizon from the perspective of a beach-elevation viewer. Ocean Wind has voluntarily committed to use ADLS and non-reflective pure white (RAL Number 9010) or light gray (RAL Number 7035) paint colors as described in Appendix H to reduce impacts. Additionally, the lower sections of each WTG would be marked with high-visibility (RAL Number 1023) yellow paint from the water line to a minimum height of 50 feet (15.2 meters). Due to Earth curvature (EC), the yellow paint would be below the horizon beyond approximately 11.4 miles (18.3 kilometers) from eye levels of 5 feet (1.5 meters).

The visual impact of future offshore wind structures could affect recreation and tourism. The visual contrast created by the WTGs could have a beneficial, adverse, or neutral impact on the quality of the recreation and tourism experience depending on the viewer's orientation, activity, and purpose for visiting the area. As discussed in Section 3.20.3, the Proposed Action's landscape/seascape evaluation scale ranges from faint, to apparent, to conspicuous, to prominent, to dominant. No onshore viewpoints would result in either prominent or dominant conditions. Offshore potential viewpoints' evaluations range from faint to dominant. Some of the limited available research on the link between visual impacts of future offshore wind, and resultant impacts on recreation and tourism, is summarized in Section 3.18.3.2.

BOEM expects the impact of visible WTGs on the use and enjoyment of recreation and tourist facilities and activities during O&M of the Proposed Action to be long term, continuous, and moderate. Beaches with views of WTGs could gain trips from the estimated 2.6 percent of beach visitors for whom viewing the WTGs would be a positive result, offsetting some lost trips from visitors who consider views of WTGs to be negative and the 8 percent of respondents who stated they would visit a different beach without offshore wind development (Parsons and Firestone 2018).

Traffic: The Proposed Action would contribute to increased vessel traffic and associated vessel collision risk, primarily during Project construction and decommissioning, along routes between ports and the offshore construction areas. Construction of the Proposed Action would generate between 20 and 65 vessels operating in the Wind Farm Area or over the offshore export cable route at any given time (Section 3.16). Recreational vessels may experience delays within the ports serving construction (outside the geographic analysis area), but most recreational boaters in the geographic analysis area would experience only minor inconvenience from construction-related vessel traffic. Vessel travel requiring a specific route that crosses or approaches the offshore export cable routes could potentially experience minor impacts.

For regularly scheduled maintenance and inspections, Ocean Wind anticipates that, on average, the Proposed Action would generate approximately 10 trips daily. Operation of the Proposed Action would have localized, long-term, intermittent, minor impacts on recreational vessel traffic near ports and in open waters. Impacts during decommissioning would be similar to the impacts during construction and installation.

Section 2.2 describes the non-routine activities associated with the Proposed Action. Activities requiring repair of WTGs, equipment or cables, or spills from maintenance or repair vessels, which could affect water quality, would generally require intense, temporary activity to address emergency conditions or respond to an oil spill. Non-routine activities could temporarily prevent or deter recreation or tourist activities near the site of a given non-routine event. With implementation of the navigation-related APMs listed in Section 3.16, the impacts of non-routine activities on recreation and tourism would be minor.

EMF: Once installed, onshore export cables would generate EMF during operations of the Project. The cables, which would be buried at a target depth of 4 feet, would be in and near areas of recreation and tourism use, including at Island Beach State Park, where visitors may be exposed to EMF generated by the cables. Buried power cables produce weak field strengths well below the recommended threshold values for human exposure (CSA Ocean Sciences, Inc. and Exponent 2019). Based on typical EMF values from submarine cables buried at a depth of 3 feet (1 meter), maximum emissions directly above the onshore export cable would not exceed 165 milliGauss. From 10 to 25 feet (3 to 7.5 meters) away from the onshore export cable, emissions values drop to less than 0.1 to 12 milliGauss (Ocean Wind 2023). These values are well below the reported human health reference levels of 2,000 and 9,040 milliGauss for the general population (BOEM 2021b). EMF impacts from onshore cable routes on recreation and tourism would be long term but negligible.

3.18.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities.

Anchoring: The Proposed Action would contribute a noticeable increment to the cumulative anchoring impacts on recreational boating, which would likely be localized, short term, and minor to moderate during the period in which offshore wind projects are being constructed in the geographic analysis area. A greater number of vessels would be anchored when multiple offshore wind projects are under construction at one time within the recreation and tourism geographic analysis area, potentially resulting in moderate impacts.

Land disturbance: The exact extent of land disturbance associated with other projects would depend on the locations of landfall, onshore transmission cable routes, and onshore substations for other offshore wind energy projects. Therefore, the Proposed Action would contribute a noticeable increment to the cumulative land disturbance impacts on recreation and tourism, which would be localized, short term, and minor.

Lighting: Offshore wind projects could cause aviation hazard lighting from 761 additional WTGs (859 total WTGs, including the Proposed Action) to be potentially visible within the geographic analysis area. As described in Section 3.18.3 and Section 3.20, without use of ADLS, lighting from offshore wind projects would include red flashing lights on top of WTG nacelles and at the midpoint of WTG towers. The Proposed Action would contribute a noticeable increment to the cumulative lighting impacts, which would be negligible.

Cable emplacement and maintenance: Specific cable locations associated with other offshore wind projects have not been identified within the geographic analysis area, except for Atlantic Shores South. The Proposed Action would contribute a noticeable increment to the cumulative impacts of cable emplacement and maintenance on recreational marine activities, which would likely be short term and minor.

Noise: The Proposed Action would contribute a noticeable increment to the cumulative noise impacts on marine recreation activities, which would likely be localized, short term, and minor to moderate during construction, and long term and negligible during operation.

Port utilization: The Proposed Action would result in negligible cumulative port utilization impacts on recreation and tourism.

Presence of structures: Structures from other planned offshore wind development would generate comparable types of impacts on recreation and tourism as the Proposed Action alone. The geographic extent of impacts would increase as additional offshore wind projects are constructed, but the level of impacts would likely be the same: minor to moderate adverse impacts on recreational fishing, recreational sailing and boating, and for-hire recreational fishing, as well as minor beneficial impacts. As described in Section 3.16, the lack of a common turbine spacing and layout throughout all adjoining wind projects could make it more difficult for SAR aircraft to perform operations in the Lease Area. The Proposed Action would contribute a noticeable increment to the cumulative impacts on marine recreational activities, which would be minor to moderate.

Portions of 859 WTGs from the Proposed Action combined with future offshore wind projects could potentially be visible from coastal and elevated locations in the geographic analysis area and contribute to impacts on recreation and tourism. The simulations prepared by Ocean Wind show anticipated views in clear conditions of future offshore wind projects associated with the No Action Alternative combined with the Proposed Action (Appendix M). The WTGs would be discernable on a clear day, with the color and irregular forms of the WTGs contrasting with the uninterrupted horizontal horizon line associated with the open ocean. As shown in the simulations, the Proposed Action WTGs would contribute the most from the closest locations, the northernmost coast of Cape May County and the coast of Atlantic County. The Proposed Action would be visually subordinate to future offshore wind projects along the shore of Ocean County. Atmospheric conditions could limit the number of WTGs discernable during daylight hours for a significant portion of the year (COP Volume III, Appendix L; Ocean Wind 2023). The

Proposed Action would contribute a noticeable increment to the cumulative visual impacts on recreation and tourism from ongoing and planned activities including offshore wind, which would be moderate.

Traffic: Overlapping construction schedules of offshore wind projects in the geographic analysis area would increase traffic between ports and work areas, requiring increased alertness on the part of recreational or tourist-related vessels, and possibly resulting in a greater number of minor delays or route adjustments. The likelihood of vessel collisions would increase as a result of the higher volumes of vessel traffic during construction. Modest levels of vessel traffic are anticipated from offshore wind operations (Section 3.16). The Proposed Action would contribute an undetectable increment to the cumulative vessel traffic impacts on recreation and tourism, which would be short term, variable, and minor during construction and long term, intermittent, localized, and negligible during operations.

EMF: The Proposed Action would contribute an undetectable increment to the cumulative EMF impact on recreation and tourism, which would be long term and negligible.

3.18.5.3. Conclusions

Impacts of the Proposed Action. Overall, the impacts of the Proposed Action are anticipated to be **moderate** and **minor beneficial**. Impacts would result from short-term impacts during construction: noise, anchored vessels, and hindrances to navigation from the installation of the export cable and WTGs; and the long-term presence of cable hardcover and structures in the Wind Farm Area during operations, with resulting impacts on recreational vessel navigation and visual quality. Beneficial impacts would result from the reef effect and sightseeing attraction of offshore wind energy structures.

Cumulative Impacts of the Proposed Action. The incremental impacts contributed by the Proposed Action to the cumulative impacts on recreation and tourism would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts associated with the Proposed Action would be **moderate** with **minor beneficial** impacts. The main drivers for this impact rating are the minor visual impacts associated with the presence of structures and lighting; impacts on fishing and other recreational activity from noise, vessel traffic, and cable emplacement during construction; and beneficial impacts on fishing from the reef effect.

3.18.6 Impacts of Alternatives B, C, and D on Recreation and Tourism

Impacts of Alternatives B, C, and D. Impacts of Alternatives B-1, B-2, and D would be similar to those of the Proposed Action for recreation and tourism except for the impact of the presence of structures. Construction of Alternatives B-1, B-2, and D would install fewer WTGs (up to 9 fewer WTGs for Alternative B-1, up to 19 fewer WTGs for Alternative B-2, and up to 15 fewer WTGs for Alternative D) and associated inter-array cables, which would slightly reduce the construction impact footprint and installation period. The removal of 9 and 19 WTGs for Alternatives B-1 and B-2, respectively, would result in a negligible reduction of impacts on visual resources compared to the Proposed Action, unnoticeable to the casual viewer (Section 3.20). Alternatives B-1, B-2, and D could potentially reduce gear entanglements and loss as well as allisions, and recreational fishing may see a slight decrease due to fewer structures providing reef habitat for targeted species. Fewer vessels and vessel trips would be expected, which would reduce the risk of discharges, fuel spills, and trash in the area and decrease the risk of collision with marine mammals and sea turtles (Sections 3.15 and 3.19).

Impacts of Alternative C-1 would be similar to those of the Proposed Action for recreation and tourism except for the impact of the presence of structures. As described in Section 3.20, the visual differences between the Alternative C-1 WTG array and the Proposed Action WTG array would not be noticeable to the casual viewer and would not have a substantive effect on recreation and tourism. As described in Section 3.16, the proposed buffer (0.81 to 1.08 nm) between WTGs in the Ocean Wind 1 Lease Area and

WTGs in the Atlantic Shores South Lease Area would be an improvement to vessel navigation and SAR considerations over no separation between lease areas. This buffer would allow for the transit of larger fishing vessels through the Wind Farm Area and address navigational safety concerns as recommended by USCG (Section 3.16). The buffer could improve safety for recreational fishing vessels in the Wind Farm Area.

Impacts of Alternative C-2 would be similar to those of the Proposed Action for recreation and tourism except for the impact of the presence of structures. As described in Section 3.16, the reduced turbine array row spacing distance (from 1 nm to no less than 0.99 nm) is within the preferred range for the safe navigation of vessels less than 200 feet in length and would not result in a substantive difference in impacts compared to the Proposed Action. The buffer between WTGs in the Ocean Wind 1 Lease Area and WTGs in the Atlantic Shores South Lease Area would allow for the transit of larger fishing vessels or survey vessels through the Wind Farm Area. The buffer could improve safety for recreational fishing vessels in the Wind Farm Area.

Cumulative Impacts of Alternatives B, C, and D. The incremental impacts contributed by Alternatives B, C, and D to the cumulative impacts on recreation and tourism would be similar to those described under the Proposed Action.

3.18.6.1. Conclusions

Impacts of Alternatives B, C, and D. The **moderate** impacts and **minor beneficial** impacts associated with the Proposed Action would not change substantially under Alternatives B-1, B-2, C-1, C-2, and D. The impacts associated with these action alternatives would be slight improvements over the Proposed Action’s impacts, but the impact level would not change.

Cumulative Impacts of Alternatives B, C, and D. The incremental impacts contributed by Alternatives B-1, B-2, C-1, C-2, and D to the cumulative impacts on recreation and tourism would be the same as under the Proposed Action and would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts of these action alternatives would likely be **moderate** and **minor beneficial**.

3.18.7 Impacts of Alternative E on Recreation and Tourism

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. The impacts of Alternative E on recreation and tourism would be the same as those of the Proposed Action except for noise and vehicle traffic produced during construction. The impacts resulting from individual IPFs associated with the construction and installation, O&M, and decommissioning of the Project under Alternative E would be similar to those described under the Proposed Action. Island Beach State Park is one of the state’s most visited parks. Increased onshore construction activity on Island Beach State Park may potentially disturb and restrict park operations and visitation due to typical construction impacts such as increased noise, traffic, and road disturbances. Construction activities would be planned to occur during the off season; however, future maintenance and emergency repairs may be needed during times of heavy park visitation. Impacts on recreation and tourism would remain localized and short term while the cables are being installed and BOEM does not anticipate impacts to be materially different than those described under the Proposed Action.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impact on recreation and tourism would be similar to those described under the Proposed Action.

3.18.7.1. Conclusions

Impacts of Alternative E. Alternative E could result in increased impacts on land use associated with temporary construction activity compared to the southern export cable route on Island Beach State Park and Barnegat Bay under the Proposed Action. The impact magnitudes would be the same as that of the Proposed Action because the cable corridor would largely follow existing right-of-way and the primary impacts would be limited to the duration of construction. The impacts resulting from individual IPFs associated with Alternative E are anticipated to be **moderate** and **minor beneficial**.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on recreation and tourism would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts of Alternative E would be **moderate** and **minor beneficial**.

3.18.8 Proposed Mitigation Measures

A measure is proposed to minimize impacts on recreation and tourism (Appendix H, Table H-3). If the measure analyzed below is adopted by BOEM or cooperating agencies, some adverse impacts would be further reduced.

Table 3.18-2 Additional Proposed Measures (Also Identified in Appendix H, Table H-3): Recreation and Tourism

Measure	Description	Effect
Recreational fishing	BOEM would ensure that Ocean Wind develops a construction schedule that minimizes overlap with recreational fishing tournaments and other important seasonal recreational fishing events.	If this mitigation measure is adopted by BOEM or cooperating agencies, construction activities would not occur during recreational fishing events, avoiding impacts such as vessel traffic, noise, and other construction activity that might otherwise adversely affect these events. This mitigation measure would minimize impacts on recreational fishing but would not reduce the cumulative impact level. Impacts from the Proposed Action and other action alternatives would remain moderate and minor beneficial.

3.18.8.1. Measures Incorporated in the Preferred Alternative

BOEM has not identified any additional measures in Table 3.18-2 to be incorporated in the preferred alternative.

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3.19. Sea Turtles (see Appendix G)

The reader is referred to Appendix G for a discussion of current conditions and potential impacts on sea turtles from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.20. Scenic and Visual Resources

This section discusses potential impacts on seascape, open ocean, and landscape character and viewers from the proposed Project, alternatives, and ongoing and planned activities in the scenic and visual resources geographic analysis area, as advised in the *Assessment of Seascape, Landscape, and Visual Impacts of Offshore Wind Developments on the Outer Continental Shelf of the United States* (BOEM 2021c) and the *Guidelines for Landscape and Visual Impact Assessment* (3rd Edition) (Landscape Institute and Institute of Environmental Management and Assessment 2016). The 40-mile (64.4-kilometer) geographic analysis area, as shown on Figure 3.20-1, includes the New Jersey coastline from Cape May Borough to Berkeley Township and extends 64 miles (103 kilometers) offshore and 25 miles (40.2 kilometers) inland to incorporate potential views of the Project. The onshore geographic analysis area encompasses the 1-mile perimeters for the Oyster Creek and BL England onshore substations, landfalls, onshore export cable routes to the onshore substations, and the connections from the onshore substations to the existing grid (0.25-mile perimeters). This geographic analysis area was selected to coincide with Ocean Wind's Visual Impact Assessment (VIA) analysis area (COP Volume III, Appendix L; Ocean Wind 2023) to address Project visibility from sensitive resources and encompass all locations where BOEM anticipates impacts associated with Project construction, O&M, and conceptual decommissioning. Appendix M, *Seascape, Landscape, and Visual Impact Assessment*, contains additional analysis of the seascape character units, open ocean character unit, landscape character units, and viewer experiences that would be affected by Proposed Action and alternatives, and visual simulations of the Proposed Action, No Action Alternative, Alternative B, and Alternative C.

3.20.1 Description of the Affected Environment for Scenic and Visual Resources

New Jersey's Public Trust Doctrine (NJDEP 2006) holds all tidally flowed lands in trust for the use and enjoyment of the public. This includes the ocean, bays, and tidal rivers, as well as the adjacent shoreline over which these waters flow and, in certain circumstances, some amount of upland area, even if the upland area is privately owned. This section summarizes the seascape, open ocean, landscape, and viewer baseline conditions as described in Volume III, Appendix L (Visual Impact Assessment) of the Ocean Wind 1 COP (Ocean Wind 2023). The demarcation line between seascape and open ocean is the most-distant edge of the sea visible from the coastline's mean high tide line. This shared boundary (3.45 miles [5.6 kilometers]) is based on a 5.5-foot eye level and EC, and aligns with the state seaward jurisdictional boundary for New Jersey (U.S. Congress Submerged Lands Act, 1953). The line defining the separation of seascape and landscape is based on the juxtaposition of seacoast and landward landscape elements, including topography, water (bays and estuaries), vegetation, and structures.

The geographic analysis area is classified by broadly defined land and water areas and more specific Landscape Similarity Zones. The land and water areas are based on major differences in landscape structure that define the physical character of the geographic analysis area and include open ocean, shoreline, marsh and bay, and inland areas. Each area is subdivided into Landscape Similarity Zones, areas defined by similar land use patterns, topography, ecological characteristics, and proximity to the ocean. Landscape Similarity Zones provide a more specific description of the existing landscape and provide a framework to systematically analyze potential visual effects throughout the geographic analysis area (COP Volume III, Appendix L, Section 5.5; Ocean Wind 2023). The land and water areas and Landscape Similarity Zones, or character units, used in this analysis are summarized in Table 3.20-1.

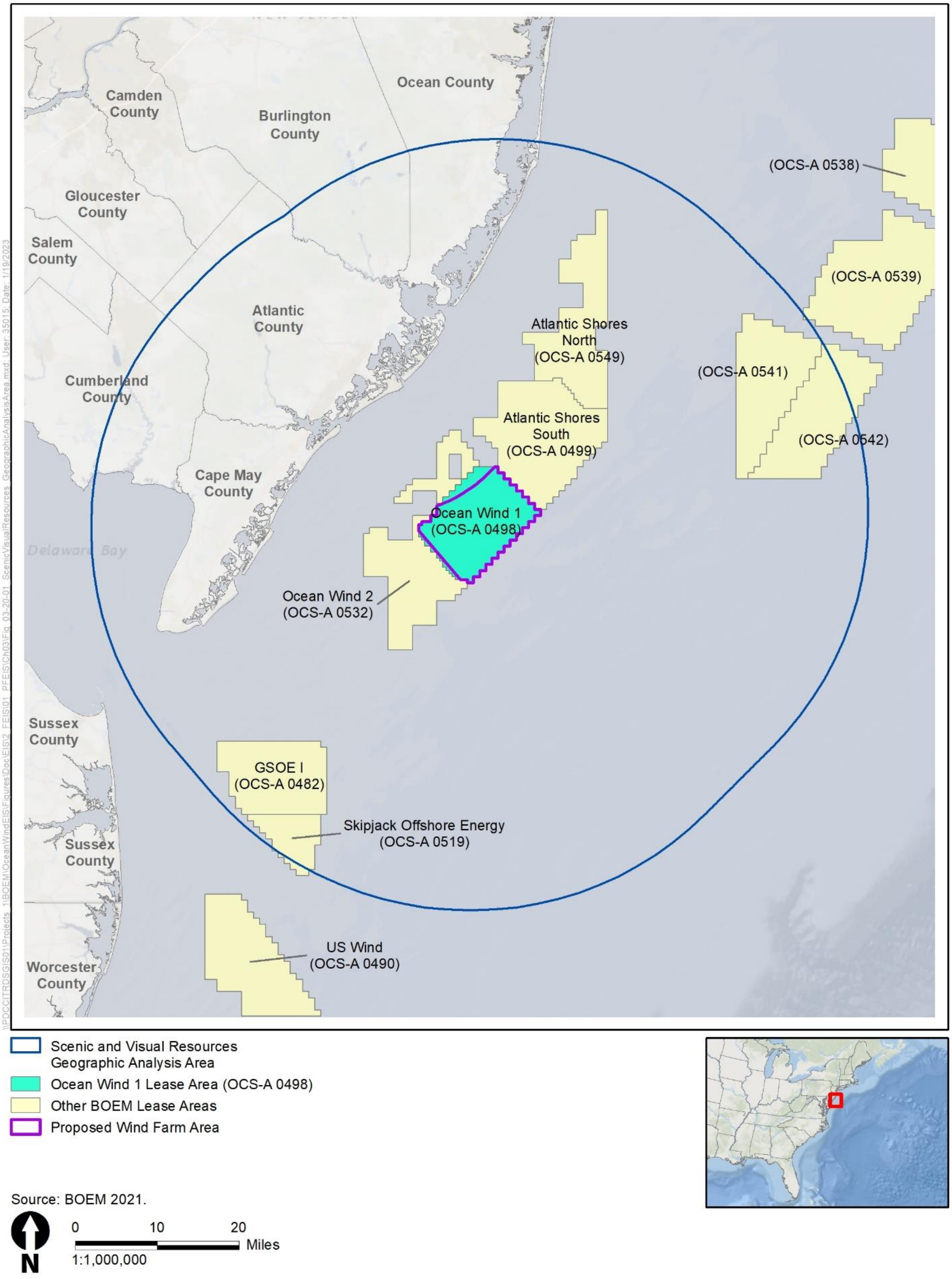

Figure 3.20-1 Scenic and Visual Resources Geographic Analysis Area

Table 3.20-1 Land and Water Areas and Landscape Similarity Zones

Land and Water Areas	Landscape Similarity Zones/Character Units
Atlantic Ocean	Open Ocean
Shoreline	Jetty/Seawall, Beachfront, Coastal Dune, Boardwalk, Island Community
Marsh and Bay	Marshland, Bay/Shoreline, Ridges
Inland	Mainland

Existing scenic resources in the geographic analysis area including conservation areas, historic resources, scenic byways, national wild and scenic rivers, and other resources are mapped on the Scenic Resources Overview Map in Attachment M-1 to Appendix M. The geographic analysis area's landforms, water, vegetation, and built environment structures contain common and distinctive landscape features as outlined in Table 3.20-2.

Table 3.20-2 Landform, Water, Vegetation, and Structures

Category	Landscape Features
Landform	Flat shorelines to gently sloping beaches, dunes, islands, and inland topography
Water	Ocean, bay, estuary, tidal river, river, and stream water patterns
Vegetation	Tidal salt marshes and estuarine biomes, beach grass, meadows, and maritime forests; vegetation community indicator species: beach plum (*Prunus maritime*), sweet pepperbush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), poison ivy (*Toxicodendron radicans*), sour gum (*Nyssa sylvatica*), swamp magnolia (*Magnolia virginiana*), red cedar (*Juniperus virginiana*), and red maple (*Acer rubrum*)
Structures	Buildings, plazas, signage, walks, parking, roads, trails, seawalls, jetties, and infrastructure

The visual characteristics of the seascape, open ocean, and landscape conditions in the geographic analysis area, including surroundings of the Wind Farm Area, landfall sites, offshore and onshore export cable corridors, and onshore substation areas, contain both locally common and regionally distinctive physical features, characters, and experiential views (Table 3.20-3).

Table 3.20-3 Seascape, Open Ocean, and Landscape Conditions

Category	Seascape, Open Ocean, and Landscape
Seascape	Inter-visibility by pedestrians and boaters within coastal and adjacent marine areas (3.45 miles [5.6 kilometers]) within the 40-mile (64.4-kilometer) geographic analysis area.
Seascape Features	Physical features range from built elements, landscape, dunes, and beaches to flat water and ripples, waves, swells, surf, foam, chop, and whitecaps.

Category	Seascape, Open Ocean, and Landscape
Seascape Character	Experiential characteristics stem from built and natural landscape forms, lines, colors, and textures to the foreground water's tranquil, mirrored, and flat; active, rolling, and angular; vibrant, churning, and precipitous. Forms range from horizontal planar to vertical structures', landscapes', and water's slopes; lines range from continuous to fragmented and angular; colors of structures, landscape, and the water's foam, and spray reflect the changing colors of the daytime and nighttime, built environment, land cover, sky, clouds, fog, and haze; and textures range from mirrored smooth to disjointed coarse.
Open Ocean	Inter-visibility within the open ocean (beyond the 3.45-mile [5.6-kilometer] seascape area) within the 40-mile (64.4-kilometer) geographic analysis area from seagoing vessels, including recreational cruising and fishing, commercial "cruise ship" routes, commercial fishing activities, tankers and cargo vessels; and air traffic over and near the WTG array and cable routes.
Open Ocean Features	Physical features range from flat water to ripples, waves, swells, surf, foam, chop, and whitecaps.
Open Ocean Character	Experiential characteristics range from tranquil, mirrored, and flat; to active, rolling, and angular; to vibrant, churning, and precipitous. Forms range from horizontal planar to vertical slopes; lines range from continuous and horizontal to fragmented and angular; colors of water, foam, and spray reflect the changing colors of sky, clouds, fog, haze, and the daytime and nighttime, built environment and land cover; and textures range from mirrored smooth to disjointed coarse.
Landscape	Inter-visibility within the adjacent inland areas, seascape, and open ocean; nighttime views diminished by ambient light levels of shorefront development; open, modulated, and closed views of water, landscape, and built environment; and pedestrian, bike, and vehicular traffic throughout the region.
Landscape Features	Natural elements: landward areas of barrier islands, bays, marshlands, shorelines, vegetation, tidal rivers, flat topography, and natural areas. Built elements: boardwalks, bridges, buildings, gardens, jetties, landscapes, life-saving stations, umbrellas, lighthouses, parks, piers, roads, seawalls, skylines, trails, single-family residences, commercial corridors, village centers, mid-rise motels, moderate to high-density residences, and high-rise casinos.
Landscape Character	Tranquil and pristine natural, to vibrant and ordered, to chaotic and disordered.
Designated Public Places	Barnegat Branch Trail, Barnegat Lighthouse State Park, Bass River State Forest, Belleplain State Forest, Cape May National Wildlife Refuge, Cape May State Park, Corson's Inlet State Park, Crook Horn Creek, Edwin B. Forsythe National Wildlife Refuge, Emil Palmer Park, Enos Pond County Park, Forked River State Marina, Forked River Mountain WMA, Garden State Parkway, Gillian's Wonderland Pier, Great Egg Harbor Bay, Island Beach State Park, National Natural Landmark Manahawkin Bottomland Hardwood Forest, Ocean City Boardwalk, Ocean City Park, Peck Bay, Sandcastle Park, Southern Pinelands Natural Heritage Trail, Stainton Wildlife Refuge, Stone Harbor Bird Sanctuary, Tuckahoe WMA, Upper Barnegat Bay WMA, Vincent Klune Park, and Wharton State Forest.

WMA = Wildlife Management Area

The sensitivity of the geographic analysis area's seascape character is defined by its innate features, elements, and value to residents and visitors. Seascape sensitivity rating criteria are high, medium, or low defined as follows:

- High: Seascape character is distinctive and highly valued by residents and visitors.

- Medium: Seascape character is moderately distinctive and moderately valued by residents and visitors.
- Low: Seascape character is common and unimportant to residents and visitors.

The sensitivity of the open ocean is defined by the activities of viewers; innate character; and susceptibility to the type of change proposed by the Project.

- High: Open ocean characteristics are pristine, highly distinctive, and highly valued by residents and visitors.
- Medium: Open ocean characteristics are moderately distinctive and moderately valued by residents and visitors.
- Low: Open ocean characteristics are common or with minimal scenic value.

The sensitivity of the geographic analysis area's landscape character is defined by its innate features, elements, and value to residents and visitors. Landscape sensitivity rating criteria are high, medium, or low defined as follows:

- High: Landscape characteristics are highly distinctive, highly valued by residents and visitors, or within a designated scenic or historic landscape.
- Medium: Landscape characteristics are moderately distinctive and moderately valued by residents and visitors.
- Low: Landscape characteristics are common or within a landscape of minimal scenic value.

Table 3.20-4 summarizes the conditions within seascape, open ocean, and landscape settings with high, medium, and low innate sensitivity.

Table 3.20-4 Seascape, Open Ocean, and Landscape Sensitivity

Settings	Conditions
High-Sensitivity Seascape[1]	Ocean shoreline, beach, and dune areas, and ocean areas within 3.45 statute miles (5.5 kilometers) of the shoreline (Table 3.20-1) Seascapes with national, state, or local designations: Barnegat Branch Trail, Barnegat Lighthouse State Park, Bass River State Forest, Belleplain State Forest, Cape May National Wildlife Refuge, Cape May State Park, Corson's Inlet State Park, Crook Horn Creek, Edwin B. Forsythe National Wildlife Refuge, Emil Palmer Park, Enos Pond County Park, Forked River State Marina, Forked River Mountain WMA, Garden State Parkway, Gillian's Wonderland Pier, Great Egg Harbor Bay, Island Beach State Park, National Natural Landmark Manahawkin Bottomland Hardwood Forest, Ocean City Boardwalk, Ocean City Park, Peck Bay, Sandcastle Park, Southern Pinelands Natural Heritage Trail, Stainton Wildlife Refuge, Stone Harbor Bird Sanctuary, Tuckahoe WMA, Upper Barnegat Bay WMA, Vincent Klune Park, and Wharton State Forest Beaches, seaward boardwalks, jetties, and piers
High-Sensitivity Open Ocean	Ocean areas within the geographic analysis area

Settings	Conditions
High-Sensitivity Landscape[2]	Scenic and medium to high resident and visitor use volume coastal areas and bays, islands, sounds, and adjoining estuaries. Cemeteries, churches, historic sites, lighthouses, scenic overlooks, schools, town halls, and residential areas within the geographic analysis area. Landscapes with national, state, local designations or valued places: Absecon Bay, All Wars Memorial Park, Barnegat Bay, Barnegat Branch Trail, Barnegat Lighthouse State Park, Bass River State Forest, Belleplain State Forest, Birch Grove Park, Cape May National Wildlife Refuge, Cape May County Park and Zoo, Cape May Point State Park, Corson's Inlet State Park, Crook Horn Creek, Doc Cramer Park, Edwin B. Forsythe National Wildlife Refuge, Egg Harbor City Park, Egg Island State WMA, Emil Palmer Park, Enos Pond County Park, Estelle Manor County Park, Forked River State Marina, Forked River Mountain WMA, Garden State Parkway, Gillian's Wonderland Pier, Great Bay, Great Egg Harbor Bay, Great Sound, Green Acres Park, Green Bank State Forest, Harold N Peek Preserve, Hartshorn Park, Heritage Park, Heislerville WMA, Island Beach State Park, John F. Kennedy Park, Keyrec Field, Lakes Bay, Lenape Park, Little Bay, Ludlam Bay, Manahawkin Bay, Manahawkin Wildlife Area, Michael Debbi Park, Millville State Conservation Area, Mystic Island Park, National Natural Landmark Manahawkin Bottomland Hardwood Forest, Ocean City Boardwalk, Ocean City Park, Park Avenue Park, Peaslee State Conservation Area, Peck Bay, Penn State Park, Port Republic State Conservation Area, Reeds Bay, River Bend County Park, Sandcastle Park, Sedge Island Marine Conservation Zone, Southern Pinelands Natural Heritage Trail, Stafford Forge State Conservation Area, Stainton Wildlife Refuge, Stites Sound, Stone Harbor Bird Sanctuary, Tony Canale Park, Townsend Sound, Tuckahoe WMA, Upper Barnegat Bay WMA, Veterans Memorial Park, Vincent Klune Park, Weymouth Furance Park, and Wharton State Forest.
Medium-Sensitivity Landscape	Moderately distinctive areas of medium scenic value and low resident or visitor use volume inland areas
Low-Sensitivity Landscape	Indistinctive areas with low scenic value and limited to no resident or visitor use volume

[1] Locations also listed under Landscape extend to both Seascape and Landscape.
[2] Locations also listed under Seascape extend to both Landscape and Seascape.
WMA = Wildlife Management Area

The susceptibility of the geographic analysis area's seascape character is defined by both the susceptibility to impacts from the Project and its visual resources' rarity and scenic value. Seascape susceptibility rating criteria include:

- High: Seascape character is highly vulnerable to the type of change proposed, distinctive, and highly valued by residents and visitors.
- Medium: Seascape character is reasonably resilient to the type of change proposed, moderately distinctive, and moderately valued by residents and visitors.
- Low: Seascape character is unlikely to be affected by the type of change proposed, common, and unimportant to residents and visitors.

The susceptibility of the geographic analysis area's open ocean character is defined by both the susceptibility to impacts from the Project and its visual resources' rarity and scenic value. Open ocean susceptibility rating criteria include:

- High: Open ocean character is highly vulnerable to the type of change proposed, distinctive, and highly valued by residents and visitors.

- Medium: Open ocean character is reasonably resilient to the type of change proposed, moderately distinctive, and moderately valued by residents and visitors.
- Low: Open ocean character is unlikely to be affected by the type of change proposed, common, and unimportant to residents and visitors.

The susceptibility of the geographic analysis area's landscape character is defined by both the vulnerability to impacts from the Project, and the visual resources' rarity and scenic value. Landscape susceptibility ratings include:

- High: The character is highly vulnerable to the type of change proposed, distinctive, and highly valued by residents and visitors.
- Medium: The character is reasonably resilient to the type of change proposed, moderately distinctive, and moderately valued by residents and visitors.
- Low: The character is unlikely to be affected by the type of change proposed, common, and unimportant to residents and visitors.

Table 3.20-5 summarizes the conditions within seascape, open ocean, and landscape settings with high, medium, and low susceptibility.

Table 3.20-5 Seascape, Open Ocean, and Landscape Susceptibility

Settings	Conditions
High-Susceptibility Seascape[1]	Ocean shoreline, beach, and dune areas, and ocean areas within 3.45 statute miles (5.5 kilometers) of the shoreline (Table 3.20-1) Seascapes with national, state, or local designations: 26th Street Playground, 32nd Street Veterans Memorial, 42nd Street Recreation Area, Absecon State WMA, Altman Field Park, Artlantic Wonder Park, Barnegat Lighthouse State Park, Beaver Swamp State Conservation Area, Brighton Park, Cape May National Wildlife Refuge, Corson's Inlet State Park, Dennis Creek State Conservation Area, Edwin B. Forsythe National Wildlife Refuge, Emil Palmer Park, Gillian's Wonderland Pier, Illinois Avenue Park, Island Beach State Park, Jerome Avenue Park, Maine Avenue Waterfront Park, Ocean City Boardwalk, Ocean City Park, O'Donnell Park, Sandcastle Park, and Veterans Park Beaches, seaward boardwalks, jetties, and piers
High-Susceptibility Open Ocean	Ocean areas within the geographic analysis area

Settings	Conditions
High-Susceptibility Landscape[2]	Landscapes with national, state, or local designations or valued places: Absecon Bay, All Wars Memorial Park, Barnegat Bay, Barnegat Branch Trail, Barnegat Lighthouse, Barnegat Lighthouse State Park, Bass River State Forest, Belleplain State Forest, Birch Grove Park, Bowen Memorial Park, Cape May National Wildlife Refuge, Cape May County Park and Zoo, Cape May State Park, Corson's Inlet State Park, Crook Horn Creek, Dennis Creek State Conservation Area, Edwin B. Forsythe National Wildlife Refuge, Egg Harbor City Park, Emil Palmer Park, Enos Pond County Park, Estelle Manor County Park, Forked River State Marina, Forked River Mountain WMA, Garden State Parkway, Gillian's Wonderland Pier, Great Bay, Great Egg Harbor Bay, Great Sound, Green Acres Park, Green Bank State Forest, Harold N Peek Preserve, Hartshorn Park, Heislerville WMA, Heritage Park, Island Beach State Park, John F. Kennedy Park, Keyrec Field, Lakes Bay, Little Bay, Ludlam Bay, Manahawkin Bay, National Natural Landmark Manahawkin Bottomland Hardwood Forest, Manahawkin Wildlife Area, Michael Debbi Park, Mill Creek Park, Millville State Conservation Area, Multica Recreation Field, Mystic Island Park, Ocean City Boardwalk, Ocean City Park, Park Avenue Park, Peaslee State Conservation Area, Peck Bay, Penn State Forest, Playground Park, Port Republic State Conservation Area, Reeds Bay, River Bend County Park, Sandcastle Park, Sedge Island Marine Conservation Zone, Southern Pinelands Natural Heritage Trail, Stafford Forge State Conservation Area, Stainton Wildlife Refuge, Stites Sound, Stone Harbor Bird Sanctuary, Tony Canale Park, Townsend Sound, Tuckahoe WMA, Upper Barnegat Bay WMA, Vincent Klune Park, Weymouth Furance Park, Veterans Memorial Park, and Wharton State Forest
Medium-Susceptibility Landscape	N/A
Low-Susceptibility Landscape	N/A

[1] Locations also listed under Landscape extend to both Seascape and Landscape.
[2] Locations also listed under Seascape extend to both Landscape and Seascape.
N/A = not applicable; WMA = Wildlife Management Area

Table 3.20-6 lists the jurisdictions with ocean beach views to the Project Wind Farm Area. The nearest and most distant view conditions, Atlantic City Beachfront and Barnegat Lighthouse, respectively, are portrayed on Figure 3.20-2 and Figure 3.20-3, respectively (Appendix D to COP Volume III, Appendix L; Ocean Wind 2023).

Table 3.20-6 Jurisdictions with Ocean Beach Views

Ocean View	Jurisdiction
Ocean view from a seascape beach	Atlantic City, Avalon Borough, Barnegat Light Borough, Beach Haven Borough, Berkeley Township, Brigantine, Cape May, Galloway Township, Harvey Cedars Borough, Long Beach Township, Longport Borough, Lower Township, Margate City, North Wildwood, Ocean City, Sea Isle City, Ship Bottom Borough, Stone Harbor Borough, Surf City Borough, Upper Township, and Ventnor City, Wildwood, and Wildwood Crest
Ocean view from an inland landscape	Absecon, Atlantic City, Avalon Borough, Barnegat Light Borough, Barnegat Township, Bass River Township, Beach Haven Borough, Berkeley Township, Brigantine, Buena Vista Township, Cape May, Cape May Point Borough, Commercial Township, Corbin City, Dennis Township, Downe Township, Eagleswood Township, Egg Harbor Township, Estell Manor, Folsom Borough, Galloway Township, Hamilton Township, Hammonton, Harvey Cedars Borough, Linwood, Little Egg Harbor Township, Long Beach Township, Longport Borough, Lower Township, Margate City, Maurice River Township, Middle Township, Millville, Mullica Township, North Wildwood, Northfield, Ocean City, Ocean Township, Pleasantville, Port Republic, Sea Isle City, Ship Bottom Borough, Somers Point, Stafford Township, Stone Harbor Borough, Surf City Borough, Tuckerton Borough, Upper Township, Ventnor City, Vineland, Washington Township, West Cape May Borough, West Wildwood Borough, Weymouth Township, and Wildwood

Figure 3.20-2 Atlantic City Beachfront View

Figure 3.20-3 Barnegat Lighthouse View

Onshore to offshore view distances to the Project Wind Farm Area range from 15.3 miles (24.6 kilometers) to 40 miles (64.4 kilometers). At the 15.3-mile (25.6-kilometer) distance, the Project wind farm would occupy 37.6° (30 percent) of the typical human's 124° horizontal field of view (FOV) and 0.6° (1 percent) of the typical 55° vertical FOV (measured from eye level). This vertical measure also indicates the perceived proportional size and relative height of the wind farm. At 40 miles (64.4 kilometers) distance, the Project may appear 0.03° above the horizon and 16° along the horizon, 0.04 percent and 12 percent of the human vertical and horizontal FOV, respectively. WTG and OSS visibility would be variable throughout the day depending on specific factors. View angle, sun angle, atmospheric conditions, and distance would affect the visibility and noticeability. Visual contrast of WTGs and OSS would vary throughout the day depending on whether the WTGs and OSS are backlit, side-lit, or front-lit and based on the visual character of the horizon's backdrop. These variations through the course of the day may result in periods of moderate to major visual effects while at other times of day would have minor or negligible effects.

At distances of 12 miles or closer, the form of the WTG may be the dominant visual element creating the visual contrast regardless of color. At greater distances, color may become the dominant visual element creating visual contrast under certain visual conditions that give visual definition to the WTG's form and line.

The range of sensitivity of view receptors and people viewing the Project is determined by their engagement and view expectations. Table 3.20-7 lists the sensitivity issues identified for the seascape, open ocean, landscape, and visual impact assessment (SLVIA) and the indicators and criteria used to assess impacts for the Final EIS.

Table 3.20-7 View Receptor Sensitivity Ranking Criteria

Sensitivity	Sensitivity Criteria
High	Residents with views of the Project from their homes; people with a strong cultural, historic, religious, or spiritual connection to landscape or seascape views; people engaged in outdoor recreation whose attention or interest is focused on the seascape and landscape and on particular views; visitors to historic or culturally important sites, where views of the surroundings are an important contributor to the experience; people who regard the visual environment as an important asset to their community, churches, schools, cemeteries, public buildings, and parks; and people traveling on scenic highways and roads, or walking on beaches and trails, specifically for enjoyment of views
Medium	People engaged in outdoor recreation whose attention or interest is unlikely to be focused on the landscape and on particular views because of the type of activity; people at their places of livelihood, commerce, and personal needs (inside or outside) whose attention is generally focused on that engagement, not on scenery, and where the seascape and landscape setting is not important to the quality of their activity; and, generally, those commuters and other travelers traversing routes that are dominated by non-scenic developments
Low	People who regard the visual environment as an unvalued asset

Key Observation Points (KOP) represent individuals or groups of people who may be affected by changes in views and visual amenity. Based on higher viewer sensitivity, viewer exposure, and context photography, 32 designated KOPs provide the locational bases for detailed analyses of the geographic analysis area's seascape, open ocean, landscape, and viewer experiences as shown on Figure 3.20-4 (COP Volume III, Appendix L; Ocean Wind 2023). Sensitive receptors in the vicinity of the BL England and Oyster Creek substations and onshore export cable corridors are identified in COP Volume III, Appendix L, Section 8.2 (Ocean Wind 2023). KOPs and their view contexts are summarized in Table 3.20-8.

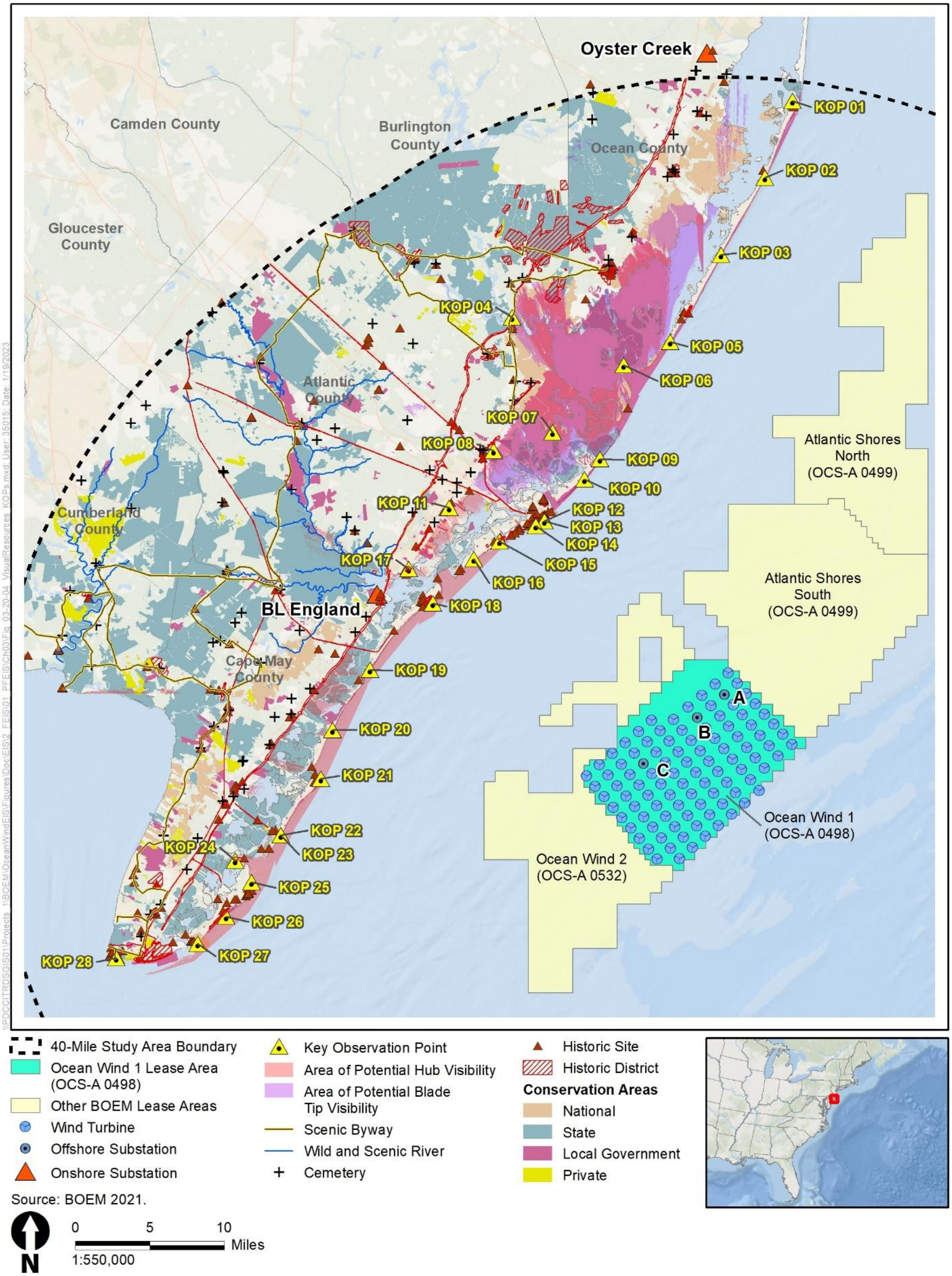

Figure 3.20-4 Scenic Resources and Key Observation Points

Table 3.20-8 Representative View Receptor Contexts and Key Observation Points

View Context	Key Observation Points
Vantage Point	KOP-1 Barnegat Lighthouse KOP-2 Harvey Cedars Beach Access KOP-3 Bay View Park KOP-8 Absecon Creek Boat Ramp KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-14 Atlantic City Playground Pier KOP-15 Ventor City, City Hall KOP-16 Lucy the Elephant National Historic Landmark KOP-18 Ocean City Boardwalk KOP-21 Avalon Beach Jetty KOP-25 Hereford Inlet Lighthouse KOP-26 Wildwood Crest Fishing Pier KOP-28 Cape May Lighthouse
Linear Receptor	KOP-4 Garden State Parkway KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-13 Atlantic City Beachfront—Nighttime KOP-20 Sea Isle City Promenade KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime KOP-24 North Wildwood Boulevard Bridge Representative KOP-32 Cruise Ship Shipping Lanes
Scenic Area	KOP-3 Bayview Park KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-11 Atlantic City Country Club KOP-17 Bay Front Historic District, Municipal Beach Park KOP-19 Corson's Inlet State Park KOP-27 Cape May National Wildlife Refuge Representative KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area
Substation Area	KOP-29 BL England Substation Area KOP-30 Oyster Creek Substation Area

WMA = Wildlife Management Area

The sensitivity of KOPs is determined with reference to view location and activity through (1) review of relevant designations and the level of policy importance that they signify (such as landscapes designated at the national, state, or local level); and (2) application of criteria that indicate value (such as scenic quality, rarity, recreational value, representativeness, conservation interests, perceptual aspects, and artistic associations). Judgements regarding seascape, open ocean, landscape, and KOP sensitivity are informed by COP Volume III, Appendix L (Ocean Wind 2023). Table 3.20-9 lists onshore KOP viewer sensitivity ratings.

Table 3.20-9 Onshore Key Observation Point Viewer Sensitivity Ratings

Rating	Key Observation Points
High	KOP-1 Barnegat Lighthouse KOP-2 Harvey Cedars Beach Access KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-11 Atlantic City Country Club KOP-12 Atlantic City Beachfront—Daytime KOP-13 Atlantic City Beachfront—Nighttime KOP-14 Atlantic City Playground Pier KOP-15 Ventor City, City Hall KOP-16 Lucy the Elephant National Historic Landmark KOP-17 Bay Front Historic District, Municipal Beach Park KOP-18 Ocean City Boardwalk KOP-19 Corson's Inlet State Park KOP-20 Sea Isle City Promenade KOP-21 Avalon Beach Jetty KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-26 Wildwood Crest Fishing Pier KOP-27 Cape May National Wildlife Refuge KOP-28 Cape May Lighthouse KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area KOP-32 Cruise Ship Shipping Lanes
Medium	KOP-29 BL England Substation Area KOP-30 Oyster Creek Substation Area
Low	None

WMA = Wildlife Management Area

Offshore viewing receptors include the fishing boats, pleasure craft, cruise ships, and undefined craft (60.3 percent) that represent marine traffic in the area (COP Volume II, Figure 2.3.6-3; Ocean Wind 2023). Daytime and nighttime views range from immediate foreground (0-mile [0-kilometer]) to 40-mile (64.4-kilometer) distances.

Daytime and nighttime aircraft receptors, arriving and departing Ocean City Municipal Airport and Atlantic City International Airport traffic, and others traversing the coast, range from foreground to background viewing situations. Aircraft receptors are more frequently affected by view-limiting atmospheric conditions than are land and water receptors.

Typical meteorological conditions limit visibility of the Wind Farm Area from inland and the coast on 77 percent of days and provide clear visibility on 23 percent of days (1 of every 4 to 5 days) (Atlantic Shores 2021). Views from nearer the shoreline are more limited by atmospheric conditions than views from inland areas. Many viewers, particularly recreational users, are more likely to be present on beaches, seawalls, and jetties on clearer days, when viewing conditions are better than on rainy, hazy, or foggy days. Therefore, affected environment and VIAs of the Project are based on clear-day and clear-night visibility. Elevated boardwalks, jetties, and seawalls afford greater visibility of offshore elements for viewers in tidal beach areas. Nighttime views toward the ocean from the beach and adjacent inland areas are diminished by ambient light levels and glare of shorefront developments.

3.20.2 Environmental Consequences

3.20.2.1. Impact Level Definitions for Scenic and Visual Resources

Definitions of impact levels are provided in Table 3.20-10. There are no beneficial impacts on scenic and visual resources.

Table 3.20-10 Impact Level Definitions for Scenic and Visual Resources

Impact Level	Impact Type	Definition
Negligible	Adverse	SLIA: Very little or no effect on seascape/landscape unit character, features, elements, or key qualities either because unit lacks distinctive character, features, elements, or key qualities; values for these are low; or Project visibility would be minimal. VIA: Very little or no effect on viewers’ visual experience because view value is low, viewers are relatively insensitive to view changes, or Project visibility would be minimal.
Minor	Adverse	SLIA: The Project would introduce features that may have low to medium levels of visual prominence within the geographic area of an ocean/seascape/ landscape character unit. The Project features may introduce a visual character that is slightly inconsistent with the character of the unit, which may have minor to medium negative effects on the unit’s features, elements, or key qualities, but the unit’s features, elements, or key qualities have low susceptibility or value. VIA: The visibility of the Project would introduce a small but noticeable to medium level of change to the view’s character; have a low to medium level of visual prominence that attracts but may or may not hold the viewer’s attention; and have a small to medium effect on the viewer’s experience. The viewer receptor sensitivity/susceptibility/value is low. If the value, susceptibility, and viewer concern for change is medium or high, the nature of the sensitivity is evaluated to determine if elevating the impact to the next level is justified. For instance, a KOP with a low magnitude of change but a high level of viewer concern (combination of susceptibility/value) may justify adjusting to a moderate level of impact.

Impact Level	Impact Type	Definition
Moderate	Adverse	SLIA: The Project would introduce features that would have medium to large levels of visual prominence within the geographic area of an ocean/ seascape/landscape character unit. The Project would introduce a visual character that is inconsistent with the character of the unit, which may have a moderate negative effect on the unit's features, elements, or key qualities. In areas affected by large magnitudes of change, the unit's features, elements, or key qualities have low susceptibility or value. VIA: The visibility of the Project would introduce a moderate to large level of change to the view's character; may have moderate to large levels of visual prominence that attracts and holds but may or may not dominate the viewer's attention; and has a moderate effect on the viewer's visual experience. The viewer receptor sensitivity/susceptibility/value is medium to low. Moderate impacts are typically associated with medium viewer receptor sensitivity (combination of susceptibility/value) in areas where the view's character has medium levels of change, or low viewer receptor sensitivity (combination of susceptibility/value) in areas where the view's character has large changes to the character. If the value, susceptibility, and viewer concern for change is high, the nature of the sensitivity is evaluated to determine if elevating the impact to the next level is justified.
Major	Adverse	SLIA: The Project would introduce features that would have dominant levels of visual prominence within the geographic area of an ocean/seascape/ landscape character unit. The Project would introduce a visual character that is inconsistent with the character of the unit, which may have a major negative effect on the unit's features, elements, or key qualities. The concern for change (combination of susceptibility/value) to the character unit is high. VIA: The visibility of the Project would introduce a major level of character change to the view; attract, hold, and dominate the viewer's attention; and have a moderate to major effect on the viewer's visual experience. The viewer receptor sensitivity/susceptibility/value is medium to high. If the magnitude of change to the view's character is medium but the susceptibility or value at the KOP is high, the nature of the sensitivity is evaluated to determine if elevating the impact to major is justified. If the sensitivity (combination of susceptibility/ value) at the KOP is low in an area where the magnitude of change is large, the nature of the sensitivity is evaluated to determine if lowering the impact to moderate is justified.

SLIA = seascape, open ocean, and landscape impact assessment

3.20.3 Impacts of the No Action Alternative on Scenic and Visual Resources

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on scenic and visual resources, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for scenic and visual resources. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.20.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for seascape, open ocean, landscape, and viewers described in Section 3.20.1, *Description of the Affected Environment for Scenic and Visual Resources*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing activities that contribute to impacts on scenic and visual resources in the geographic analysis area primarily involve onshore development and construction activities and offshore vessel traffic. These activities have the potential to contribute to new structures, traffic congestion, and nighttime light impacts. There are no ongoing offshore wind activities within the geographic analysis area for scenic and visual resources.

3.20.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned activities (without the Proposed Action). Planned non-offshore wind activities within the geographic analysis area that contribute to impacts on seascape, open ocean, landscape, and viewers include activities related to development of undersea transmission lines, gas pipelines, and submarine cables; dredging and port improvements; marine minerals extraction; military use; and marine transportation (see Section F.2 in Appendix F for a description of planned activities in the geographic analysis area). Planned activities have the potential to affect seascape character, open ocean character, landscape character, and viewer experience through the introduction of structures, light, land disturbance, traffic, air emissions, and accidental releases to the landscape or seascape. Table F1-22 in Appendix F provides additional information on potential impacts on scenic and visual resources associated with ongoing and planned non-offshore wind activities.

BOEM expects planned offshore wind development activities to affect seascape character, open ocean character, landscape character, and viewer experience through the following primary IPFs. Tables M-13 through M-16 in Appendix M consider effects on seascape, open ocean, landscape, and viewers of offshore wind development without the Proposed Action and in combination with the Proposed Action.

Presence of structures: Other offshore wind development will add structures offshore including WTGs and OSS. Under the No Action Alternative, seven offshore wind projects (Atlantic Shores South, Atlantic Shores North, Hudson South Lease Areas OCS-A 0541 and OCS-A 0542, Ocean Wind 2, Garden State, and Skipjack) would be constructed in the geographic analysis area between 2024 and 2030. The placement of 761 WTGs (excluding the Proposed Action) within the geographic analysis area under the planned activities scenario (Appendix F, Table F2-1) would contribute to adverse impacts on scenic and visual resources. Appendix M provides simulations of offshore wind development without the Proposed Action from four KOPs with views to the northeast and southeast (see Appendix M, simulations 1C, 2C, 3C, 4C, 5C, 6C, 7C, and 8C). Although seven offshore wind projects are planned within the geographic analysis area, it was determined that the Hudson South Lease Areas OCS-A 0541 and OCS-A 0542 would not have the potential to be seen within the same viewshed as the Project from ground-level coastal KOPs; therefore, these projects were not included in the simulations of other planned future offshore wind development. The total number of WTGs that would be visible from any single KOP would be substantially less than the 761 WTGs considered under the planned activities scenario. For example, a total of 406 WTGs would be theoretically visible from KOP-14 (Playground Pier) in Atlantic City and a total of 488 WTGs would be theoretically visible from KOP-22 Stone Harbor Beach Access (BOEM 2022). The presence of structures associated with offshore wind development would affect seascape character, open ocean character, landscape character, and viewer experience, as simulated from sensitive onshore receptors (Appendix M). The seascape character and open ocean character would reach the maximum level of change to their features and characters from formerly undeveloped ocean to dominant wind farm character by approximately 2030, which would result in major impacts.

Lighting: Construction-related nighttime vessel lighting would be used if offshore wind development projects include nighttime, dusk, or early morning construction or material transport. In a maximum-case scenario, lights could be active throughout nighttime hours for up to seven offshore wind projects within the geographic analysis area (excluding the Proposed Action). The impact of vessel lighting on scenic and visual resources during construction would be localized and short term. Visual impacts of nighttime lighting on vessels would continue during O&M of planned offshore wind facilities and the impact on seascape character, open ocean character, nighttime viewer experience, and valued scenery from vessel lighting would be intermittent and long term.

Permanent aviation warning lighting required on the WTGs would be visible from beaches and coastlines within the geographic analysis area and would have major to negligible impacts on scenic and visual resources. FAA hazard lighting systems would be in use for the duration of O&M for up to 761 WTGs. The cumulative effect of these WTGs and associated synchronized flashing strobe lights affixed with a minimum of three red flashing lights at the mid-section of each tower and one at the top of each WTG nacelle within the offshore wind lease areas would have long-term minor to major impacts on sensitive onshore and offshore viewing locations, based on viewer distance and angle of view and assuming no obstructions. Atmospheric and environmental factors such as haze and fog would influence visibility and perception of hazard lighting from sensitive viewing locations.

The implementation of ADLS would activate the hazard lighting system in response to detection of nearby aircraft. The synchronized flashing of the aviation lights, if ADLS is implemented, would result in shorter-duration night sky impacts on the seascape, open ocean, landscape, and viewers. The shorter-duration synchronized flashing of the ADLS is anticipated to have reduced visual impacts at night compared to the standard continuous, medium-intensity red strobe FAA warning system due to the reduced duration of activation. A Capital Airspace Group analysis estimated that ADLS-controlled obstruction lights would be activated for 1 hour 19 minutes and 17 seconds over a 1-year period based on historical air traffic data (Capital Airspace Group 2020). It is anticipated that the reduced time of FAA hazard lighting resulting from an implemented ADLS would reduce the duration of potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS. Although when lit the nighttime impacts of FAA aviation lighting would fall within BOEM’s major impact definition, BOEM has concluded that the ADLS-activated lighting system would reduce the impacts from major to negligible and moderate to negligible during those periods when the ADLS is not activated. Moonlit night times would increase the overall impacts of the wind farm from negligible to minor.

Traffic (vessel): Other offshore wind project construction and decommissioning and, to a lesser extent, O&M would generate increased vessel traffic that could contribute to adverse moderate to major impacts on scenic and visual resources within the geographic analysis area. The impacts would occur primarily during construction along routes between ports and the offshore wind construction areas. Vessel traffic for each project is not known but is anticipated to be similar to that of the Proposed Action, which is projected to generate between 20 and 65 vessels operating in the Wind Farm Area or over the offshore export cable route at any given time during the construction phase (Section 3.16). As shown in Table F2-1 in Appendix F, between 2023 and 2030 as many as seven offshore wind projects (excluding the Proposed Action) could be under construction simultaneously (in 2026). During such periods, assuming similar vessel counts as under the Proposed Action, construction of offshore wind projects would generate an average of 140 vessel trips daily from Atlantic Coast ports to worksites in the geographic analysis area, with as many as 455 vessels present (either underway or at anchor) during times of peak construction. Stationary and moving vessels would change the daytime and nighttime seascape and open ocean character from open ocean to active waterway.

Onshore and offshore visual impacts would continue from visible vessel activity related to O&M of offshore wind facilities. O&M activities for the Proposed Action are anticipated to generate an average of

10 vessel trips per day between a port and the Wind Farm Area. Based on the estimates for the Proposed Action, O&M of seven offshore wind projects under the No Action Alternative would generate an average of 70 vessel trips per day within the geographic analysis area. During O&M of offshore wind projects (excluding the Proposed Action), vessel traffic would result in long-term, intermittent contrasts to seascape and open ocean character and in the viewer experience of valued scenery. Vessel activity would increase again during decommissioning at the end of the assumed 35-year operating period of each project, with impacts similar to those described for construction.

Land disturbance: Other offshore wind development would require installation of onshore export cables, onshore substations, and transmission infrastructure to connect to the electric grid, which would result in localized, temporary visual impacts near construction sites due to land disturbance for vegetation clearing, site grading or trenching, and construction staging. These impacts would last through construction and continue until disturbed areas are restored. Intermittent land disturbance may also be required to maintain onshore infrastructure during O&M. The exact extent of impacts would depend on the locations of project infrastructure for offshore wind energy projects; however, the No Action Alternative would generally have localized, short-term minor to moderate impacts on scenic and visual resources during construction or O&M due to land disturbance.

Accidental releases: Accidental releases during construction, O&M, and decommissioning of offshore wind projects (excluding the Proposed Action) could affect nearby seascape character, open ocean character, landscape character, and viewers through the accidental release of fuel, trash, debris, or suspended sediments. Nearshore accidental releases could cause temporary closure of beaches, which would limit the opportunity for viewer experience of affected seascapes, open ocean area, and landscapes. The potential for accidental releases would be greatest during construction and decommissioning of offshore wind projects, and would be lower but continuous during O&M. Accidental releases would cause short-term moderate to major impacts.

3.20.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, current regional trends and activities would continue, and scenic and visual resources would continue to be affected by natural and human-caused IPFs. Ongoing non-offshore wind activities would have continuing short- and long-term impacts on seascape, open ocean, landscape, and viewer experience, primarily through the daytime and nighttime presence of structures, lighting, and vessel traffic. The character of the coastal landscape would change in the short term and long term through natural processes and planned activities that would continue to shape onshore features, character, and viewer experience. Ongoing activities in the geographic analysis area that contribute to visual impacts include construction activities and vessel traffic, which lead to increased nighttime lighting, visible congestion, and the introduction of new structures. The No Action Alternative would result in **minor** to **moderate** impacts on scenic and visual resources from ongoing activities.

Cumulative Impacts of the No Action Alternative. Planned activities in the geographic analysis area other than offshore wind include new cable emplacement and maintenance, dredging and port improvements, marine minerals extraction, military use, marine transportation, and onshore development activities. Other offshore wind projects planned within the geographic analysis area would lead to the construction of approximately 761 WTGs in areas where no offshore structures currently exist, and would change the surrounding marine environment from undeveloped ocean to a wind farm environment. The seascape character and open ocean character would reach the maximum level of change to their features and characters from formerly undeveloped ocean to dominant wind farm character by approximately 2030. The No Action Alternative combined with all other planned activities (including other offshore wind activities) would result in **major** impacts on visual and scenic resources within the geographic analysis area due to addition of new structures, nighttime lighting, onshore construction, and increased vessel traffic.

3.20.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on scenic and visual resources:

- The Project layout, including the number, size, and placement of the WTGs and OSS, and the design of lighting systems for structures;
- The number and type of vessels involved in construction, O&M, and decommissioning, and time of day that construction, O&M, and decommissioning would occur; and
- Onshore cable export route options and the size and location of onshore substations.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- WTG number, size, location, and lighting: More WTGs and larger turbine sizes closer to shore would increase visual impacts from onshore KOPs.
- The design and type of WTG lighting would affect nighttime visibility of WTGs from shore. Implementation of ADLS technology would reduce visual impacts.
- Vessel lighting: Nighttime construction, O&M, and decommissioning activities that involve nighttime lighting would increase visibility at night.
- Location and scale of onshore Project components: Installation of larger-scale onshore Project components in closer proximity to sensitive receptors would have greater impacts.

Ocean Wind has committed to measures to minimize impacts on scenic and visual resources such as addressing key design elements including visual uniformity, use of tubular towers, and proportion and color of turbines (VIS-01) and seeking public input in evaluating the visual site design elements of proposed wind energy facilities (VIS-03). Ocean Wind has also committed to screening the onshore substations where they are visible and highly contrasting to their surroundings (VIS-05) and to giving consideration to visually adapting the buildings and other substation components into their physical context, including using non-reflective paint (VIS-06) (COP Volume II, Table 1.1-2; Ocean Wind 2023).

3.20.5 Impacts of the Proposed Action on Scenic and Visual Resources

3.20.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.20.8, *Impacts of Alternative E on Scenic and Visual Resources*.

This section addresses the impacts associated with construction, O&M, and decommissioning of the Proposed Action on seascape character, open ocean character, landscape character, and viewer experience in the geographic analysis area. The impact level is judged with reference to the sensitivity of the view receptor and the magnitude of impact, which considers the noticeable features; distance and FOV effects;

view framing and intervening foregrounds; and the form, line, color, and texture contrasts, scale of change, and prominence in the characteristic seascape, open ocean, and landscape.

The degree of adverse effects is determined by the following criteria:

- The Proposed Action's characteristics, contrasts, scale of change, prominence, and spatial interactions with the special qualities and extents of the baseline seascape, open ocean, and landscape characters;
- Intervisibility between viewer locations and the Proposed Action's features; and
- The sensitivities of viewers.

Viewers or visual receptors within the Proposed Action's zone of theoretical visibility include:

- Residents living in coastal communities or individual residences;
- Tourists visiting, staying in, or traveling through the area;
- Recreational users of the seascape, including those using ocean beaches and tidal areas;
- Recreational users of the open ocean, including those involved in yachting, fishing, boating, and passage on ships;
- Recreational users of the landscape, including those using landward beaches, golf courses, cycle routes, and footpaths;
- Tourists, workers, visitors, or local people using transport routes;
- People working in the countryside, commerce, or dwellings; and
- People working in the marine environment, such as those on fishing vessels and crews of ships.

KOPs 1 through 30 (Figure 3.20-4) are representative of sensitive receptors (and their vicinities) in the shoreward (seascape and landscape) parts of the geographic analysis area, and two representative offshore (open ocean) KOPs (KOP-31 and KOP-32) are typical of views of the Lease Area from boats, cruise ships, and commercial ships. KOP-13 Atlantic City Beachfront—nighttime and KOP-23 Stone Harbor Beach Access—nighttime represent the nighttime assessment. Appendix D to COP Volume III, Appendix L presents visual simulations from each of 30 onshore KOPs considered in this analysis. Cumulative visual simulations in Appendix M, Attachment 2 portray future conditions of the Proposed Action and in combination with other offshore wind development (including Atlantic Shores South, Atlantic Shores North, Ocean Wind 2, Garden State, and Skipjack) from four representative KOPs: KOP-6 Great Bay Boulevard Wildlife Management Area; KOP-14 Playground Pier, Atlantic City; KOP-19 Corson's Inlet State Park, Ocean City; and KOP-22 Stone Harbor Beach Access. Tables M-13 through M-16 in Appendix M consider effects on seascape, open ocean, landscape, and viewers of offshore wind development without the Proposed Action and in combination with the Proposed Action.

Presence of structures: The Proposed Action would install 98 WTGs extending up to 906 feet (276 meters) above MLLW and three OSS extending up to 296 feet (90.2 meters) above MLLW within the Lease Area. The WTGs would be painted white or light gray, no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey. RAL 7035 Light Grey would help reduce potential visibility against the horizon. Additionally, the lower sections of each WTG would be marked with high-visibility (RAL 1023) yellow paint from the water line to a minimum height of 50 feet (15.2 meters). The presence of structures within the geographic analysis area under the Proposed Action would affect seascape character, open ocean character, landscape character, and viewer experience. The magnitude of WTG and OSS impact is defined by the contrast, scale of the change, prominence, FOV, viewer experience, geographical extent, and duration, correlated against the sensitivity of the receptor, as simulated from onshore KOPs. Appendix D to COP Volume III, Appendix L presents WTG and OSS visual simulations from each of 30 onshore KOPs considered in this analysis. The effects analyses involved consideration of those COP VIA clear-day simulations of similar distance, variability of viewer location within KOP vicinity, variability of sun angles throughout the day, and nighttime variability of cloud cover, ocean reflections, and moonlight.

Distance-based comparison of the perceived size of a typical onshore cell tower with the perceived size of an Ocean Wind 1 offshore turbine is as follows: A 100-foot (30.5-meter)-tall microwave tower seen at 1.7 miles (2.7 kilometers) distance would be perceived as the same height and occupy the same vertical portion of the view (0.64-degree-vertical in the overall 55-degree vertical FOV) as a 906-foot (276.1-meter)-tall Ocean Wind 1 WTG seen at 15.3 miles (24.6 kilometers) distance.

Appendix M in this Final EIS provides additional (cumulative effects) simulations of the Proposed Action from four KOPs with views to the northeast and southeast (see Appendix M, simulations 1A, 2A, 3A, 4A, 5A, 6A, 7A, and 8A) and provides an assessment of the Proposed Action's noticeable elements, distance effects, FOV effects, foreground elements and influence, scale effects, prominence effects, and contrast rating effects by seashore character unit, open ocean character unit, landscape character unit, and offshore and onshore KOP.

The seascape character units, open ocean character unit, landscape character units, and viewer experiences would be affected by the Proposed Action's noticeable elements (Table M-6), applicable distances (Table M-7), and FOV extents (Table M-8), open views versus view framing or intervening foregrounds (Table M-9), and form, line, color, and texture contrasts in the characteristic seascape, open ocean, and landscape (Table M-10). Higher impact significance stems from unique, extensive, and long-term appearance of strongly contrasting vertical structures in the otherwise horizontal open ocean environment, where structures are an unexpected element and viewer experience includes formerly open views of high-sensitivity seascape, open ocean, and landscape, and from high-sensitivity view receptors. Table 3.20-11 considers the totality of the Proposed Action's level of impact by seascape character unit, open ocean character unit, and landscape character unit.

Table 3.20-11 Proposed Action Impact on Seascape Character, Open Ocean Character, and Landscape Character

Level of Impact	Seascape Character Units, Open Ocean Character Unit, and Landscape Character Units
Major	SLIA: Open Ocean Character Unit
Moderate	SLIA: Seascape Character Units and Landscape Character Units: Beachfront and Jetty/Seawall, Boardwalk, Coastal Dune, and Island Community
Minor	SLIA: Landscape Character Units: Bay/Shoreline, Island, Mainland, Marshland, and Ridges
Negligible	SLIA: Landscape Character Units: Island, Mainland, and Ridges

SLIA = seascape, open ocean, and landscape impact assessment

Table 3.20-12 considers the totality of the Proposed Action's level of impact by offshore and onshore KOPs.

Table 3.20-12 Proposed Action Impact on Viewer Experience

Level of Impact	Offshore and Onshore Key Observation Points
Major	VIA: KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area KOP-32 Cruise Ship Shipping Lanes KOP-13 Atlantic City Beachfront—Nighttime[1]
Moderate	VIA: KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-14 Atlantic City Playground Pier KOP-16 Lucy the Elephant National Historic Landmark KOP-18 Ocean City Boardwalk KOP-19 Corson's Inlet State Park KOP-21 Avalon Beach Jetty KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime[2]
Minor	VIA: KOP-1 Barnegat Lighthouse KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp KOP-11 Atlantic City Country Club KOP-17 Bay Front Historic District, Municipal Beach Park KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-26 Wildwood Crest Fishing Pier KOP-28 Cape May Lighthouse KOP-29 BL England Substation Area KOP-30 Oyster Creek Substation Area
Negligible	VIA: KOP-2 Harvey Cedars Beach Access KOP-13 Atlantic City Beachfront—Nighttime[3] KOP-15 Ventor City, City Hall KOP-20 Sea Isle City Promenade KOP-23 Stone Harbor Beach—Nighttime[3] KOP-27 Cape May National Wildlife Refuge

[1] Major impacts when ADLS is activated.
[2] Moderate impacts when ADLS is activated.
[3] Negligible impacts when ADLS is not activated.
SLIA = seascape, open ocean, and landscape impact assessment; WMA = Wildlife Management Area

The Proposed Action would also add two onshore substations in the vicinity of Oyster Creek and BL England. Considering the location of the sites relative to scenic resources and public viewpoints, context of the sites and surrounding land uses, visual contrast between the substations and the surrounding landscape, and ability to screen the substations from public viewpoints, impacts of the substations on scenic and visual resources would be negligible to minor. All landfall export cable infrastructure would be underground and would not contribute to impacts on scenic and visual resources through the presence of structures IPF.

Lighting: Nighttime vessel lighting could result from construction, O&M, and decommissioning of the Proposed Action if these activities are undertaken during nighttime, evening, or early morning hours. Vessel lighting, depending on the quantity, intensity, and location, could be visible from unobstructed sensitive onshore and offshore viewing locations based on viewer distance and atmospheric conditions. The impact of vessel lighting on scenic and visual resources during construction and decommissioning would be moderate to major, localized, and short term. Visual impacts of nighttime lighting on vessels would continue during O&M but long-term impacts would be less due to the lower number of forecast vessel trips.

Vessel lights could be active during nighttime hours for up to eight offshore wind projects including the Proposed Action. Nighttime vessel lighting for the Proposed Action in combination with other offshore wind development would affect seascape character, open ocean character, nighttime viewer experience, and valued scenery. This impact would be localized and short-term during construction and decommissioning and intermittent and long-term during O&M.

Permanent aviation warning lighting on Proposed Action WTGs would be visible from beaches and coastlines within the geographic analysis area and would have impacts on scenic and visual resources. Field observations associated with visibility of FAA hazard lighting under clear-sky conditions indicate that FAA hazard lighting may be visible at a distance of 40 miles or more from the viewer. Darker-sky conditions may increase this distance due to increased contrast of the light dome (reflections from the ocean) and cloud reflections caused by the hazard lights.

Ocean Wind has committed to installing ADLS on WTGs, which activates the hazard lighting system in response to detection of nearby aircraft (GEN-07, COP Volume II, Table 1.1-2; Ocean Wind 2023). The synchronized flashing of the aviation lights occurs only when aircraft are present, resulting in shorter-duration night sky impacts on the seascape, open ocean, landscape, and viewers. Historical air traffic data for flights indicates that ADLS-controlled obstruction lights would be activated for an estimated 1 hour 19 minutes and 17 seconds over a 1-year period. Considering the local sunrise and sunset times, an ADLS-controlled obstruction lighting system could result in over a 99-percent reduction in system activated duration as compared to a traditional always-on obstruction lighting system (Capitol Airspace Group 2020). The shorter-duration synchronized flashing of ADLS is anticipated to have reduced visual impacts at night as compared to the standard continuous, medium-intensity red strobe FAA warning system due to the duration of activation. ADLS hazard lighting would be in use for the duration of O&M of the Proposed Action and would have intermittent and long-term effects on sensitive onshore and offshore viewing locations based on viewer distance and angle of view, and assuming no obstructions. Although when lit the nighttime impacts of FAA aviation lighting would fall within BOEM’s major impact definition, BOEM has concluded that the ADLS-activated lighting system would reduce the impacts from major to negligible and moderate to negligible during periods when the ADLS is not activated. A nighttime visual simulation that simulates activation of ADLS lighting is provided in Appendix M, Attachment M-4.

The OSS would be lit and marked in accordance with Occupational Safety and Health Administration lighting standards to provide safe working conditions when O&M personnel are present. The OSS would have nighttime lighting up to 296 feet (90.2 meters) above sea level. Due to EC, from eye levels of 5 feet

(1.5 meters), these lights would become invisible above the ocean surface beyond approximately 23.8 miles (38.3 kilometers). Lights of the three OSS, when lit for maintenance, potentially would be visible from beaches and adjoining areas during hours of darkness. The nighttime sky light dome and cloud lighting caused by reflections from the water surface may be seen from distances beyond the 40-mile (64.4-kilometer) geographic analysis area, depending on variable ocean surface and meteorological reflectivity.

The WTGs would be lit and marked in accordance with FAA and USCG lighting standards and consistent with BOEM best practices. Per USCG requirements, a mid-tower light would be located 256 feet (78 meters) above sea level. FAA hazard lighting systems would be in use for the duration of O&M for up to 859 WTGs including the Proposed Action and other offshore wind development. These WTGs and associated synchronized flashing strobe lights affixed with a minimum of three red flashing lights at the mid-section of each tower and one at the top of each WTG nacelle within the offshore wind lease areas would have long-term impacts on sensitive onshore and offshore viewing locations, based on viewer distance and angle of view and assuming no obstructions. Atmospheric and environmental factors such as haze and fog would influence visibility and perception of hazard lighting from sensitive viewing locations.

Traffic (vessel): Construction and installation, O&M, and decommissioning of the Proposed Action would generate increased vessel traffic that could contribute to adverse impacts on scenic and visual resources within the geographic analysis area. The impacts would occur primarily during construction along routes between ports and the offshore wind construction areas. Construction and installation of the Proposed Action is projected to generate between 20 and 65 vessels operating in the Wind Farm Area or over the offshore export cable route at any given time (Section 3.16). O&M activities for the Proposed Action are anticipated to generate an average of 10 vessel trips per day between a port and the Wind Farm Area. Impacts from the Proposed Action related to vessel traffic would be moderate to major.

Vessel traffic for each project is not known but is anticipated to be similar to that of the Proposed Action. As shown in Table F2-1 in Appendix F, between 2023 and 2030 as many as seven offshore wind projects (excluding the Proposed Action) could be under construction simultaneously (in 2026). During such periods, assuming similar vessel counts as under the Proposed Action, construction of offshore wind projects would generate an average of 140 vessel trips daily from Atlantic Coast ports to worksites in the geographic analysis area, with as many as 455 vessels present (either underway or at anchor) during times of peak construction. Stationary and moving vessels would change the daytime and nighttime seascape and open ocean characters from open ocean to active waterway.

Onshore and offshore visual impacts would continue from visible vessel activity related to O&M of offshore wind facilities. Based on the estimates for the Proposed Action, O&M of eight offshore wind projects (including the Proposed Action) would generate an estimated 80 vessel trips per day within the geographic analysis area. Vessel traffic during O&M would result in long-term, intermittent contrasts to open ocean character and in the viewer experience of valued scenery. Vessel activity would increase again during decommissioning at the end of the assumed 35-year operating period of each project, with impacts similar to those described for construction. Maintenance activities would cause minor effects on seascape character and open ocean character due to increased O&M vessel traffic to and from the offshore wind lease areas. Increases in these vessel movements would be noticeable to onshore and offshore viewers, but are unlikely to have a significant effect.

Land disturbance: The Proposed Action would require installation of onshore export cables, onshore substations, and transmission infrastructure to connect to the electrical grid, which would result in localized, temporary visual impacts near construction sites due to land disturbance for vegetation clearing, site grading or trenching, and construction staging. These impacts would last through construction and continue until disturbed areas are restored. Intermittent land disturbance may also be required to maintain onshore infrastructure during O&M. Impacts from the Proposed Action related to land disturbance would be minor to moderate.

Accidental releases: Accidental releases during construction, O&M, and decommissioning of the Proposed Action could affect nearby seascape character, open ocean character, landscape character, and viewers through the accidental release of fuel, trash, debris, or suspended sediments. Nearshore accidental releases could cause temporary closure of beaches, which would limit the opportunity for viewer experience of affected seascapes, open ocean, and landscapes.

3.20.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities.

Presence of structures: The Proposed Action would contribute 98 of a combined total of 859 WTGs that would be installed in the geographic analysis area between 2024 and 2030, which accounts for approximately 11 percent of offshore wind development planned for the geographic analysis area. The total number of WTGs that would be visible from any single KOP would be substantially fewer than the 859 WTGs considered under the planned activities scenario in combination with the Proposed Action. For example, a total of 504 WTGs would be theoretically visible from KOP-14 (Playground Pier) in Atlantic City and a total of 587 WTGs would be theoretically visible from KOP-22 Stone Harbor Beach Access (BOEM 2022). Appendix M provides simulations of the Proposed Action in combination with other offshore wind projects that would be theoretically visible within the same viewshed as the Project, including Atlantic Shores South, Atlantic Shores North, Ocean Wind 2, Garden State, and Skipjack. The presence of structures associated with offshore wind development in combination with the Proposed Action would have major seascape character, open ocean character, landscape character, and viewer experience impacts, as simulated from sensitive onshore receptors (see Appendix M, simulations 1B, 2B, 3B, 4B, 5B, 6B, 7B, and 8B). The open ocean character would reach the maximum level of change to its features and characters from formerly undeveloped ocean to dominant wind farm character by approximately 2030, which would result in major impacts.

Lighting: The extent to which other offshore wind projects would implement ADLS is unknown. Impacts from lighting would be reduced if ADLS is implemented across all offshore wind projects in the geographic analysis area and would be more adverse if other projects do not commit to using ADLS. Based on recent studies (Atlantic Shores 2021), activation of ADLS, if implemented, would occur for less than 11 hours per year, compared to standard continuous FAA hazard lighting. It is estimated that the reduced time of FAA hazard lighting resulting from an implemented ADLS would reduce the duration of potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS. Atmospheric and environmental factors such as haze and fog would influence visibility and perception of hazard lighting from sensitive viewing locations. Each offshore wind project would also have at least one OSS that would be lit and marked in accordance with USCG and Occupational Safety and Health Administration lighting standards. The Proposed Action would contribute an appreciable increment to the combined lighting impacts on scenic and visual resources from ongoing and planned activities including offshore wind, which would be major. Due to variable distances from visually sensitive viewing locations and potential use of ADLS, other reasonably foreseeable offshore wind projects in combination with the Proposed Action would have minor to major long-term impacts on visually sensitive viewing areas due to lighting. The recreational and commercial fishing, pleasure, and tour boating community would experience major adverse effects in foreground views.

Vessel traffic: The Proposed Action would contribute a noticeable increment to the combined vessel traffic impacts on scenic and visual resources from ongoing and planned activities including offshore wind, which would be moderate to major. Offshore wind activities would increase vessel traffic in the geographic analysis area beyond what the Proposed Action would generate in isolation.

Land disturbance: The Proposed Action would contribute a noticeable increment to the combined land disturbance impacts on scenic and visual resources from ongoing and planned activities including offshore wind, which would be minor to moderate. The exact extent of impacts would depend on the locations of project infrastructure for other offshore wind energy projects.

Accidental releases: The Proposed Action would contribute an appreciable increment to the combined impacts on scenic and visual resources from ongoing and planned activities including offshore wind, which would be moderate to major. The potential for accidental releases would be greatest during construction and decommissioning of offshore wind projects, and would be lower but continuous during O&M.

3.20.5.3. Conclusions

Impacts of the Proposed Action. The seascape character units, open ocean character unit, landscape character units, and viewer experience would be affected during construction, O&M, and decommissioning by the Project's features, applicable distances, horizontal and vertical FOV extents, view framing or intervening foregrounds, and form, line, color, and texture contrasts, scale of change, and prominence. These assessments are documented in Appendix M. Project decommissioning effects would be similar to construction effects. Due to distance, extensive FOVs, strong contrasts, large scale of change, and level 6 prominence, and heretofore undeveloped ocean views, the Proposed Action would have major impacts on the open ocean character unit and viewer boating and cruise ship experiences. Due to view distances (effects ranges discussion in Appendix M), moderate FOVs, moderate and weak visual contrasts, clear-day conditions, and nighttime ADLS activation, Proposed Action effects on high- and moderate-sensitivity seascape character units and landscape character units would be moderate to major. The daytime presence of offshore WTGs and OSS, as well as their nighttime lighting, would change perception of ocean scenes from natural and undeveloped to a developed wind energy environment characterized by WTGs and OSS. In clear weather, the WTGs and OSS would be an unavoidable presence in views from the coastline, with moderate to major effects on seascape character and landscape character.

Onshore, temporary moderate effects would occur during construction and decommissioning of the landfalls and onshore export cables. Effects during O&M activities would involve temporary vehicular and personnel presence and would be negligible. The context of the onshore substation sites surrounding industrial elements, strong visual contrast between the sites and the surrounding landscape, and the scale of change would be insubstantial as viewed from the KOPs. While the Project's visibility would be moderately prominent from the KOPs, the value of the onshore view is low, having little or no effect on viewers' quality of visual experience. Impacts of the onshore substations on scenic and visual resources would be negligible to minor. Impacts of the Proposed Action on scenic and visual resources would range from **minor** to **major**.

Cumulative Impacts of the Proposed Action. The incremental impacts contributed by the Proposed Action to the cumulative impacts on scenic and visual resources would be appreciable. BOEM anticipates that the impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities including other offshore wind development would be **major**. The main drivers for this impact rating are the major visual impacts associated with the presence of structures, lighting, and vessel traffic.

3.20.6 Impacts of Alternative B on Scenic and Visual Resources

Impacts of Alternative B. Alternative B was developed through the scoping process for the Draft EIS in response to public comments concerning the visual impacts of the Project. Under Alternative B, no surface occupancy would occur at select WTG positions to reduce the visual impacts of the proposed Project. Alternative B-1 would exclude placement of WTGs at up to nine WTG positions that are nearest to coastal communities (positions F01 to K01 and B02 to D02). Alternative B-2 would exclude placement of WTGs at up to 19 WTG positions that are nearest to coastal communities (positions F01 to K01, A02 to K02, A03, and C03). Selection of Alternative B-2 would be contingent on the larger WTG with a 240-meter rotor diameter being commercially available when BOEM issues its ROD.

The impacts of Alternatives B-1 and B-2 on seascape character units, open ocean character unit, and landscape character units are summarized in Table 3.20-13. Appendix M presents the methods, analyses, and visual simulations used to assess the impact of Alternatives B-1 and B-2.

Table 3.20-13 Alternatives B-1 and B-2 Impact on Seascape Character, Open Ocean Character, and Landscape Character

Level of Impact	Seascape Character Units, Open Ocean Character Unit, and Landscape Character Units
Major	SLIA: Open Ocean Character Unit
Moderate	SLIA: Seascape Character Units and Landscape Character Units: Beachfront and Jetty/Seawall, Boardwalk, Coastal Dune, and Island Community
Minor	SLIA: Landscape Character Units: Bay/Shoreline, Island, Mainland, Marshland, and Ridges
Negligible	SLIA: Landscape Character Units: Island, Mainland, and Ridges

SLIA = seascape, open ocean, and landscape impact assessment

The impacts of Alternatives B-1 and B-2 on viewer experience from offshore and onshore KOPs are summarized in Table 3.20-14.

Table 3.20-14 Impact of Alternatives B-1 and B-2 on Viewer Experience

Impact Level	Offshore and Onshore Key Observation Points
Major	VIA: KOP-13 Atlantic City Beachfront—Nighttime[1] KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area KOP-32 Cruise Ship Shipping Lanes
Moderate	VIA: KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-14 Atlantic City Playground Pier KOP-16 Lucy the Elephant National Historic Landmark KOP-18 Ocean City Boardwalk KOP-19 Corson's Inlet State Park KOP-21 Avalon Beach Jetty KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime[2]

Impact Level	Offshore and Onshore Key Observation Points
Minor	SLIA: Landscape Character Units: Marshland, and Bay/Shoreline KOP-1 Barnegat Lighthouse VIA: KOP-2 Harvey Cedars Beach Access KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp KOP-11 Atlantic City Country Club KOP-17 Bay Front Historic District, Municipal Beach Park KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-26 Wildwood Crest Fishing Pier KOP-28 Cape May Lighthouse KOP-29 BL England Substation Area KOP-30 Oyster Creek Substation Area
Negligible	VIA: KOP-2 Harvey Cedars Beach Access KOP-13 Atlantic City Beachfront—Nighttime[3] KOP-15 Ventor City, City Hall KOP-20 Sea Isle City Promenade KOP-23 Stone Harbor Beach—Nighttime[3] KOP-27 Cape May National Wildlife Refuge

[1] Major impacts when ADLS is activated.
[2] Moderate impacts when ADLS is activated.
[3] Negligible impacts when ADLS is not activated.
SLIA = seascape, open ocean, and landscape impact assessment; WMA = Wildlife Management Area

Cumulative Impacts of Alternative B. The incremental impacts resulting from individual IPFs would be appreciable.

3.20.6.1. Conclusions

Impacts of Alternative B. The seascape character units, open ocean character unit, landscape character units, and viewer experience would be affected by construction, O&M, and decommissioning of Alternatives B-1 and B-2 due to the noticeable elements, distance effects, FOV extents, view framing and intervening foregrounds, and visual contrasts, scale of change, and prominence effects as presented in Appendix M and summarized below.

Alternative B-1: For those shoreline viewers directly northwest of the Wind Farm Area, the distance to the nearest WTG would increase from 15.3 miles (24.6 kilometers) under the Proposed Action to 16.1 miles (25.9 kilometers) under Alternative B-1. The width of the front edge of the Wind Farm Area would be similar to that of the Proposed Action. Because WTG and OSS construction specifications would remain constant, the minimal change in Project size, character, and contrasts would be unnoticeable to viewers, particularly because the Proposed Action view would not be seen for comparison. This negligible reduction within the overall clear-day 124° horizontal FOV and 55° vertical FOV would be unnoticeable to the casual viewer at this distance and would not have noticeable differences in form, line, color, or texture contrasts to seascape unit character, open ocean unit character, or landscape unit character, or onshore or offshore viewer experience as compared to the Proposed Action.

Alternative B-2: For those onshore viewers directly northwest of the Wind Farm Area, increasing the distance to the nearest WTG from 15.3 miles (24.6 kilometers) under the Proposed Action to 16.9 miles (25.9 kilometers) under Alternative B-2 would decrease the wind farm's horizontal FOV by 0.8 percent (1°) and the vertical FOV (perceived height) of the nearest WTGs by 0.02 percent (0.03°) in a typical human's overall 55° vertical FOV. At a baseline distance of 15.3 miles (24.6 kilometers), removal of one row of WTGs from the northwestern side of the layout would decrease the FOV from 37.6° to 35.4°. This 2.2° difference within the typical overall 124° horizontal FOV would be unnoticeable to the casual viewer at this distance and would not have noticeable differences in form, line, color, or texture contrasts to seascape unit character or landscape unit character, or onshore or offshore viewer experience compared to under the Proposed Action.

The effects of Alternatives B-1 and B-2 on seascape character, open ocean character, landscape character, and viewer experience would be similar to the effects of the Proposed Action. Due to distance, extensive FOVs, strong contrasts, and heretofore undeveloped ocean views, Alternatives B-1 or B-2 would have **major** effects on the seascape unit character and viewer boating and cruise ship experiences. Due to view distances, moderate FOVs, moderate and weak visual contrasts, clear-day conditions, and nighttime ADLS activation, effects of Alternatives B-1 or B-2 on high- and moderate-sensitivity landscape character units would be **moderate**. The daytime presence of offshore WTGs and OSS, as well as their nighttime lighting, would change perception of ocean scenes from natural and undeveloped to a developed wind energy environment characterized by WTGs and OSS. In clear weather, the WTGs and OSS would be an unavoidable presence in views from the coastline, with moderate to major effects on landscape character.

Onshore, temporary minor to moderate effects would occur during construction and decommissioning of the landfalls and onshore export cables. Effects during O&M activities would involve temporary vehicular and personnel presence and would be negligible. The context of the onshore substation sites surrounding industrial elements, strong visual contrast between the sites and the surrounding landscape, and the scale of change would be substantial as viewed from the KOPs. While the Project's visibility would be prominent from the KOP, the value of the view is low, having little or no effect on viewers' quality of visual experience. Impacts of the onshore substations on scenic and visual resources would be **minor** to **moderate**.

Cumulative Impacts of Alternative B. The incremental impacts contributed by Alternatives B-1 or B-2 to the cumulative impacts on scenic and visual resources would be appreciable. BOEM anticipates that the cumulative impacts of Alternatives B-1 or B-2 would be **major**. The main drivers for this impact rating are the major visual impacts associated with the presence of structures, lighting, and vessel traffic.

3.20.7 Impacts of Alternatives C and D on Scenic and Visual Resources

Impacts of Alternatives C and D. Impacts of Alternative C and Alternative D related to the primary IPFs (presence of structures, light, vessel traffic, land disturbance, and accidental releases) would be similar to the impacts described for the Proposed Action. The seascape character units, open ocean character unit, landscape character units, and viewer experience would be affected by construction, O&M, and decommissioning of Alternatives C-1, C-2, and D due to the noticeable elements, distance effects, FOV extents, view framing and intervening foregrounds, and contrast rating effects as presented in Appendix M and summarized below.

The effects of Alternatives C-1, C-2, or D on seascape character, open ocean character, landscape character, and viewer experience would be similar to the effects of the Proposed Action. Alternative C-1 would relocate eight WTGs, Alternative C-2 would compress the WTG array layout, and Alternative D would install up to 15 fewer WTGs in the northeastern portion of the Lease Area. Horizontal and vertical FOV extent would be similar for all alternatives (Table 3.20-15 and Table 3.20-16) and differences between the alternatives and the Proposed Action would not be noticeable to the casual viewer at applicable distances to the WTG array.

Table 3.20-15 Horizontal FOV Occupied by Alternatives C-1, C-2, and D

Noticeable Element	Width miles (km)	Distance miles (km)	Horizontal FOV	Human FOV	Percent of FOV
C-1 WTGs	10.6 (17.1)	14.1 (22.7)	36.9°	124°	30%
C-2 WTGs	10.7 (17.2)	15.1 (24.3)	35.3°	124°	30%
D WTG	11.8 (19.0)	15.3 (25.9)	37.6°	124°	30%

km = kilometers

Table 3.20-16 Vertical FOV Occupied by Alternatives C-1, C-2, and D

Noticeable Element	Height feet (m) MLLW	Distance miles (km)	Visible Height[1] feet (m)	Vertical FOV	Human FOV	Percent of FOV
C-1 Rotor Blade Tip	906 (276.1)	14.1 (22.7)	820 (244)	0.6°	55°	1%
C-2 Rotor Blade Tip	906 (276.1)	15.1 (24.3)	804 (244)	0.6°	55°	1%
D Rotor Blade Tip	906 (276.1)	15.3 (25.9)	801 (244)	0.6°	55°	1%

[1] Based on intervening EC and clear-day conditions.
km = kilometers; m = miles

Cumulative Impacts of Alternatives C and D. The incremental impacts resulting from individual IPFs would be appreciable.

3.20.7.1. Conclusions

Impacts of Alternatives C and D. The effects of Alternatives C-1, C-2, or D on seascape character, open ocean character, landscape character, and viewer experience would be similar to the effects of the Proposed Action. Due to distance, extensive FOVs, strong contrasts, and heretofore undeveloped ocean views, Alternatives C-1, C-2, or D would have **major** effects on the open ocean character unit and viewer boating and cruise ship experiences. Due to view distances, moderate FOVs, moderate and weak visual contrasts, clear-day conditions, and nighttime ADLS activation, effects of Alternatives C-1, C-2, or D on high- and moderate-sensitivity seascape character units and landscape character units would be **moderate**. The daytime presence of offshore WTGs and OSS, as well as their nighttime lighting, would change perception of ocean scenes from natural and undeveloped to a developed energy environment characterized by WTGs and OSS. In clear weather, the WTGs and OSS would be an unavoidable presence in views from the coastline, with **moderate** effects on landscape character.

Onshore, temporary **moderate** effects would occur during construction and decommissioning of the landfalls and onshore export cables. Effects during O&M activities would involve temporary vehicular and personnel presence and would be **negligible**. The context of the onshore substation sites' surrounding industrial elements, strong visual contrast between the sites and the surrounding landscape, and the scale of change would be substantial as viewed from the KOPs. While the Project's visibility would be prominent from the KOP, the value of the view is low, having little or no effect on viewers' quality of visual experience; as such, impacts of the onshore substations on scenic and visual resources would be **negligible** to **minor**. Impacts of Alternatives C-1, C-2, or D on scenic and visual resources would range from **negligible** to **major**.

Cumulative Impacts of Alternatives C and D. The incremental impacts resulting from individual IPFs would be appreciable. BOEM anticipates that the cumulative impacts of Alternatives C-1, C-2, or D would be **major**. The main drivers for this impact rating are the major visual impacts associated with the presence of structures, lighting, and vessel traffic.

3.20.8 Impacts of Alternative E on Scenic and Visual Resources

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. Alternative E would lead to the same types of impacts on scenic and visual resources from construction and installation, O&M, and conceptual decommissioning activities in the Offshore Project area as described for the Proposed Action. The longer northern export cable route on Island Beach State Park could result in a slight increase to the localized, temporary visual impacts due to land disturbance for vegetation clearing, site grading or trenching, and construction staging as compared to the southern export cable route option under the Proposed Action. These impacts would last through construction and continue until disturbed areas are restored. Intermittent land disturbance may also be required to maintain onshore infrastructure during O&M.

Cumulative Impacts of Alternative E. The incremental impacts resulting from individual IPFs would be similar to those of the Proposed Action.

3.20.8.1. Conclusion

Impacts of Alternative E. The impacts of Alternative E on seascape character, open ocean character, landscape character, and viewer experience would be approximately the same as those of the Proposed Action, and would be **major** on the open ocean character unit and viewer boating and cruise ship experiences and **moderate** to **major** on high- and moderate-sensitivity seascape character units and landscape character units. The daytime presence of offshore WTGs and OSS, as well as their nighttime lighting, would change viewers' perception of ocean scenes from natural and undeveloped to a developed energy environment characterized by WTGs and OSS. In clear weather, the WTGs and OSS would be unavoidable presences in views from the coastline, with **moderate** to **major** impacts on seascape character, open ocean character, and landscape character.

Onshore, temporary **minor** to **moderate** impacts would occur during construction and decommissioning of the landfalls and onshore export cables. Impacts during O&M activities would involve temporary vehicular and personnel presence and would be negligible. The context of the onshore substation sites surrounding industrial elements, strong visual contrast between the sites and the surrounding landscape, and the scale of change would be substantial as viewed from the KOPs. While the Project's visibility would be prominent from the KOP, the value of the view is low, having little or no impact on viewers' quality of visual experience; as such, impacts of the onshore substations on scenic and visual resources would be **minor** to **moderate**. Impacts of Alternative E on scenic and visual resources would range from **moderate** to **major**.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the overall impacts on scenic and visual resources would be appreciable. BOEM anticipates that the cumulative impacts of Alternative E would be **minor** to **major**. The main drivers for this impact rating are the major visual impacts associated with the presence of structures, lighting, and vessel traffic.

3.20.9 Proposed Mitigation Measures

The National Park Service has proposed measures to minimize impacts on scenic and visual resources (Appendix H, Table H-3). If the measures analyzed below are adopted some adverse impacts could be further reduced.

Table 3.20-17 Additional Proposed Measures (Also Identified in Appendix H, Table H-3): Scenic and Visual Resources

Measure	Description	Effect
Adopt sustainable lighting practices	Adopt NPS-recommended sustainable lighting practices for outdoor lighting at onshore facilities (e.g., onshore substation and O&M facility). Sustainable outdoor lighting specifications include use of LEDs in warm colors, recessed and fully shielded lights, fixtures that include timers, motion detectors, hue adaptors, and dimmers, reducing light intensity, and proper installation of lights (see https://www.nps.gov/subjects/nightskies/sustainable-outdoor-lighting.htm).	Implementation of this measure would reduce the visual impact contributed by lighting at onshore facilities. Implementation of this measure would not reduce the major impact of the Proposed Action because the major impact level is primarily associated with the presence of structures in the offshore environment, including WTGs and OSS that are lit according to BOEM's Lighting and Marking Guidelines and FAA and USCG lighting standards.

LED = light-emitting diode; NPS = National Park Service

3.20.9.1. Measures Incorporated in the Preferred Alternative

BOEM has identified the following additional measures in Table 3.20-17 as incorporated in the Preferred Alternative: adopt sustainable lighting practices. The effect of this measure, if adopted, is described in Table 3.20-17.

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3.21. Water Quality (see Appendix G)

The reader is referred to Appendix G for a discussion of current conditions and potential impacts on water quality from implementation of the No Action Alternative, the Proposed Action, and other action alternatives.

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3.22. Wetlands

This section discusses potential impacts on wetlands from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The wetlands geographic analysis area, as shown on Figure 3.22-1, includes all subwatersheds that intersect the Onshore Project area, which encompasses all wetlands and surface waters that are most likely to experience impacts from the proposed Project. See Section 3.21 for a discussion of impacts on water quality.

3.22.1 Description of the Affected Environment for Wetlands

The National Wetlands Inventory (NWI) and NJDEP wetland data were used to determine the potential presence of wetlands. NWI information is provided in Appendix I and NJDEP information is provided in this section. NWI and NJDEP data rely on trained image analysts to identify potential wetlands. Tidal wetlands are areas where the Atlantic Ocean and estuaries meet land, are found below the spring high tide line, and are subject to regular flooding by the tides. Tidal wetlands are typically categorized into two zones, high marsh and low marsh. Non-tidal wetlands, otherwise referred to as freshwater wetlands, are not influenced directly by tides and are typically categorized based on their hydrology and predominant vegetation.

The BL England Onshore Project area lies within four watersheds: Cedar Swamp Creek (hydrologic unit code [HUC] 12 No. 020403020304), Corson Inlet-Ludlam Bay (HUC 12 No. 020403020407), Great Egg Harbor Bay-Atlantic Ocean Deep (HUC 12 No. 020403020500), and Great Egg Harbor Bay-Great Egg Harbor Inlet (HUC 12 No. 020403020408). All of these watersheds are within the Great Egg Harbor Watershed Management Area. The major watercourses draining these watersheds into the bays include Patcong Creek and the Great Egg Harbor, Middle, and Tuckahoe Rivers in the southern portion of the Project area. According to NJDEP and NWI wetland data, estuarine wetlands within the BL England Onshore Project area are dominated by large, contiguous swaths of tidal saline low marsh communities fringed by Phragmites (see COP Volume II, Figure 2.2.1-3; Ocean Wind 2023). Tidal wetlands are limited to areas adjacent to Roosevelt Boulevard and the Great Egg Harbor shoreline at the BL England substation. Freshwater wetlands are dominated by forested wetland communities. A large expanse of freshwater forested/shrub wetland is also identified within the Tuckahoe Wildlife Management Area along the BL England Onshore Project area boundary. NWI data are consistent with NJDEP wetland data that show estuarine and marine wetlands present along the backbays, major watercourses, and their tributaries (Ocean Wind 2023).

The Oyster Creek Onshore Project area lies within two watersheds: Forked River-Barnegat Bay (HUC 12 No. 020403010405) and Oyster Creek-Barnegat Bay (HUC 12 No. 020403010407). Both watersheds are within the Barnegat Bay Watershed Management Area. Oyster Creek and the South Branch of the Forked River are the major river systems within this area. Based on the NJDEP and NWI wetland data, estuarine and freshwater wetlands are found within the Oyster Creek Onshore Project area (See COP Volume II, Figure 2.2.1-4; Ocean Wind 2023). According to NJDEP data, wetlands are concentrated along the Forked River, Oyster Creek, and their tributaries. Freshwater wetlands are dominated by forested wetlands with large areas of Atlantic white cedar wetlands. Tidal wetlands are limited to areas adjacent to Barnegat Bay and the mouth of Oyster Creek and the Forked River. A large area of low-saline marsh dominates the area at the mouth of the Forked River. Low-saline marsh Phragmites-dominated coastal wetlands and scrub shrub wetlands dominate the area at the mouth of Oyster Creek (Ocean Wind 2023).

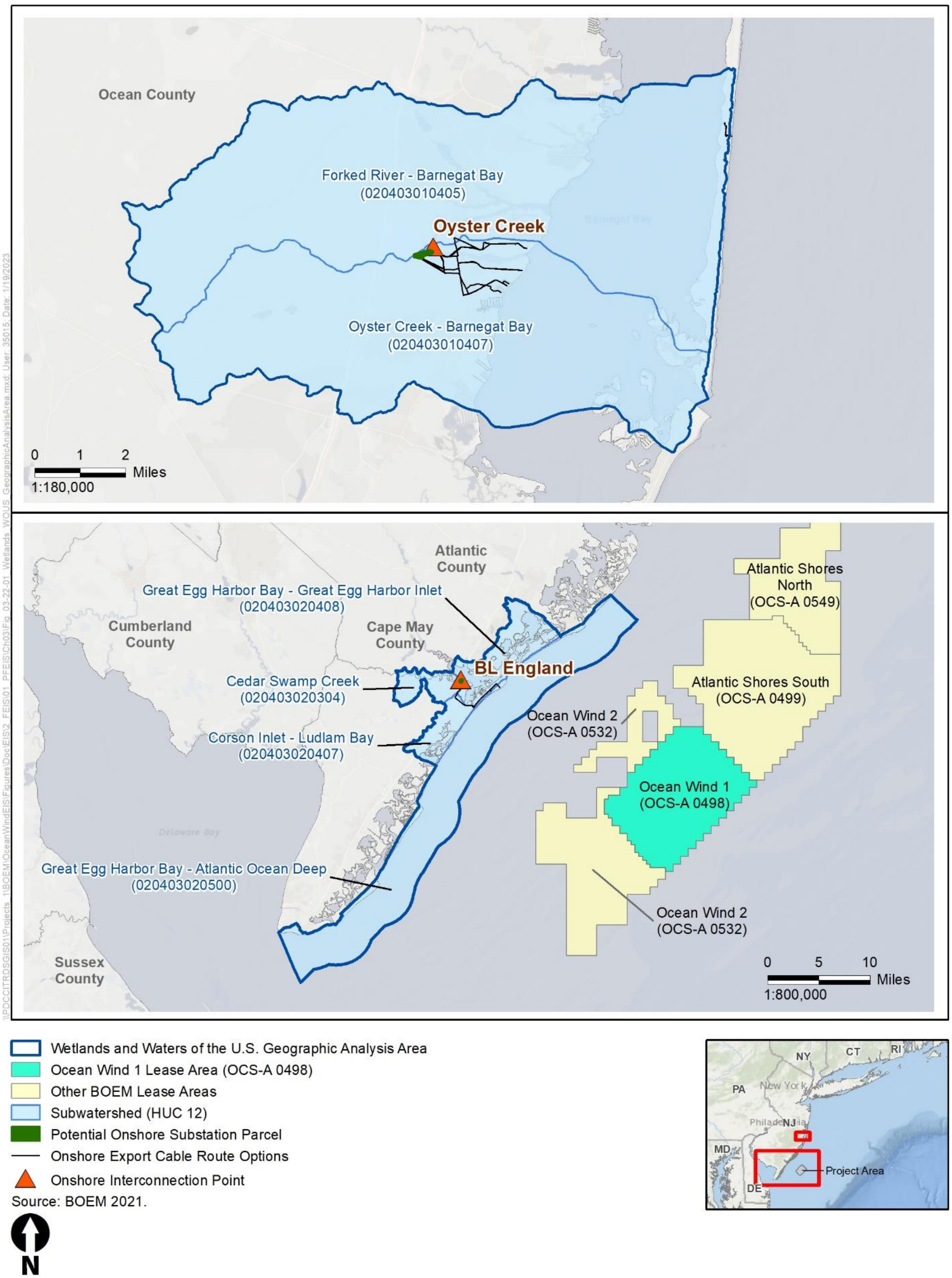

Figure 3.22-1 Wetlands Geographic Analysis Area

Wetlands are important features in the landscape that provide numerous beneficial services or functions. Some of these include protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, providing aesthetic value, ensuring biological productivity, filtering pollutant loads, and maintaining surface water flow during dry periods. The majority of the wetlands in the geographic analysis area are tidally influenced saline marshes, which provide shelter, food, and nursery grounds for coastal fisheries species including shrimp, crab, and many finfish. Saline marshes also protect shorelines from erosion by creating a buffer against wave action and by trapping soils. In flood-prone areas, saline marshes reduce the flow of flood waters and absorb rainwater. Tidal wetlands also serve as carbon sinks, holding carbon that would otherwise be released into the atmosphere and contribute to climate change. Wetlands in and around Barnegat Bay provide flood protection during storm events and function to sequester a significant amount of the nitrogen and phosphorous loading to the bay. These coastal wetlands can remove (through deposition and plant growth) approximately 85 percent of the nitrogen and 54 percent of the phosphorus entering the bay from upland sources (NJDEP 2021). Wetlands can provide habitat for a variety of wildlife species. COP Volume II, Tables 2.2.2-1 and 2.2.2-2, provide a list species associated with habitats in the onshore export cable study area, including species that may utilize wetland habitats. With more than 28 percent of Barnegat Bay's salt marshes having been lost to development, stabilizing and restoring existing wetlands and preventing the loss of any more wetlands is of significant importance (NJDEP 2021).

Table 3.22-1 displays the wetland communities within the geographic analysis area based on NJDEP wetland data.

Table 3.22-1 Wetland Communities in the Geographic Analysis Area

Wetland Community	Acres	Percent of Total
Freshwater		
Agricultural Wetlands (Modified)	26	0.1%
Atlantic White Cedar Wetlands	1,672	5.5%
Coniferous Scrub/Shrub Wetlands	375	1.2%
Coniferous Wooded Wetlands	1,664	5.4%
Deciduous Scrub/Shrub Wetlands	471	1.5%
Deciduous Wooded Wetlands	665	2.2%
Disturbed Wetlands (Modified)	45	0.1%
Former Agricultural Wetland (Becoming Shrubby, Not Built-Up)	3	0.0%
Herbaceous Wetlands	335	1.1%
Managed Wetland in Built-Up Maintained Rec Area	71	0.2%
Managed Wetland in Maintained Lawn Greenspace	22	0.1%
Mixed Scrub/Shrub Wetlands (Coniferous Dom.)	298	1.0%
Mixed Scrub/Shrub Wetlands (Deciduous Dom.)	415	1.4%
Mixed Wooded Wetlands (Coniferous Dom.)	1,470	4.8%
Mixed Wooded Wetlands (Deciduous Dom.)	971	3.2%
Phragmites Dominate Interior Wetlands	222	0.7%
Phragmites Dominate Urban Area	9	0.0%
Vegetated Dune Communities	1,622	5.3%
Wetland Rights-of-Way	67	0.2%

Wetland Community	Acres	Percent of Total
Tidal		
Saline Marsh (High Marsh)	465	1.5%
Saline Marsh (Low Marsh)	18,961	62.0%
Disturbed Tidal Wetlands	34	0.1%
Phragmites Dominate Coastal Wetlands	700	2.3%
Total	**30,581**	**100.0%**

Source: NJDEP 2015.

3.22.2 Environmental Consequences

3.22.2.1. Impact Level Definitions for Wetlands

As described in Section 3.3, this EIS uses a four-level classification scheme to characterize potential beneficial and adverse impacts of alternatives, including the Proposed Action. The definitions of impact levels are provided in Table 3.22-2. There are no beneficial impacts on wetlands. USACE and NJDEP define wetland impacts differently than BOEM due to requirements under CWA Section 404 and the New Jersey Freshwater Protection Act (as summarized below).

Table 3.22-2 Impact Level Definitions for Wetlands

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on wetlands would be so small as to be unmeasurable and impacts would not result in a detectable change in wetland quality and function.
Minor	Adverse	Impacts on wetlands would be minimized and would be relatively small and localized. If impacts occur, wetlands would completely recover.
Moderate	Adverse	Impacts on wetlands would be minimized; however, permanent impacts would be unavoidable. Compensatory mitigation required to offset impacts on wetland functions and values and would have a high probability of success.
Major	Adverse	Impacts on wetlands would be minimized; however, permanent impacts would be regionally detectable. Extensive compensatory mitigation required to offset impacts on wetland functions and values would have a marginal or unknown probability of success.

New Jersey Administrative Code 7:7A, Freshwater Wetlands Protection Act Rules, defines temporary disturbance as a regulated activity that occupies, persists, or occurs on a site for no more than 6 months. Impacts on wetlands that persist longer than 6 months are considered permanent. USACE defines temporary impacts as those that occur when fill or cut impacts occur in wetlands that are restored to preconstruction contours when construction activities are complete. (e.g., stockpile, temporary access). Conversion of a wetland type is also considered a permanent impact.

All earth disturbances from construction activities would be conducted in compliance with the New Jersey Pollutant Discharge Elimination System General Permit for Stormwater Discharges associated with Construction Activities and the approved stormwater pollution prevention plan (SWPPP) for the Project. Any work in wetlands would require a CWA Section 404 permit from USACE or NJDEP and a

Section 401 Water Quality Certification from NJDEP; any wetlands permanently lost would require compensatory mitigation.

3.22.3 Impacts of the No Action Alternative on Wetlands

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on wetlands, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for wetlands. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.22.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for wetlands described in Section 3.22.1, *Description of the Affected Environment for Wetlands*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing activities. Ongoing non-offshore activities within the geographic analysis area that may contribute to impacts on wetlands are generally associated with onshore development activities and climate change (see Section F.2 in Appendix F for a description of ongoing and planned activities). Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect wetlands through activities that can have permanent (e.g., fill placement) and short-term (e.g., vegetation removal) impacts on wetland habitat, water quality, and hydrology functions. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. If impacts would not be entirely avoided, mitigation would be anticipated to compensate for wetland loss. Climate change–induced sea level rise in the geographic analysis area is also anticipated to continue to affect wetlands. Inundation and rising water levels would result in the conversion of vegetated areas into areas of open water, with a consequent loss of wetland functions associated with the loss of vegetated wetlands. Wetlands have very specific water elevation tolerances; if water is not deep enough, it is no longer a wetland. Slowly rising waters on a gentle, continuously rising surface can result in wetlands migrating landward. In areas where slopes are not gradual or where there are other features blocking flow (e.g., bulkhead or surrounding developed landscape), wetland migration would be slowed or impeded. Rising coastal waters would also continue to cause saltwater intrusion, which occurs when saltwater starts to move farther inland and creeps into freshwater/non-tidal areas. Saltwater intrusion would continue to change wetland plant communities and habitat (i.e., freshwater species to saltwater species) and overall wetland functions. In Barnegat Bay, recent estimates indicate a 2.9-percent loss of tidal marsh wetlands per decade (NJDEP 2020). See Table F1-24 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for wetlands. There are no ongoing offshore wind activities within the geographic analysis area for wetlands.

3.22.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action). Planned non-offshore wind activities that may affect wetlands would primarily include increasing onshore construction and development activities (see Appendix F, Table F-8). These activities may permanently (e.g., fill placement) and temporarily (e.g., vegetation removal) affect wetland habitat, water quality, and hydrology functions. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. If impacts would not be entirely avoided, mitigation would be anticipated to compensate for wetland loss.

Impacts on wetlands from other offshore wind projects may occur if onshore and nearshore activity from these projects overlaps with the geographic analysis area. Atlantic Shores North and Ocean Wind 2, which are adjacent to the proposed Project, could have cable landings along the New Jersey coast that intersect the geographic analysis area. Atlantic Shores South currently has a landfall site proposed in the geographic analysis area in Atlantic City. The impacts of these offshore wind activities on wetlands would be of the same type as those of the Proposed Action, including impacts related to land disturbance.

BOEM expects planned offshore wind activities to affect wetlands through accidental releases, land disturbance, and cable emplacement and maintenance. The land disturbance IPF discusses impacts on freshwater/non-tidal wetlands landward of the mean high water line. The cable emplacement and maintenance IPF discusses impacts on tidally influenced wetlands below the mean high water line.

Accidental releases: During onshore construction of offshore wind projects in the geographic analysis area, oil leaks and accidental spills from construction equipment are potential sources of wetland water contamination. While many wetlands act to filter out contaminants, any significant increase in contaminant loading could exceed the capacity of a wetland to perform its normal water quality functions. Although degradation of water quality in wetlands could occur during construction, decommissioning, and, to a lesser extent, O&M, due to the small volumes of spilled material anticipated these impacts would all be short term until the source of the contamination is removed. Compliance with applicable state and federal regulations related to oil spills and waste handling would minimize potential impacts from accidental releases. These include the Resource Conservation and Recovery Act, Department of Transportation Hazardous Material regulations, and implementation of a Spill Prevention, Control, and Countermeasure Plan. Impacts from accidental releases on wetlands would be minor because accidental releases would be small and localized, and compliance with state and federal regulations would avoid or minimize potential impacts on wetland quality or functions.

Land disturbance: Construction of onshore components (e.g., onshore export cables, substations) in the geographic analysis area for Atlantic Shores South, Atlantic Shores North, and Ocean Wind 2 is anticipated to require clearing, excavating, trenching, fill, and grading, which could result in the loss or alteration of wetlands, causing adverse effects on wetland habitat, water quality, and flood and storage capacity functions. Fill material permanently placed in wetlands during construction would result in the permanent loss of wetlands, including any habitat, flood and storage capacity, and water quality functions that the wetlands may provide. If a wetland were partially filled and fragmented or if wetland vegetation were trimmed, cleared, or converted to a different vegetation type (e.g., forest to herbaceous), habitat would be altered and degraded (affecting wildlife use) and water quality and flood and storage capacity functions would be reduced by changing natural hydrologic flows and reducing the wetland’s ability to impede and retain stormwater and floodwater. On a watershed level, any permanent wetland loss or alteration could reduce the capacity of regional wetlands to provide wetland functions. Short-term wetland impacts may occur from construction activity that crosses or is adjacent to wetlands, such as rutting, compaction, and mixing of topsoil and subsoil. Where construction leads to unvegetated or otherwise unstable soils, precipitation events could erode soils, resulting in sedimentation that could affect water quality in nearby wetlands, as well as alter wetland functions if sediment loads are high (e.g., adverse habitat impacts from burying vegetation). The extent of wetland impacts would depend on specific construction activities and their proximity to wetlands. These impacts would occur primarily during construction and decommissioning; impacts during O&M would only occur if new ground disturbance was required, such as to repair a buried component. BOEM anticipates that onshore project components from other offshore wind projects would likely be sited in disturbed areas (e.g., along existing roadways), which would avoid and minimize wetland impacts. In addition, BOEM expects the offshore wind projects would be designed to avoid wetlands to the extent feasible. Offshore wind projects would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. Impacts from land disturbance on wetlands would be moderate because permanent wetland impacts would likely occur and compensatory mitigation would be required.

Cable emplacement and maintenance: Atlantic Shores South is anticipated to install export cables in the geographic analysis area. Atlantic Shores North and Ocean Wind 2 could also propose installation of export cables in the geographic analysis area. The wetland impact types and mechanisms would be similar to those described for the land disturbance IPF, and impacts on wetland functions (i.e., water quality, habitat, and hydrology) would be similar. Most tidal wetlands in the geographic analysis area are non-wooded tidal wetlands (e.g., saline marsh). Installation of cable would be unlikely to cause permanent wetland impacts because it would be unlikely that a permanent facility (e.g., substation) would be constructed in tidal wetlands and trenchless cable installation methods (HDD) would likely be used to avoid and minimize impacts. Affected wetlands would be restored to pre-existing conditions per permitting requirements. BOEM also anticipates the offshore wind projects would be designed to avoid wetlands (including tidal wetlands) to the extent feasible. Offshore wind projects would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. Impacts from cable emplacement on tidal wetlands would be minor because wetland impacts are anticipated to be short term and would not require compensatory mitigation.

3.22.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and wetlands would continue to be affected by natural and human-caused IPFs. Land disturbance from onshore construction periodically would cause short-term and permanent loss of wetlands. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. If impacts would not be entirely avoided or minimized, mitigation would be anticipated for projects to compensate for lost wetlands. Ongoing activities, especially land disturbance, would likely result in moderate impacts on wetlands. Therefore, the No Action Alternative would result in **moderate** impacts on wetlands.

Cumulative Impacts of the No Action Alternative. Planned activities could cause impacts that would be similar to those of the Proposed Action. Currently, there are no future offshore wind activities proposed in the geographic analysis area. If any were to occur, they would have some potential to result in temporary disturbance and permanent loss of wetlands. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands, thereby avoiding or minimizing impacts. If impacts would not be entirely avoided, compensatory mitigation would be anticipated for projects that result in permanent impacts, resulting in moderate impacts. Considering the IPFs and regulatory requirements for avoiding, minimizing, and mitigating impacts on wetlands, BOEM anticipates that the cumulative impacts of the No Action Alternative would be **moderate**, primarily through land disturbance.

3.22.4 Relevant Design Parameters & Potential Variances in Impacts

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in similar or lesser impacts than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on wetlands:

- The onshore export cable routing variants within the Onshore Project area

An onshore export cable route with less wetlands within or adjacent to the right-of-way would have less potential for direct and indirect impacts on wetlands.

Ocean Wind has committed to measures to minimize impacts on wetland resources. To the extent practicable, Ocean Wind would use appropriate installation technology designed to minimize disturbance to the seabed and sensitive habitat (such as beaches and dunes, wetlands and associated buffers, streams, hard-bottom habitats, seagrass beds, and the near-shore zone); avoid anchoring on sensitive habitat; and implement turbidity reduction measures to minimize impacts on sensitive habitat from construction activities (GEN-08). Ocean Wind is also coordinating wetland mitigation options with state and federal agencies and may identify a mix of banking and onsite restoration, depending on agency preference and availability (TCHF-03) (COP Volume II, Table 1.1-2; Ocean Wind 2023). Ocean Wind proposes to purchase wetland credits from the Great Bay Wetland Mitigation Bank through Evergreen Environmental, LLC, the mitigation banker. The proposed wetland impacts are entirely within the Geographic Service area of the Great Bay Wetland Mitigation Bank. The Great Bay Wetland Mitigation Bank is a federally approved mitigation bank with available credits.

3.22.5 Impacts of the Proposed Action on Wetlands

3.22.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.22.7, *Impacts of Alternative E on Wetlands*.

The Proposed Action could affect wetlands through accidental releases, land disturbance, and cable emplacement and maintenance. The land disturbance IPF discusses impacts on freshwater/non-tidal wetlands landward of the mean high water line. The cable emplacement and maintenance IPF discusses impacts on tidally influenced wetlands below the mean high water line.

Accidental releases: Onshore construction activities would require heavy equipment use and HDD activities, and potential spills could occur as a result of an inadvertent release from the machinery or during refueling activities. Ocean Wind would develop and implement a Spill Prevention, Control, and Countermeasure Plan to minimize impacts on water quality (prepared in accordance with applicable regulations such as NJDEP Site Remediation Reform Act, Linear Construction Technical Guidance, and Spill Compensation and Control Act). In addition, all wastes generated onshore would comply with applicable federal regulations, including the Resource Conservation and Recovery Act and the Department of Transportation Hazardous Material regulations. Therefore, BOEM anticipates the Proposed Action would result in minor and temporary impacts on wetlands as a result of releases from heavy equipment during construction and other cable installation activities.

Land disturbance: Construction impacts on wetlands and related functions would be similar to those described in Section 3.22.3.2. Construction of the Oyster Creek and BL England onshore substations and the onshore export cables via typical trenching and open-cut methods would result in excavation, rutting, compaction, mixing of topsoil and subsoil, and potential alteration due to clearing at handhole and manhole locations. These impacts would be mostly short term in non-wooded wetlands, as restoration would be conducted in accordance with applicable USACE and NJDEP permit requirements. Following installation of export cables within wetlands, topography would be restored and soils would be decompacted to avoid long-term impacts on soils and hydrology. Appendix I contains figures showing wetlands in the Oyster Creek and BL England Onshore Project areas.

Long-term changes from wooded to herbaceous wetlands could occur if clearing is required in wooded wetlands. Ocean Wind has estimated that up to 4.98 acres of long-term disturbance would occur within wooded wetlands. Loss of wetland could occur if permanent placement of fill is required in wetlands. Placement of fill within a wetland or permanent conversion of wooded wetlands to herbaceous or shrub/scrub wetlands within the permanent easement would constitute a permanent impact on wetlands. Other long-term impacts on wetlands would include clearing wooded wetlands within the temporary workspace. While these would be allowed to revert to forested wetland condition, the recovery is expected to take more than 3 years. Table 3.22-3 quantifies the impacts based on NJDEP's wetland mapping and the cable route options as described in COP Volume I (Ocean Wind 2023).

Approximately 0.53 acre of short-term wetland impacts could potentially occur as a result of cable burial at BL England, and 20.04 acres of short-term and long-term impacts could potentially occur as a result of cable burial at Oyster Creek. Wetland impacts for the PDE were calculated for each indicative route (using a 50-foot-wide corridor and the necessary workspace) that had the highest wetland impact for each wetland type. For example, the Farm Property reroute was the only route with impacts on mixed scrub/shrub wetlands (coniferous), so for that wetland type the impacts associated with the Farm Property reroute were included in Table 3.22-3. The Nautilus route would result in the highest impact on mixed wooded wetlands (coniferous), so the impacts associated with this route were included in Table 3.22-3. Finally, impacts from additional workspaces for these wetlands types were added; additional workspace for Oyster Creek was added to the Farm property landfall and the workspace at Island Beach State Park. Additional workspace was also added for the landfall at Bay Parkway, Lighthouse Drive, and Nautilus Drive, and for potential HDD areas west of Route 9. The PDE includes two crossings of Island Beach State Park, where the offshore export cable would make landfall for a short distance and then enter Barnegat Bay. Both would cross wetlands, including deciduous scrub shrub, mixed scrub shrub, and saline marsh (south crossing only), but the southerly crossing would avoid wetland impacts due to the proposed use of HDD that would avoid wetlands (see Section 3.22.7 below).

Following construction, these wetland impact areas would be restored to pre-existing conditions, and herbaceous vegetation would become reestablished (GEN-13; see COP Volume II, Table 1.1-2; Ocean Wind 2023). Trenchless technology methods may be used along portions of the onshore export cable routes to avoid impacts on wetlands or other sensitive and unique habitats. Construction laydown areas would be located in previously disturbed areas where possible. The BL England and Oyster Creek substation sites have been selected within already disturbed and developed areas to minimize impacts on habitat. Permanent and temporary workspace for substation construction would be sited to avoid wetlands to the extent practicable. Depending on the site selected, it may be necessary to locate an access road within these resources.

NJDEP-regulated adjacent transition areas may also be affected by clearing and soil disturbance. Water quality within wetlands could be affected by sedimentation from nearby exposed soils. Ocean Wind would use erosion and sedimentation controls and BMPs and develop and implement a SWPPP to avoid and minimize impacts during onshore construction (GEN-11; see COP Volume II, Table 1.1-2; Ocean Wind 2023). Additionally, during onshore construction, dewatering may be required. BMPs would be used during dewatering activities, such as diversion, filtering, and energy dissipation devices. Dewatering activities would be short term, and water drawdown would be minimal.

Normal O&M activities are not expected to involve further wetland alteration beyond periodic woody vegetation removal. The permanent right-of-way around handholes and manholes would be maintained in an herbaceous state during the operational life of the Project. The onshore cable routes generally would have no maintenance needs unless a fault or failure occurs. Decommissioning of the onshore Project components would have similar impacts as construction.

Impacts on wetlands would be avoided and minimized by locating substations, cable routes, and work areas within upland areas. For impacts that are unavoidable, compensatory mitigation would be necessary to replace the loss of wetlands and associated functions. Ocean Wind will identify compensatory mitigation based on the requirements of USACE and NJDEP. Ocean Wind is coordinating wetland mitigation options with state and federal agencies and may identify a mix of banking and onsite restoration, depending on agency preference and availability (TCHF-03).[1] In summary, potential adverse impacts on wetlands would be short term and long term, and localized. The impacts of land disturbance on wetlands resulting from the Proposed Action would be moderate, because although impacts on wetlands would be minimized, compensatory mitigation would likely be necessary because of unavoidable permanent impacts.

Table 3.22-3 Wetland Impacts Along Onshore Export Cable Routes – Proposed Action

Wetland Community	Impact (Acres)	% Relative to Wetlands in GAA	Duration
BL England			
Tidal			
Phragmites dominant coastal wetlands	0.35	0.05	Short term (<3 years)
Saline marsh (low marsh)	0.18	<0.01	Short term (<3 years)
BL England Subtotal	**0.53**	**--**	**--**
Oyster Creek			
Freshwater			
Deciduous scrub/shrub wetlands	1.53	0.33	Short term (<3 years)
Deciduous wooded wetlands	0.96	0.14	Long term (>3 years)
Herbaceous wetlands	0.08	0.02	Short term (<3 years)
Mixed scrub/shrub wetlands (coniferous dominant)	0.81	0.27	Short term (<3 years)
Mixed scrub/shrub (deciduous dominant)	1.55	0.37	Short term (<3 years)
Mixed wooded wetlands (coniferous dominant)	0.87	0.06	Long term (>3 years)
Vegetated dune communities	0.53	0.03	Short term (<3 years)
Atlantic white cedar wetlands	2.39	0.14	Long term (>3 years)
Coniferous scrub/shrub wetlands	0.40	0.11	Short term (<3 years)
Coniferous wooded wetlands	0.42	0.03	Long term (>3 years)
Managed wetland in built-up maintained recreation area	0.48	0.68	Short term (<3 years)
Mixed wooded wetlands (deciduous dominant)	0.34	0.04	Long term (>3 years)
Total Freshwater	10.36	--	--
Tidal			
Saline marsh (high marsh)	2.54	0.55	Short term (<3 years)
Saline marsh (low marsh)	2.72	0.01	Short term (<3 years)
Phragmites dominant coastal wetlands	5.25	0.74	Short term (<3 years)
Disturbed tidal wetlands	0.05	0.15	Short term (<3 years)
Total Tidal	9.68	--	--
Oyster Creek Subtotal	**20.04**	**--**	**--**
Total: BL England and Oyster Creek	**20.57**	**--**	**--**

Source: Ocean Wind 2023.

[1] USACE's Public Notice NAP-2017-00135-84 states that Ocean Wind proposes to purchase a total of 2.05 wetland credits from the Great Bay Wetland Mitigation Bank through Evergreen Environmental, LLC, the mitigation bank sponsor.
NJDEP Application Number 0000-21-0008.2 LUP22001 states that Ocean Wind intends to purchase wetland mitigation credits from a mitigation bank that services the area.

GAA = geographic analysis area

Cable emplacement and maintenance: Submarine cable transition to an onshore cable (cable landfall) would require connections at TJBs at the BL England and Oyster Creek landfall sites. Export cables would be installed at the landfall sites using open cut (i.e., trenching) or HDD, which would affect wetlands through compaction and excavation. Temporary work areas at landfall sites would also affect wetlands through compaction and the placement of fill material. Following installation of export cables within wetlands, topography would be restored and soils would be decompacted to avoid long-term impacts on soils and hydrology. At BL England, HDD would be used to transition from submarine cable to the landfall point. The onshore route to reach the BL England substation would traverse upland road right-of-way, but may affect tidal wetlands adjacent to Roosevelt Boulevard. At Oyster Creek, the northernmost landfall option in the PDE would be in tidal wetlands and, after cable landfall, the onshore cable route would traverse tidal wetlands. Although HDD would also be used for the Oyster Creek export cable route for the transition from submarine cables to the landfall point, tidal wetlands are more extensive in this location and there are two cables. Emplacement of cables in tidal wetlands would affect 0.53 acre of wetland at BL England and 9.68 acres at Oyster Creek (Table 3.22-3). Construction impacts on these wetlands and related functions would be similar to those described in Section 3.22.3.2.

Normal O&M activities are not expected to involve further wetland alteration beyond periodic woody vegetation removal. The permanent right-of-way around TJBs would be maintained in an herbaceous state during the operational life of the Project. The onshore cable routes generally would have no maintenance needs unless a fault or failure occurs. Decommissioning of the onshore Project components would have similar impacts as construction.

Impacts on tidal wetlands would be avoided and minimized by the proposed use of HDD at export cable landfalls and to cross waterbodies and the associated wetlands such as Oyster Creek and Crook Horn Creek/Peck Bay. For impacts that are unavoidable, compensatory mitigation would be necessary to replace the loss of wetlands and associated functions. Mitigation would likely include a combination of onsite restoration of wetlands temporarily affected during construction and mitigation banking credit purchase.[2] Wetland impacts would be primarily short term because the wetlands are non-wooded and impact areas would be restored to pre-existing conditions, and herbaceous vegetation would become reestablished (GEN-13; see COP Volume II, Table 1.1-2; Ocean Wind 2023). The impacts of cable emplacement on wetlands resulting from the Proposed Action would be moderate, because although impacts on wetlands would be minimized, compensatory mitigation would likely be necessary because of unavoidable permanent impacts.

3.22.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities. Ongoing and planned non-offshore wind activities related to onshore development activities would contribute to impacts on wetlands through the primary IPFs of accidental releases, land disturbance, and cable emplacement and maintenance. The construction, O&M, and decommissioning of onshore infrastructure for offshore wind activities in the geographic analysis area would also contribute to the primary IPF of land disturbance. Temporary disturbance and

[2] USACE's June 17, 2022, Public Notice NAP-2017-00135-84 states, "The proposed project, including the Oyster Creek and BL England components, will result in a proposed permanent disturbance to 0.028 acres of tidal, emergent wetlands and 2.013 acres of non-tidal, emergent wetlands dominated by common reed and mowed turfgrass. In order to compensate for the unavoidable impacts, the applicant proposes to purchase a total of 2.05 wetland credits from the Great Bay Wetland Mitigation Bank through Evergreen Environmental, LLC, the mitigation bank sponsor."

permanent loss of wetland may occur as a result of offshore wind development. BOEM is not aware of any future offshore wind activities other than the Proposed Action that would overlap the geographic analysis area for wetlands. However, if wetland alteration or loss is anticipated, it would likely be minimal, the overall scale of impacts is expected to be small, and any activities that would result in these impacts would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts.

Accidental releases: The Proposed Action would contribute an undetectable increment to the cumulative accidental release impacts on wetlands. Impacts would likely be short term and minor due to the low risk and localized nature of the most likely spills, the use of an Oil Spill Response Plan for projects, and regulatory requirements for the protection of wetlands. These impacts would occur primarily during construction, but also during operation and decommissioning to a lesser degree. Given the low probability of these spills occurring, BOEM does not expect ongoing and planned activities, including offshore wind, to contribute to impacts on wetlands resulting from accidental releases.

Land disturbance: The Proposed Action would contribute noticeable incremental impacts to the cumulative land disturbance impacts. Impacts would likely be short term to long term and moderate due to the permanent wetland impacts that would require compensatory mitigation. Impacts due to onshore land use changes are expected to include a gradually increasing amount of wetland alteration and loss. The future extent of land disturbance from ongoing and planned non-offshore wind activities over the next 35 years is not known with as much certainty as the extent of land disturbance that would be caused by the Proposed Action, but based on regional trends is anticipated to be similar to or greater than that of the Proposed Action. Some information is available for Atlantic Shores South, which has a similar geographic analysis area to that of Ocean Wind 1 and would result in approximately 2.76 acres of temporary wetland impacts and 0.13 acre of permanent wetland impacts (Atlantic Shores 2021). If other future projects were to overlap the geographic analysis area or even be co-located (partly or completely) within the same right-of-way corridor that the Proposed Action would use, then the impacts of those future projects on wetlands would be of the same type as those of the Proposed Action alone; the degree of impacts may increase, although the location and timing of future activities would influence this. For example, repeated construction in a single right-of-way corridor would be expected to have less impact on wetlands than construction in an equivalent area of undisturbed wetland.

Cable emplacement and maintenance: The Proposed Action would contribute noticeable incremental impacts to the cumulative cable emplacement and maintenance impacts. Impacts due to onshore land use changes are expected to include a gradually increasing amount of tidal wetland alteration and loss. Impacts would likely be short term to long term and moderate due to the permanent wetland impacts that would require compensatory mitigation. The future extent of tidal wetland disturbance from ongoing and planned non-offshore wind activities over the next 35 years is not known with as much certainty as the extent of disturbance that would be caused by the Proposed Action but, based on regional trends, is anticipated to be similar to or greater than that of the Proposed Action. Some information is available for Atlantic Shores South, which has a similar geographic analysis area to that of Ocean Wind 1 and would result in only 215 square feet of temporary tidal wetland impacts (Atlantic Shores 2021). If other future projects were to overlap the geographic analysis area or even be co-located (partly or completely) within the same corridor that the Proposed Action would use, then the impacts of those future projects on tidal wetlands would be of the same type as those of the Proposed Action; the degree of impacts may increase, although the location and timing of future activities would influence this. For example, repeated construction in a single corridor would be expected to have less impact on tidal wetlands than construction in an equivalent area of undisturbed wetland. All earth disturbances from construction activities would be conducted in compliance with the New Jersey Pollutant Discharge Elimination System General Permit for Stormwater Discharges associated with Construction Activities and the approved SWPPP for the Project. Any work in wetlands would require a CWA Section 404 permit from USACE or

NJDEP and a Section 401 Water Quality Certification from NJDEP; any wetlands permanently lost would require compensatory mitigation.

3.22.5.3. Conclusions

Impacts of the Proposed Action. The Proposed Action may affect wetlands through short-term or permanent disturbance from activities within or adjacent to these resources. Considering the avoidance, minimization, and mitigation measures required under federal and state statutes (e.g., CWA Section 404), construction of the Proposed Action would likely have **moderate** impacts on wetlands.

Cumulative Impacts of the Proposed Action. BOEM anticipates that the cumulative impacts on wetlands in the geographic analysis area would be moderate. The incremental impacts contributed by the Proposed Action to the cumulative impacts on wetlands would be noticeable. BOEM anticipates that the impacts associated with the Proposed Action when combined with the impacts on wetlands from ongoing and planned activities including offshore wind would likely be **moderate**. The Proposed Action would contribute to the cumulative impact rating primarily through short-term and permanent impacts on wetlands from cable landfall and onshore construction activities. Measurable impacts would be relatively small and the resource would likely recover completely when the affecting agent (e.g., temporary construction activity) is gone and remedial or mitigating action is taken.

3.22.6 Impacts of Alternatives B, C, and D on Wetlands

Impacts of Alternatives B, C, and D. The impacts of Alternatives B, C, and D would be similar to those of the Proposed Action because these alternatives differ only with respect to offshore components, and offshore components of the proposed Project have no potential impacts on wetlands. The impacts resulting from land disturbance, accidental releases, and cable emplacement and maintenance associated with onshore construction under Alternatives B, C, and D on wetlands are expected to be the same as those of the Proposed Action.

Cumulative Impacts of Alternatives B, C, and D. The cumulative impacts on wetlands would be moderate for the same reasons described for the Proposed Action. The incremental impacts contributed by the action alternatives to the cumulative impacts on wetlands would be the same as described under the Proposed Action.

3.22.6.1. Conclusions

Impacts of Alternatives B, C, and D. The expected **moderate** impacts associated with the Proposed Action would not change under Alternatives B, C, and D because the alternatives only differ in offshore components, and offshore components would not contribute to impacts on wetlands; the same construction and installation, O&M, and conceptual decommissioning activities would still occur.

Cumulative Impacts of Alternatives B, C, and D. The incremental impacts contributed by Alternatives B, C, and D to the cumulative impacts on wetlands would be the same as those of the Proposed Action: noticeable. Because the impacts of the Proposed Action would not change under Alternatives B, C, and D, BOEM anticipates that the cumulative impacts of Alternatives B, C, and D would be the same as described for the Proposed Action. Therefore, the cumulative impacts of Alternatives B, C, and D would be **moderate**.

3.22.7 Impacts of Alternative E on Wetlands

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. The impacts on wetlands from Alternative E would be similar to those of the Proposed Action. While Alternative E would cross less wetlands than the southern crossing option on Island Beach State Park, the southern crossing would completely avoid wetlands because wetlands would be bored under with HDD. Therefore, Alternative E may have slightly greater wetland impacts compared to the Proposed Action (if Ocean Wind elected to use the southern crossing option under the Proposed Action) because the trenching method would be used to install the onshore cable for the northern crossing of Island Beach State Park (Figure 3.22-2). Impacts from accidental releases, land disturbance, and cable emplacement and maintenance would still remain small, impacts would primarily occur in existing rights-of-way, mitigation measures (e.g., Spill Prevention, Control, and Countermeasure Plan and SWPPP) would be implemented, and compliance with federal and state regulations (e.g., CWA Section 404) for protection of wetlands would be required.

Cumulative Impacts of Alternative E. The cumulative impacts on wetlands would be moderate for the same reasons described for the Proposed Action. The incremental impacts contributed by Alternative E to the cumulative impacts on wetlands would be the same as those of the Proposed Action. While Alternative E may have slightly greater wetland impacts compared to the Proposed Action (if Ocean Wind elected to use the southern crossing option under the Proposed Action), the impact rating would not change.

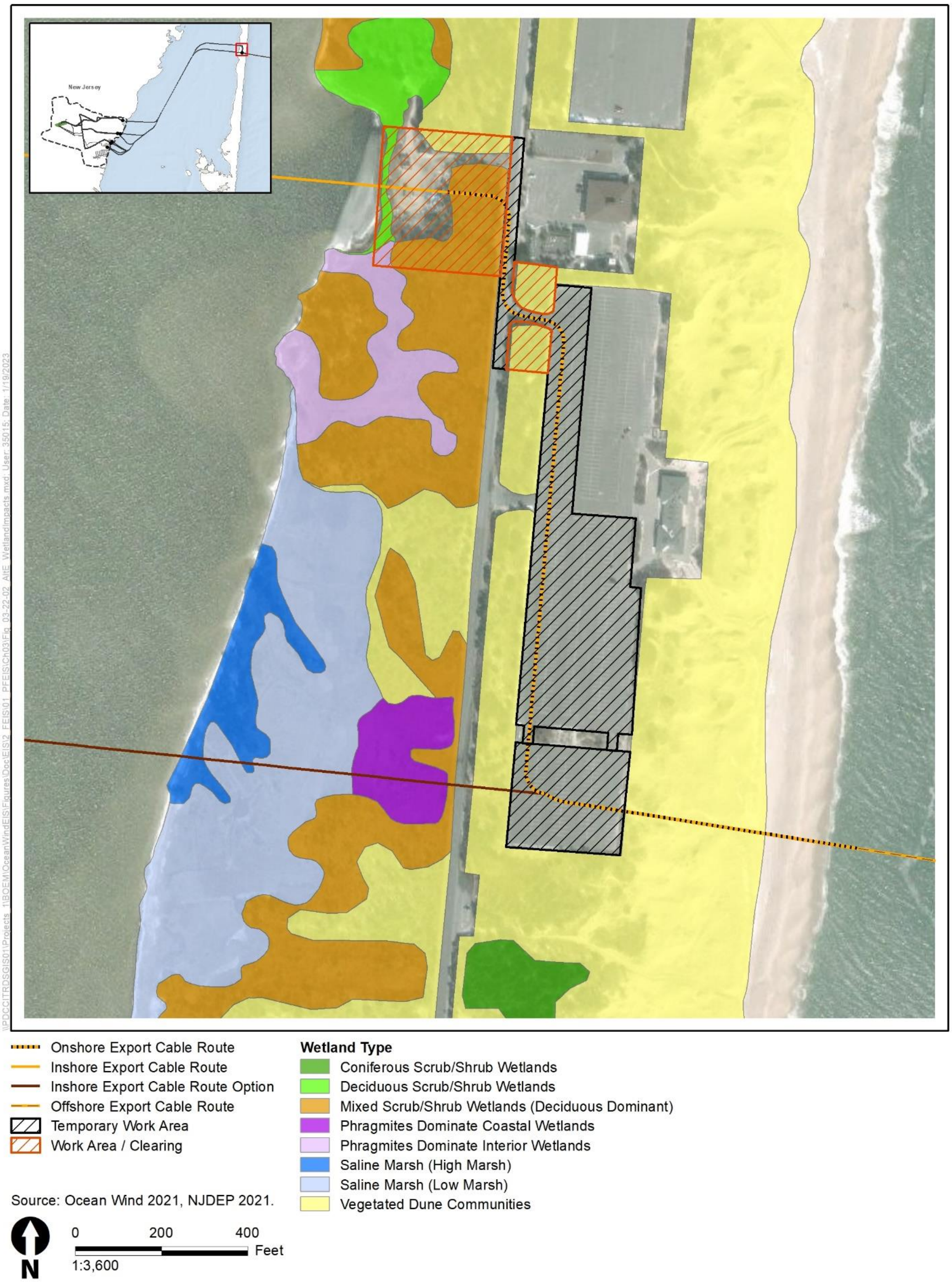

Figure 3.22-2 Wetlands at Alternative E Crossing of Island Beach State Park

3.22.7.1. Conclusions

Impacts of Alternative E. Alternative E would have the same **moderate** impacts on wetlands as the Proposed Action. The impacts on wetlands would not be materially different because land disturbance would remain small, and implementation of mitigation measures and regulatory compliance would minimize impacts related to onshore ground disturbance.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on wetlands would be the same as those of the Proposed Action: noticeable. Because the impacts of the Proposed Action would not change substantially under Alternative E, BOEM anticipates that the cumulative impacts associated with Alternative E would be the same as described for the Proposed Action. Therefore, cumulative impacts of Alternative E would be **moderate**.

3.22.8 Proposed Mitigation Measures

No additional measures to mitigate impacts on wetlands have been proposed for analysis.

Appendix A. Required Environmental Permits and Consultations

A.1. Required Environmental Permits

Table A-1 includes a summary of federal, state, and local permits or approvals that are required for Project implementation.

Table A-1 Required Environmental Permits and Approvals for the Proposed Project

Agency/Regulatory Authority	Permit/Approval	Status
Federal (Portions of the Project within Federal Jurisdiction)		
BOEM	COP Approval	COP filed with BOEM on August 15, 2019. Updates to the COP were submitted on March 13, 2020, September 24, 2020, March 24, 2021, November 16, 2021/December 10, 2021, May 27, 2022, October 14, 2022, and April 24, 2023.
BSEE	Oil Spill Response Plan	Submitted with COP
FAA	FAA Form 7460-1, Notice of Proposed Construction or Alteration (for Hazard to Air Navigation Determination)	Received No Hazard to Air Navigation determination in February 2022; Oyster Creek Substation: Submitted in March 2023; BL England Substation application planned for submittal Q2 2023
NMFS	MMPA Section 101(a)(5) Letter of Authorization	Proposed Incidental Take Regulations published on October 26, 2022
USACE	CWA Section 404 and RHA Section 10 Individual Permit	Complete application received May 11, 2022; Public Notice published June 17, 2022
USACE	Section 408	Complete application received May 27, 2022
USCG	PATON authorization	Anticipate filing in July/August 2023
USCG	Local Notice to Mariners per Ports and Waterways Safety Act	Anticipate filing in August 2023
USEPA	CAA OCS Air Permit	Complete application received January 4, 2023
State (Portions of the Project within State Jurisdiction)		
NJDEP, DLUR	Waterfront Development Permit and Coastal Consistency Determination	Permit issued April 27, 2023
NJDEP, DLUR	Coastal Areas Facility Review Act Permit and Coastal Consistency Determination	Permit issued April 27, 2023

Agency/Regulatory Authority	Permit/Approval	Status
NJDEP, DLUR	Coastal Wetlands Permit	Permit issued April 27, 2023
NJDEP, DLUR	Flood Hazard Area Verification	Permit issued April 27, 2023
NJDEP, DLUR	Freshwater Wetlands Permit	Permit issued April 27, 2023
NJDEP, DLUR	Section 401 Water Quality Certification	Permit issued April 27, 2023
NJDEP, Division of Water Quality	Stormwater Construction General Permit (5G3)	Expected Q3 2023
NJDEP, Division of Water Quality	Short Term De Minimis General Permit (B7)	Expected Q3 2023
NJDEP, Bureau of Water Allocation and Well Permitting	Temporary Dewatering Permit	Expected Q3 2023
NJDEP, Bureau of Tidelands Management	Tidelands License	Expected Q3 2023
NJDEP, Green Acres Program	Major Diversion of Parkland	Diversion approved by the State House Commission March 9, 2023
NJDEP, Division of Parks and Forestry, Natural Heritage Program	New Jersey Endangered Species Conservation Act, threatened and endangered species consultation	Consultation concluded with permit issuance April 27, 2023
NJDEP, New Jersey Historic Preservation Office	NHPA Act Section 106 Review and New Jersey Register of Historic Places Act	Ongoing BOEM coordination as part of NHPA Section 106 process. Historic and cultural resources assessment was also part of the DLRP permit (issued April 27, 2023)
NJDEP, Site Remediation and Waste Management Program	Linear Construction Project Notification	Expected Q3 2023
NJDEP, Division of Parks and Forestry	Consultations and approvals for activities on State Lands and Parks	State House Commission approval received March 9, 2023; Right of Entry Agreement expected to be signed July 2023
New Jersey Department of Transportation	Highway Occupancy Permit	Expected Q3 2023
New Jersey Pinelands Commission	Development Application	No development application required.
Local (Portions of the Project within Local Jurisdiction)		
Ocean County Soil Conservation District	Soil Erosion and Sediment Control Plan Certification	Expected Q3 2023
Cape Atlantic Soil Conservation District	Soil Erosion and Sediment Control Plan Certification	Expected Q3 2023
Cape May County Division of Engineering	Utility Opening/Highway Occupancy Permit	Expected Q3 2023
Ocean City Engineering Department	Road Opening Permit	Expected Q3 2023

Agency/Regulatory Authority	Permit/Approval	Status
Municipal/county building and zoning permits and approvals	Lacey Township, Ocean Township, Ocean City, Upper Township, Ocean County, Atlantic County, Cape May County	Expected Q3/Q4 2023

CAA = Clean Air Act; DLRP = Division of Land Resource Protection; DLUR = Division of Land Use Regulation; Q = quarter

A.2. Consultation and Coordination

A.2.1 Introduction

This section discusses public and agency involvement leading up to the preparation and publication of the Final EIS, including formal consultations, cooperating agency exchanges, the public scoping comment period, and correspondence. This section discusses public involvement in the preparation of this EIS, including BOEM’s responses to public comments, formal consultations, and cooperating agency exchanges. Interagency consultation, coordination, and correspondence throughout the development of this Final EIS occurred primarily through virtual meetings, teleconferences, and written communications (including email). BOEM coordinated with numerous agencies throughout the development of this document, as listed in Section A.2.3.2, *Cooperating Agencies*.

A.2.2 Consultations and Authorizations

The following section provides a summary and status of each consultation. BSEE, USACE, and USEPA are co-action agencies for the ESA, MSA, and NHPA consultations.

A.2.2.1. Coastal Zone Management Act

The Coastal Zone Management Act requires that any applicant for a required federal license or permit to conduct an activity, within the coastal zone or within the geographic location descriptions (i.e., areas outside the coastal zone in which an activity would have reasonably foreseeable coastal effects), affecting any land or water use or natural resource of the coastal zone be consistent with the enforceable policies of a state’s federally approved coastal management program. Although the Project’s Lease Area does not fall within a Geographic Location Description for purposes of 16 USC 1456(c)(3)(A) and the implementing regulations at 15 CFR 930 Subparts D and E, following a request by NJDEP, Ocean Wind voluntarily submitted a federal consistency certification and a copy of the COP on March 30, 2021. Ocean Wind 1’s COP (Ocean Wind 2023) provided the necessary data and information under 15 CFR 930.58. NJDEP will review the reasonably foreseeable effects of the Project on coastal use or resources for consistency with the enforceable policies of the New Jersey coastal zone management program. On March 31, 2021, NJDEP notified BOEM that NJDEP and Ocean Wind mutually agreed to stay NJDEP’s 6-month consistency review period consistent with 15 CFR 930.60(b), and provided BOEM with a copy of the stay agreement. Pursuant to the executed extended stay agreement, the NJDEP issued a consistency determination on April 27, 2023. The state’s concurrence is required before BOEM may approve or approve with conditions the Ocean Wind 1 COP per 30 CFR 585.628(f) and 15 CFR 930.130(1).

A.2.2.2. Endangered Species Act

Section 7(a)(2) of the ESA of 1973, as amended (16 USC 1531 et seq.), requires that each federal agency ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of those species. When the action of a federal agency may affect a protected species or its critical habitat, that agency is required to consult with either NMFS or USFWS, depending upon the jurisdiction. Pursuant to 50 CFR 402.07, BOEM has accepted designation as the lead federal agency for the purposes of fulfilling interagency consultation under Section 7 of the ESA for listed species under the jurisdiction of NMFS and USFWS. BOEM consulted on the proposed activities considered in this Final EIS with both NMFS and USFWS and has prepared biological assessments for listed species under their respective jurisdictions. NMFS's biological opinion was issued on April 3, 2023. USFWS's concurrence letter and biological opinion were issued on May 12, 2023

A.2.2.3. Government-to-Government Tribal Consultation

Executive Order 13175 commits federal agencies to engage in government-to-government consultation with tribes when federal actions have tribal implications, and Secretarial Order No. 3317 requires U.S. Department of the Interior agencies to develop and participate in meaningful consultation with federally recognized tribes where a tribal implication may arise. A June 29, 2018, memorandum outlines BOEM's current tribal consultation policy (BOEM 2018). This memorandum states that "consultation is a deliberative process that aims to create effective collaboration and informed federal decision-making" and is in keeping with the spirit and intent of the NHPA and NEPA, Executive and Secretarial Orders, and U.S. Department of the Interior Policy (BOEM 2018). BOEM implements tribal consultation policies through formal government-to-government consultation, informal dialogue, collaboration, and other engagement.

On March 19, 2021, BOEM initiated formal consultation with nine tribes under the NHPA and invited them to be NHPA Section 106 consulting parties to the Project through individual letters mailed and emailed to tribal leaders with the Absentee-Shawnee Tribe of Indians of Oklahoma, the Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, the Rappahannock Tribe, Shawnee Tribe, Stockbridge-Munsee Community Band of Mohican Indians, the Narragansett Indian Tribe, and the Shinnecock Indian Nation. Three tribal leaders responded that they would like to participate as consulting parties to the Project: the Delaware Nation, the Delaware Tribe of Indians, and the Stockbridge-Munsee Community Band of Mohican Indians.

On March 30, 2021, BOEM sent another set of letters and emails to tribal leaders notifying them that the Notice of Intent (NOI) to prepare an EIS for the Project was issued that day and noted that the scoping comment period was open until April 29, 2021. BOEM then sent an email to tribal leaders on May 5, 2021, offering a government-to-government consultation meeting to discuss the public scoping information for the Project. BOEM held a government-to-government meeting with the tribes that responded, the Delaware Tribe of Indians and the Delaware Nation, on June 17, 2021. Both tribes expressed interest in continuing consultation for offshore wind, and emphasized the importance of early consultation in Project development. The Wampanoag Tribe of Gay Head Aquinnah notified BOEM that they would like to participate as a consulting party to the Project. Additional attempts were made to contact the Absentee-Shawnee Tribe of Indians of Oklahoma, Eastern Shawnee Tribe of Oklahoma, Shawnee Tribe, Narragansett Indian Tribe, and Shinnecock Indian Nation via phone and email in August and September 2021; however, no responses have been received to date.

BOEM separately contacted the Mashantucket Pequot Tribal Nation on August 17, 2021, in response to a request to participate as a cooperating agency. The Mashantucket Pequot Tribal Nation confirmed they would like to consult with BOEM as a Cooperating Tribal Nation under NEPA and an NHPA Section 106 consulting party. However, in a letter dated November 22, 2021, the Mashantucket Pequot Tribal Nation indicated that they no longer wanted to consult on the Project.

BOEM sent an email to tribal leaders on October 7, 2022, offering a government-to-government consultation meeting to discuss the Draft EIS. BOEM held a government-to-government meeting with the tribes that responded, the Shinnecock Indian Nation and Delaware Tribe of Indians, on November 2, 2022.

A.2.2.4. National Historic Preservation Act

Section 106 of the NHPA (54 USC 306108) and its implementing regulations (36 CFR 800) require federal agencies to consider the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. BOEM has determined that the proposed Project is an undertaking subject to Section 106 review. The construction of WTGs and OSS, installation of inter-array cables, and development of staging areas are ground- or seabed-disturbing activities that may adversely affect archaeological resources. The presence of WTGs may also introduce visual elements out of character with the historic setting of historic structures or landscapes; in cases where historic setting is a contributing element of historic properties' eligibility for the NRHP, the Project may adversely affect those historic properties.

The Section 106 regulations at 36 CFR 800.8 provide for use of the NEPA substitution process to fulfill a federal agency's NHPA Section 106 review obligations in lieu of the procedures set forth in 36 CFR 800.3 through 800.6. This process is commonly known as "NEPA substitution for Section 106" and BOEM is using this process and documentation required for the preparation of this EIS and the ROD to comply with Section 106. Appendix N of this Final EIS contains BOEM's Finding of Adverse Effect, which includes a description and summary of BOEM's consultation so far. On March 9, 2021, BOEM contacted ACHP and New Jersey SHPO to provide Project information and notify of BOEM's intention to use the NEPA process to fulfill Section 106 obligations in lieu of the procedures set forth in 36 CFR 800.3 through 800.6. BOEM will continue consulting with the New Jersey SHPO, ACHP, federally recognized tribes, and the consulting parties regarding the Finding of Adverse Effect and the resolution of adverse effects.

BOEM has and will be conducting Section 106 consultation meeting(s) on the Finding of Adverse Effect and the resolution of adverse effects, and the agency will be requesting the consulting parties to review and comment on the Finding of Adverse Effect and proposed resolution measures. BOEM held virtual NHPA Section 106 Consultation Meeting #1 on March 8, 2022, and shared with consulting parties a summary of the NHPA Section 106 Consultation Meeting #1 and materials presented at that meeting on March 31, 2022. BOEM held virtual NHPA Section 106 Consultation Meeting #2 on May 4, 2022, and shared with consulting parties a summary of the NHPA Section 106 Consultation Meeting #2 and materials presented at that meeting on June 8, 2022. BOEM held virtual NHPA Section 106 Consultation Meeting #3 on November 30, 2022, and shared with consulting parties a summary of the NHPA Section 106 Consultation Meeting #3 and materials presented at that meeting on November 30, 2022. BOEM held virtual NHPA Section 106 Consultation Meeting #4 on February 10, 2023, and shared with consulting parties a summary of the NHPA Section 106 Consultation Meeting #4 and materials presented at that meeting on February 22, 2023. BOEM held an additional consultation meeting with New Jersey Historic Preservation Office on February 24, 2022 to discuss the materials presented at NHPA Section 106 Consultation Meeting #4. BOEM plans to hold an additional consultation meeting to consult on the finding of effect and the resolution of adverse effects, to receive additional input regarding the EIS analysis, and to consult on a Memorandum of Agreement prior to issuing the ROD. BOEM will hold virtual NHPA Section 106 Consultation Meeting #5 in the second quarter of 2023.

On March 21, 2022, BOEM shared with consulting parties the complete terrestrial archaeological resources report, complete marine archaeological resources report, complete historic resources visual effects assessment, and complete cumulative historic resources visual effects analysis. At that time, BOEM also shared with consulting parties a technical memorandum detailing the delineation of the APE for the Project. BOEM shared with consulting parties a supplemental architectural intensive-level survey report on April 1, 2022. On November 11, 2022, BOEM shared with consulting parties the revised terrestrial archaeological resources report, revised marine archaeological resources report, revised historic resources visual effects assessment, revised architectural intensive-level survey report, and revised cumulative historic resources visual effects analysis. BOEM also distributed a consulting parties comments response matrix, which itemizes consultation comments received from consulting parties on documents distributed by BOEM on March 21 and April 1, 2022, and provides BOEM’s responses to those comments.

BOEM distributed a Notice of Availability to notify the consulting parties that the Draft EIS was available for public review and comment for the period of June 24 to August 8, 2022. On November 11, 2022, BOEM shared with consulting parties the revised Appendix N, *Finding of Adverse Effect for the Ocean Wind 1 Construction and Operations Plan*, with attachments including the draft Memorandum of Agreement. BOEM published the Final EIS on May 26, 2023.

BOEM fulfilled public involvement requirements for Section 106 of the NHPA through the NEPA public scoping and public meetings process, pursuant to 36 CFR 800.2(d)(3). The Scoping Summary Report (BOEM 2021), available on BOEM’s Project-specific website, summarizes comments on historic preservation issues. On March 17, 2021, BOEM initiated consultation with nine federally recognized tribes: Absentee-Shawnee Tribe of Indians of Oklahoma, the Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, the Rappahannock Tribe, Shawnee Tribe, Stockbridge-Munsee Community Band of Mohican Indians, the Narragansett Indian Tribe, and the Shinnecock Indian Nation (Section A.2.2.3). On May 5, 2021, BOEM invited Absentee-Shawnee Tribe of Indians of Oklahoma, the Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, the Narragansett Indian Tribe, Shawnee Tribe, Stockbridge-Munsee Community Band of Mohican Indians, and the Shinnecock Indian Nation to participate in a government-to-government consultation meeting. On May 17, 2021, BOEM corresponded with tribes who responded to the government-to-government consultation meeting invitation—the Delaware Nation and Delaware Tribe of Indians—to schedule the meeting during a day and time of mutual availability. BOEM followed up the request for scheduling on May 27 and June 1, 2021. On June 8, 2021, BOEM invited the Delaware Nation and Delaware Tribe of Indians to participate in a government-to-government consultation meeting on Thursday, June 17, 2021. BOEM hosted a government-to-government consultation meeting with the Delaware Nation and Delaware Tribe of Indians on June 17, 2021, and distributed a draft meeting summary of the June 17, 2021, government-to-government consultation meeting and requested representatives from the Delaware Nation and Delaware Tribe of Indians provide comment on July 2, 2021. BOEM reached out via phone to the Absentee-Shawnee Tribe of Indians of Oklahoma, the Eastern Shawnee Tribe of Oklahoma, the Narragansett Indian Tribe, Shawnee Tribe, and the Shinnecock Indian Nation on August 5, 2021, August 17, 2021, and September 3, 2021, to remind them of the March 30, 2021, invitations to participate as Section 106 consulting parties or NEPA cooperating agencies and requested their feedback. The Stockbridge-Munsee Community Band of Mohican Indians notified BOEM of their interest in participating as a consulting party on September 27, 2021. The Shinnecock Indian Nation notified BOEM of their interest in participating as a consulting party on September 27, 2021. The Wampanoag Tribe of Gay Head (Aquinnah) notified BOEM of their interest in participating as a consulting party on September 27, 2021. BOEM requested information on sites of religious and cultural significance to the tribes that the proposed Project could affect, and BOEM offered its assistance in providing additional details and information on the proposed Project to the tribes. The Mashantucket Pequot Tribal Nation later contacted BOEM to request participation as a sovereign tribal nation in the NEPA cooperating agency review process, and BOEM added this tribal nation to the Project as a participant in the cooperating agency review process as well as a consulting party on November 19, 2021. However, in a letter dated November 22, 2021, the Mashantucket Pequot Tribal Nation indicated that they no longer wanted to consult on the Project.

On March 30, 2021, BOEM contacted representatives of local governments, state and local historical societies, economic development commissions, and other federal agencies to solicit information on historic properties and determine their interest in participating as consulting parties. During the period of April 13–16, 2021, outreach was conducted by phone to confirm receipt of correspondence among the governments and organizations that had not responded to the invitation to consult.

On November 18, 2022, BOEM contacted representatives for eight of the ten aboveground historic properties within the Project's visual APE determined by BOEM to be adversely affected by the Project that had not previously accepted consulting party status to determine their interest in participating as consulting parties. On February 2, 2023, and February 15, 2023, BOEM contacted representatives for seven additional aboveground historic properties within the Project's visual APE determined by BOEM to be adversely affected by the Project that had not previously accepted consulting party status to determine their interest in participating as consulting parties. On March 28, 2023, BOEM contacted representatives of all 17 historic properties within the Project's visual APE determined by BOEM to be adversely affected by the Project, inviting those parties that had not previously accepted consulting party status to participate as consulting parties and to invite participating consulting parties to a meeting with BOEM to discuss Applicant-proposed mitigation to resolve the adverse effects from the Project on their respective properties. Participants that have accepted consulting party status for the NHPA Section 106 Consultation are listed in Table A-2.

Table A-2 NHPA Section 106 Consulting Parties

Participants in the Section 106 Process	Participating Consulting Parties
SHPOs and state agencies	NJDEP, Historic Preservation Office NJDEP, Office of Historic Site & Parks New Jersey Historic Trust
Federal agencies	ACHP BSEE USACE USEPA USCG National Park Service U.S. Naval History and Heritage Command
Federally recognized tribes	Delaware Nation Delaware Tribe of Indians Stockbridge-Munsee Community Band of Mohican Indians The Shinnecock Indian Nation Wampanoag Tribe of Gay Head (Aquinnah)

Participants in the Section 106 Process	Participating Consulting Parties
Local governments	Atlantic County Cape May City Cape May County City of North Wildwood Harvey Cedars Borough Linwood City Margate City Ocean City Sea Isle City Somers Point City Stafford Township
Nongovernmental organizations or groups	Absecon Lighthouse Flanders Condominium Association Garden State Seafood Association House at 114 South Harvard Avenue Long Beach Island Historical Association Ritz Condominium Association Rutgers University Save Lucy Committee, Inc. The Noyes Museum of Art Vassar Square Condominiums

A.2.2.5. Magnuson-Stevens Fishery Conservation and Management Act

Pursuant to Section 305(b) of the MSA, federal agencies are required to consult with NMFS on any action that may result in adverse effects on EFH. NMFS regulations implementing the EFH provisions of the MSA can be found at 50 CFR 600. As provided for in 50 CFR 600.920(b), BOEM has accepted designation as the lead agency for the purposes of fulfilling EFH consultation obligations under Section 305(b) of the MSA. Certain OCS activities authorized by BOEM may result in adverse effects on EFH and, therefore, require consultation with NMFS. BOEM prepared and submitted an EFH Assessment to NMFS, which was deemed complete for EFH consultation to initiate on December 16, 2022. In a letter dated February 24, 2023, NMFS issued Conservation Recommendations, to which BOEM will provide a detailed response prior to issuance of the ROD.

A.2.2.6. Marine Mammal Protection Act

Section 101(a) of the MMPA (16 USC 1361) prohibits persons or vessels subject to the jurisdiction of the United States from taking any marine mammal in waters or on lands under the jurisdiction of the United States or on the high seas (16 USC 1372(a)(l), (a)(2)). Sections 101(a)(5)(A) and (D) of the MMPA provide exceptions to the prohibition on take, which give NMFS the authority to authorize the incidental but not intentional take of small numbers of marine mammals, provided certain findings are made and statutory and regulatory procedures are met. Under Section 3 of the MMPA, “take” is defined as “harass, capture, hunt, kill, or attempt to harass, capture, hunt, or kill any marine mammal.” The incidental take of a marine mammal falls under three categories: mortality, serious injury, and harassment. Harassment is further defined as Take authorizations divide underwater noise effects on marine mammals into Level A and Level B harassment categories. MMPA regulations define Level A or Level B harassment as follows:

- Level A: Any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment) and
- Level B: Any act of pursuit, torment, or annoyance that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing a disruption of behavioral patterns including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but that does not have the potential to injure a marine mammal or marine mammal stock in the wild (Level B harassment) (16 USC 1362)

Level A harassment includes physiological impacts associated with PTS (and other non-serious injuries), whereas Level B harassment includes physiological impacts associated with TTS, masking, and behavioral effects (discussed in greater detail below).

Entities seeking to obtain authorization for the incidental take of marine mammals under NMFS jurisdiction must submit such a request (in the form of an application). Incidental Take Authorizations may be issued as either (1) regulations and associated Letters of Authorization, or (2) an Incidental Harassment Authorization. Letters of Authorizations may be issued for up to a maximum period of 5 years, and Incidental Harassment Authorizations may be issued for a maximum period of 1 year. NMFS has also promulgated regulations to implement the provisions of the MMPA governing the taking and importing of marine mammals (50 CFR 216) and has published application instructions that prescribe the procedures necessary to apply for an Incidental Take Authorization. Applicants seeking to obtain authorization for the incidental take of marine mammals under NMFS' jurisdiction must comply with these regulations and application instructions in addition to the provisions of the MMPA.

Once NMFS determines an application is adequate and complete, NMFS has a corresponding duty to determine whether and how to authorize take of marine mammals incidental to the activities described in the application. To authorize the incidental take of marine mammals, NMFS evaluates the best available scientific information to determine whether the take would have a negligible impact on the affected marine mammal species or stocks and an immitigable impact on their availability for taking for subsistence uses. NMFS must also prescribe the "means of effecting the least practicable adverse impact" on the affected species or stocks and their habitat, and on the availability of those species or stocks for subsistence uses, as well as monitoring and reporting requirements.

Ocean Wind submitted a Letter of Authorization application to NMFS on October 1, 2021. The application was reviewed and considered complete on February 11, 2022. NMFS published a Notice of Receipt in the Federal Register on March 7, 2022. NMFS published the proposed Incidental Take Regulations in the *Federal Register* on October 26, 2022.

A.2.2.7. Clean Water Act and Rivers and Harbors Act

Section 404 of the CWA (33 USC 1344) regulates the discharge of dredged or fill material into waters of the U.S., including wetlands. A permit from USACE is required regardless of whether the work is temporary or permanent and includes discharges such as dewatering of dredged material prior to disposal and temporary fills for cofferdams and work areas. Section 10 of the RHA (33 USC 403) regulates the construction of any structure in or over navigable waters of the U.S. and prohibits the creation of any obstruction to the navigable capacity of any water of the U.S. A Section 10 permit is required for structures or work that affect the course, location, or condition of the waterbody, including dredging/ excavation, submarine cable installation, and WTGs/OSS. Ocean Wind submitted an application to USACE on April 27, 2022. The application was reviewed and considered complete on May 11, 2022. USACE published a Public Notice on the Philadelphia District's website on June 17, 2022.

"Section 408 permission" is required pursuant to Section 14 of the RHA (33 USC 408) for any proposed alterations that have the potential to alter, occupy, or use any federally authorized civil works projects. The Section 408 review verifies that changes to authorized USACE Civil Works projects will not be injurious to the public interest and will not impair the usefulness of the project. Ocean Wind submitted an application to USACE on April 27, 2022, which was determined complete on May 27, 2022. A final permit decision is anticipated to be rendered by October 2023.

A.2.2.8. Clean Air Act

The OCS Air Regulations (40 CFR 55) establish the applicable air pollution control requirements, including provisions related to permitting, monitoring, reporting, fees, compliance, and enforcement, for facilities subject to the Clean Air Act (CAA) Section 328. Ocean Wind submitted an initial OCS Air Permit application on March 29, 2022. Revised applications were submitted on July 19, 2022 and September 30, 2022. EPA deemed the application complete on January 4, 2023.

A.2.3 Development of Draft Environmental Impact Statement

This section provides an overview of the development of the Draft EIS, including public scoping, cooperating agency involvement, and distribution of the Draft EIS for public review and comment.

A.2.3.1. Scoping

On March 30, 2021, BOEM issued an NOI to prepare an EIS consistent with NEPA regulations (42 USC 4321 et seq.) to assess the potential impacts of the Proposed Action and alternatives (83 *Federal Register* 13777). The NOI commenced a public scoping process for identifying issues and potential alternatives for consideration in the EIS. The formal scoping period was from March 30 through April 29, 2021. BOEM held three virtual public scoping meetings to solicit feedback and to identify issues and potential alternatives for consideration in the EIS. Throughout this timeframe, federal agencies, state and local governments, and the general public had the opportunity to help BOEM identify potential significant resources and issues, IPFs, reasonable alternatives (e.g., size, geographic, seasonal, or other restrictions on construction and siting of facilities and activities), and potential mitigation measures to analyze in the EIS, as well as provide additional information. BOEM also used the NEPA scoping process to initiate the Section 106 consultation process under the NHPA (54 USC 300101 et seq.), as permitted by 36 CFR 800.2(d)(3), which requires federal agencies to assess the effects of projects on historic properties. Additionally, BOEM informed its Section 106 consultation by seeking public comment and input through the NOI regarding the identification of historic properties or potential effects on historic properties from activities associated with approval of the COP (Ocean Wind 2023). The NOI requested comments from the public in written form, delivered by hand or by mail, or through the regulations.gov web portal.

BOEM held three virtual scoping meetings on April 13, 15, and 20, 2021. BOEM reviewed and considered all scoping comments in the development of the Draft EIS, and used the comments to identify alternatives for analysis. A Scoping Summary Report (BOEM 2021) summarizing the submissions received and the methods for analyzing them is available on BOEM's website at https://www.boem.gov/renewable-energy/state-activities/ocean-wind-1. In addition, all public scoping submissions received can be viewed online at http://www.regulations.gov by typing "BOEM-2021-0024" in the search field. As detailed in the Scoping Summary Report, the resource areas or NEPA topics most referenced in the scoping comments include NEPA/Public Involvement Process; recreation and tourism; mitigation and monitoring; commercial fisheries and for-hire recreational fishing; birds; demographics, employment and economics; and others.

A.2.3.2. Cooperating Agencies

BOEM invited other federal agencies and state, tribal, and local governments to consider becoming cooperating agencies in the preparation of the Draft EIS. According to CEQ guidelines, qualified agencies and governments are those with "jurisdiction by law or special expertise" (CEQ 1981). BOEM asked potential cooperating agencies to consider their authority and capacity to assume the responsibilities of a cooperating agency, and to be aware that an agency's role in the environmental analysis neither enlarges nor diminishes the final decision-making authority of any other agency involved in the NEPA process. BOEM also asked agencies to consider the "Factors for Determining Cooperating Agency Status" in Attachment 1 to CEQ's January 30, 2002, Memorandum for the Heads of Federal Agencies (CEQ 2002). BOEM held interagency meetings on May 18, 2020, and on March 2, May 24, June 29, July 19, 2021, and January 13, 2022, to discuss the environmental review process, schedule, responsibilities, consultation, and potential alternatives.

The following federal agencies and state governments have supported preparation of the Final EIS as cooperating agencies:

- NMFS
- National Park Service
- USACE
- BSEE
- USEPA
- USCG
- USFWS
- DOD
- NJDEP
- New York State Department of State (NYSDOS)
- New Jersey BPU

NMFS is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involve activities that have the potential to affect marine resources under its jurisdiction by law and special expertise. As applicable, permits and authorizations are issued pursuant to the MMPA, as amended (16 USC 1361 et seq.); the regulations governing the taking and importing of marine mammals (50 CFR 216); the ESA (16 USC 1531 et seq.); and the regulations governing the taking, importing, and exporting of threatened and endangered species (50 CFR 222–226). In accordance with 50 CFR 402, NMFS also serves as the Consulting Agency under Section 7 of the ESA for federal agencies proposing action that may affect marine resources listed as threatened or endangered. NMFS has additional responsibilities to conserve and manage fishery resources of the United States, which include the authority to engage in consultations with other federal agencies pursuant to the MSA and 50 CFR 600 when proposed actions may adversely affect EFH. The MMPA is the only authorization for NMFS that requires NEPA compliance. NMFS intents to adopt BOEM's Final EIS if, after independent review and analysis, NMFS determines the Final EIS to be sufficient to support the authorization.

The National Park Service is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect National Park Service resources under its jurisdiction by law and special expertise. The National Park Service is also participating as a consulting party for consultation under Section 106 of the NHPA.

USACE is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect resources under its jurisdiction by law and special expertise. As applicable, permits and authorizations are issued pursuant to Sections 10 and 14 of the RHA and Section 404 of the CWA. As an offshore wind energy project, the Project needs to be situated offshore in the water. Consequently, the fill activities associated with the Project, which consist of the inter-array cables, armoring at the base of the WTG foundations, protective cable armoring for the export cables, and temporary cofferdams, are water dependent. Issuance of Section 10 or Section 404 permits requires NEPA compliance, which will be met via adoption of BOEM’s EIS and issuance of the ROD.

BSEE is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect marine resources under its jurisdiction by law and special expertise; and safety, compliance, and enforcement issues. Pursuant to a December 2020 Memorandum of Agreement between BOEM and BSEE, BSEE conducts activities, consults, and advises BOEM on safety and environmental enforcement for renewable energy projects.

USEPA is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect resources under its jurisdiction by law and special expertise, including air quality and water quality.

USCG is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect navigation and safety issues that fall under its jurisdiction by law and special expertise.

USFWS is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect resources under its jurisdiction by law and special expertise. USFWS also serves as the consulting agency under Section 7 of the ESA for federal agencies proposing actions that may affect terrestrial resources listed as threatened or endangered.

DOD is serving as a cooperating agency pursuant to 40 CFR 1501.8 because it has special expertise with respect to potential impacts that may occur as a result of the Proposed Action.

NJDEP, NYSDOS, and New Jersey BPU are serving as cooperating agencies pursuant to 40 CFR 1501.8 because they have special expertise with respect to potential impacts that may occur as a result of the Proposed Action.

A.2.3.3. Distribution of the Draft Environmental Impact Statement for Review and Comment

On June 24, 2022, BOEM published a Notice of Availability for the Draft EIS. The Draft EIS was made available in electronic format for public viewing at https://www.boem.gov/renewable-energy/state-activities/ocean-wind-1. Notification was provided as indicated in Appendix K of the Draft EIS. Hard copies and digital copies of the Draft EIS were delivered to entities as requested. The Notice of Availability commenced the 45-day public review and comment period of the Draft EIS. On August 3, 2022, BOEM announced the 15-day extension of the public review and comment period. BOEM held three virtual public hearings to solicit feedback and identify issues for consideration in preparing the Final EIS. Throughout the public review and comment period, government agencies, members of the public, and interested stakeholders had the opportunity to provide comments on the Draft EIS in various ways, including the following:

- In hard copy form, delivered by mail, enclosed in an envelope labeled “Ocean Wind 1 COP EIS” and addressed to Program Manager, Office of Renewable Energy Programs, Bureau of Ocean Energy Management, 45600 Woodland Road, Sterling, Virginia 20166.

- Through the regulations.gov web portal by navigating to https://www.regulations.gov/, searching for docket number "BOEM-2022-0021," and submitting a comment.
- By attending one of the public hearings on the dates listed in the notice of availability and providing written or verbal comments.

BOEM reviewed and considered all comment submissions in the development of the Final EIS. BOEM's evaluation of public submissions focused on those comments within the submissions that were identified as substantive. EIS Appendix O describes the public comment processing methodology and includes comment responses. All public comment submissions received on the Draft EIS can be viewed online at https://www.regulations.gov/ by typing "BOEM-2022-0021" in the search field.

A.2.3.4. Distribution of the Final Environmental Impact Statement

The Final EIS is available in electronic form for public viewing at https://www.boem.gov/renewable-energy/state-activities/ocean-wind-1. Hard copies and digital copies of the Final EIS can be requested by contacting the Program Manager, Office of Renewable Energy Programs in Sterling, Virginia. Publication of the Final EIS initiates a minimum 30-day mandatory waiting period, during which BOEM is required to pause before issuing a ROD. The ROD will state clearly whether BOEM intends to approve, approve with conditions, or disapprove the COP for construction, operation, and eventual decommissioning of the Project. Notification will be provided as indicated in Appendix K of the Final EIS.

A.3. References Cited

Bureau of Ocean Energy Management (BOEM). 2018. *Tribal Consultation Guidance*. June 29, 2018. Available: https://www.boem.gov/sites/default/files/about-boem/Public-Engagement/Tribal-Communities/BOEM-Tribal-Consultation-Guidance-with-Memo.pdf.

Bureau of Ocean Energy Management (BOEM). 2021. *Ocean Wind Construction and Operations Plan Scoping Report*. June 2021. Available: https://www.boem.gov/renewable-energy/state-activities/ocean-wind-1.

Council on Environmental Quality (CEQ). 1981. Memorandum to Agencies: Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulation. Amended 1986. Available: https://www.energy.gov/sites/prod/files/2018/06/f53/G-CEQ-40Questions.pdf. Accessed: August 2021.

Council on Environmental Quality (CEQ). 2002. Memorandum for the Heads of Federal Agencies: Cooperating Agencies in Implementing the Procedural Requirements of the National Environmental Policy Act. Available: https://www.energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-CoopAgenciesImplem.pdf. Accessed: September 11, 2020.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

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Appendix B. List of Preparers and Reviewers, References Cited, and Glossary

B.1. List of Preparers and Reviewers

Table B-1 Bureau of Ocean Energy Management Contributors

Name	Role/Resource Area
National Environmental Policy Act (NEPA) Coordinator	
Landers, Lisa	Environmental Protection Specialist
Resource Scientists and Contributors	
Ajilore, Ololade (Lola)	Navigation and Vessel Traffic
Baker, Arianna	Navigation and Vessel Traffic
Bigger, David	Birds; Bats; Coastal Habitat and Fauna
Boatman, Mary	Other Uses
Brune, Genevieve	Land Use and Coastal Infrastructure
Bucatari, Jennifer	Other Uses – Marine Minerals
Chaiken, Emma	Demographics, Employment, and Economics; Recreation and Tourism; Commercial Fisheries and For-Hire Recreational Fishing
Cody, Mary	Marine Mammals; Sea Turtles
Conrad, Alexander	Marine Mammals; Sea Turtles
Dobbs, Kerby	Other Uses – Marine Minerals
Draher, Jennifer	Water Quality
Fulling, Gregory	Marine Mammals; Sea Turtles
Heinze, Martin	Demographics, Employment, and Economics
Hesse, Jeffrey T.	Other Uses
Horrell, Christopher	Cultural Resources
Howson, Ursula	Benthic Resources; Coastal Habitat and Fauna; Commercial Fisheries and For-Hire Recreational Fishing; Finfish, Invertebrates, and Essential Fish Habitat; Other Uses; Recreation and Tourism; Wetlands
Jensen, Mark	Demographics, Employment, and Economics
Renick, Hillary	Tribal Liaison
McCarty, John	Visual Resources; Recreation and Tourism
McCoy, Angel	Meteorologist, Technical Design Elements
Miller, Jennifer	Other Uses
Moshier, Marissa	Cultural Resources
Schnitzer, Laura (LK)	Cultural Resources
Shanahan, Amy	Cultural Resources
Slayton, Ian	Air Quality
Stokely, Sarah	Cultural Resources
Waskes, Will	Project Coordinator
Wolf, Jacob	Air Quality

Table B-2 Reviewers

Name	Title	Agency
Brown, William Y.	Chief Environmental Officer	BOEM
Baker, Karen	Chief, Office of Renewable Energy	BOEM
Morin, Michelle	Chief, Environment Branch for Renewable Energy	BOEM
Stromberg, Jessica	Acting Chief, Environment Branch for Renewable Energy	BOEM
Ottman, Noel	Solicitor	DOI
Vorkoper, Stephen	Solicitor	DOI
Heckman, Andrea	Lead Environmental Protection Specialist	BSEE
Sample, Steven	Executive Director, DOD Siting Clearinghouse	DOD
Austin, Mark	Strategic Programs, Environmental Review Team Lead	USEPA Region 2
Nolan, Katie	Team Leader for Renewable Energy & Offshore Wind, Team Leader of Redevelopment & Restoration	NJDEP
McLean, Laura	Ocean and Lakes Policy Analyst	NYSDOS
Krueger, Mary	Energy Specialist	NPS Interior Region 1, North Atlantic - Appalachian
Tuxbury, Susan	Wind Program Coordinator, GARFO Habitat and Ecosystems Division	NMFS
Crocker, Julie	Endangered Fish Branch Chief, GARFO Protected Resources Division	NMFS
Keith Hanson	Marine Habitat Resource Specialist, GARFO Habitat and Ecosystem Services Division	NMFS
Anthony, Brian	Biologist	USACE Philadelphia District
Creelman, Matthew	Marine Transportation Specialist	USCG District 5
Ciappi, Michael	Senior Fish and Wildlife Biologist	USFWS

DOI = Department of the Interior; GARFO = Greater Atlantic Regional Fisheries Office; NPS = National Park Service

Table B-3 Consultants

Name	Company	Role/Resource Area
Baer, Sarah	ICF	Demographics, Employment, and Economics; Environmental Justice
Byram, Saadia	ICF	Editor
Copeland, Tanya	ICF	Project Manager
Diller, Elizabeth	ICF	Project Director
Ernst, David	ICF	Air Quality/Climate
Gleaton, Soniya	ICF	Comment Processing
Johnson, David	ICF	Bats; Birds; Coastal Habitat; Water Quality; Wetlands
Jost, Rebecca	ICF	Other Uses; Recreation and Tourism; Land Use and Coastal Infrastructure
Lentz, Corey	ICF	Cultural Resources and Section 106 Support
Mendoza, Tiffany	ICF	Public Involvement

Name	Company	Role/Resource Area
Munaretto, Claire	ICF	Demographics, Employment, and Economics; Environmental Justice
Paulson, Merlyn	ICF	Scenic and Visual Resources
Read, Brent	ICF	Geographic Information Systems
Schanel, Pam	ICF	Public Involvement
Tavel, January	ICF	Cultural Resources and Section 106 Lead
Valley, Nathalie	ICF	Navigation and Vessel Traffic
Wheaton, Jenna	ICF	Section 106 Support; Comment Processing
Winslow, Anne	ICF	Deputy Project Manager
Latham, Pam	RPI	Benthic Resources; Finfish, Invertebrates, and Essential Fish Habitat
Butwin, Matt	Prospect Hill Consulting	Commercial Fisheries and For-Hire Recreational Fishing
Baigas, Phil	WSP	Sea Turtles
Mathies, Noelle	WSP	Marine Mammals
Zottenberg, Katelyn	WSP	Marine Mammals

QA/QC = quality assurance/quality control; RPI = Research Planning, Inc.

B.2. References Cited

B.2.1 Chapter 1, Introduction

Bureau of Ocean Energy Management (BOEM). 2012. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia Final Environmental Assessment*. (OCS EIS/EA BOEM 2012-003). January. Available: https://www.boem.gov/sites/default/files/uploadedFiles/BOEM/Renewable_Energy_Program/Smart_from_the_Start/Mid-Atlantic_Final_EA_012012.pdf.

Bureau of Ocean Energy Management (BOEM). 2021a. Commercial Wind Leasing Offshore New Jersey. Available: https://www.boem.gov/commercial-wind-leasing-offshore-new-jersey. Accessed: September 14.

Bureau of Ocean Energy Management (BOEM). 2021b. Ocean Wind. Available: https://www.boem.gov/renewable-energy/state-activities/ocean-wind-1. Accessed: September 14.

Bureau of Ocean Energy Management (BOEM). 2021c. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: https://www.boem.gov/vineyard-wind.

Bureau of Ocean Energy Management (BOEM). 2021d. *South Fork Wind Farm and South Fork Export Cable Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2020-057. Available: https://www.boem.gov/renewable-energy/state-activities/sfwf-feis.

Bureau of Ocean Energy Management (BOEM). 2022a. *Ocean Wind 1 Offshore Wind Farm Biological Assessment for the United States Fish and Wildlife Service*. November.

Bureau of Ocean Energy Management (BOEM). 2022b. *Ocean Wind 1 Offshore Wind Farm Biological Assessment for National Marine Fisheries Service*. September.

Bureau of Ocean Energy Management (BOEM). 2022c. *Ocean Wind 1 Offshore Wind Farm Essential Fish Habitat Assessment for National Marine Fisheries Service.* November.

Minerals Management Service (MMS). 2007. *Final Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf.* (OCS EIS/EA MMS 2007-046). October. Available: https://www.boem.gov/renewable-energy/guide-ocs-alternative-energy-final-programmatic-environmental-impact-statement-eis.

B.2.2 Chapter 2, Alternatives Including the Proposed Action

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

U.S. Army Corps of Engineers (USACE). 2020a. *Final Environmental Assessment, National Regional Sediment Management (RSM) Program, WRDA 2016 Section 1122 Beneficial Use Pilot Project: Barnegat Inlet, Ocean County, New Jersey*. July. Available: https://www.nap.usace.army.mil/Portals/39/docs/Civil/Reports/Final-EA-Barn-Inlet-Section-1122.pdf?ver=5ZCXRjPZrKroezSsUb6Lww%3d%3d.

U.S. Army Corps of Engineers (USACE). 2020b. *Final Environmental Assessment, National Regional Sediment Management (RSM) Program, WRDA 2016 Section 1122 Beneficial Use Pilot Project: Oyster Creek Channel, Barnegat Inlet Federal Navigation Project, Ocean County, New Jersey*. November. Available: https://www.nap.usace.army.mil/Portals/39/docs/Civil/Reports/Final-EA-Barn-Inlet-Section-1122-Oyster-Creek-November-2020.pdf?ver=SrZ2PrKeCtXGydSRoGZKzw%3d%3d.

B.2.3 Chapter 3, Affected Environment and Environmental Consequences

B.2.3.1. Section 3.1, Impact-Producing Factors

Bureau of Ocean Energy Management (BOEM). 2017. *Evaluating Benefits of Offshore Wind Energy Projects in NEPA*. July. BOEM 2017-048. Available: https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/Final-Version-Offshore-Benefits-White-Paper.pdf.

Bureau of Ocean Energy Management (BOEM). 2019. *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf*. May. OCS Study BOEM 2019-036. Available: https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/IPFs-in-the-Offshore-Wind-Cumulative-Impacts-Scenario-on-the-N-OCS.pdf.

B.2.3.2. Section 3.2, Mitigation Identified for Analysis in the Environmental Impact Statement

None.

B.2.3.3. Section 3.3, Definition of Impact Levels

None.

B.2.3.4. Section 3.4, Air Quality

Barthelmie, R. J. and S. C. Pryor. 2021. "Climate Change Mitigation Potential of Wind Energy." *Climate* 9(9):136. Available: https://www.mdpi.com/2225-1154/9/9/136. Accessed: November 5, 2021.

Buonocore, J. J., P. Luckow, J. Fisher, W. Kempton, and J. I. Levy. 2016. "Health and Climate Benefits of Offshore Wind Facilities in the Mid-Atlantic United States," *Environmental Research Letters* 11 (2016) 074019. DOI:10.1088/1748-9326/11/7/074019.

Bureau of Ocean Energy Management (BOEM). 2017. *BOEM Offshore Wind Energy Facilities Emission Estimating Tool, User's Guide*. Available: https://www.boem.gov/Wind-Power-User-Guide/. Accessed: November 5, 2021.

Council on Environmental Quality (CEQ). 2016. *Final Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change*. Available: https://ceq.doe.gov/guidance/ceq_guidance_nepa-ghg.html. Accessed: November 5, 2022.

Council on Environmental Quality (CEQ). 2023. *National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*. Available: https://www.federalregister.gov/d/2023-00158. Accessed: March 2023.

Dolan, Stacey L., and Garvin A. Heath. *Life Cycle Greenhouse Gas Emissions of Utility-Scale Wind Power*. Journal of Industrial Ecology 16(S1):S136–54. Available https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1530-9290.2012.00464.x. Accessed: January 31, 2023.

Ebi, K. L., and G. McGregor. 2008. Climate change, tropospheric ozone and particulate matter, and health impacts. *Environ Health Perspect.* 116(11):1449–1455. DOI: 10.1289/ehp.11463.

Exponent Engineering and Scientific Consulting (Exponent). 2000. *A User's Guide for the CALPUFF Dispersion Model (Version 5).* Available: http://www.src.com/calpuff/download/CALPUFF_UsersGuide.pdf. Accessed: November 15, 2022.

Federal Land Managers' Air Quality Related Values Work Group (FLAG). 2010. *Phase I Report—Revised (2010)*. Natural Resource Report NPS/NRPC/NRR—2010/232. U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service. Available: https://irma.nps.gov/DataStore/DownloadFile/568936. Accessed: September 20, 2022.

Ferraz de Paula, L., and B. S. Carmo. 2022. Environmental Impact Assessment and Life Cycle Assessment for a DeepWater Floating OffshoreWind Turbine on the Brazilian Continental Shelf. *Wind* (2):495–512. Available: https://doi.org/10.3390/wind2030027.

Hogrefe, C., K. Civerolo, J-Y. Ku, B. Lynn, J. Rosenthal, K. Knowlton, B. Solecki, J. Cox, C. Small, S. Gaffin, R. Goldberg, C. Rosenzweig, and P. L. Kinney. 2004. *Modeling the Air Quality Impacts of Climate and Land Use Change in the New York City Metropolitan Area*. Models-3 Users' Workshop, 18–20 October 2004. Research Triangle Park, NC.

Interagency Working Group on Social Cost of Greenhouse Gases (IWG). 2021. *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide – Interim Estimates under Executive Order 13990*. Available: https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf. Accessed: November 2, 2022.

Katzenstein, W., and J. Apt. 2009. Air Emissions Due to Wind and Solar Power. *Environmental Science and Technology* 43(2):253–258. Available: https://pubs.acs.org/doi/abs/10.1021/es801437t.

Kempton, W., J. Firestone, J. Lilley, T. Rouleau, and P. Whitaker. 2005. "The Offshore Wind Power Debate: Views from Cape Cod." *Coastal Management Journal* 33(2):119–149. DOI: 10.1080/08920750590917530.

Monitoring Analytics. 2021. *2020 State of the Market Report for PJM*. Available: https://www.pjm.com/-/media/committees-groups/committees/mc/2021/20210329-special/20210329-state-of-the-market-report-for-pjm-2020.ashx. Accessed: November 8, 2021.

National Oceanographic and Atmospheric Administration (NOAA). 2006. *Small Diesel Spills (500–5000 gallons)*. Available: https://dec.alaska.gov/spar/ppr/response/sum_fy10/100111201/NOAAFactsheet_Diesel.pdf. Accessed: November 2, 2021.

National Renewable Energy Laboratory (NREL). 2021. *Life Cycle Assessment Harmonization*. Available: https://www.nrel.gov/analysis/life-cycle-assessment.html. Accessed: January 31, 2023.

New Jersey Board of Public Utilities. 2019. *2019 New Jersey Energy Master Plan*. Available: https://nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf. Accessed: November 5, 2021.

New Jersey Department of Environmental Protection (NJDEP). 2019. *New Jersey 2019 IEP Technical Appendix*. Prepared by Evolved Energy research. Available: https://nj.gov/emp/pdf/New_Jersey_2019_IEP_Technical_Appendix.pdf. Accessed: November 5, 2021.

Ocean Wind LLC (Ocean Wind). 2022. *Ocean Wind Offshore Wind Farm OCS Air Permit Application*. September 30.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

O'Donoughue, Patrick R., Garvin A. Heath, Stacey L. Dolan, and Martin Vorum. 2014. *Life Cycle Greenhouse Gas Emissions of Electricity Generated from Conventionally Produced Natural Gas: Systematic Review and Harmonization*. *Journal of Industrial Ecology* 18(1):125–144. https://doi.org/10.1111/jiec.12084. Accessed: January 31, 2023.

Rueda-Bayona, J. G., J. J. Cabello Eras, and T. R. Chaparro. 2022. Impacts generated by the materials used in offshore wind technology on Human Health, Natural Environment and Resources. *Energy* 261, Part A:125223. Available: https://doi.org/10.1016/j.energy.2022.125223.

Shoaib, Nawal. 2022. "A Study on Wind Farms in New Jersey : Life Cycle Assessment and Acceptance of Wind Farms by the Tourists." *Theses, Dissertations and Culminating Projects* 1114. Available: https://digitalcommons.montclair.edu/etd/1114.

U.S. Energy Information Administration. 2014. *Oil Tanker Sizes Range from General Purpose to Ultra-Large Crude Carriers on AFRA Scale*. September 16, 2014. Available: https://www.eia.gov/todayinenergy/detail.php?id=17991. Accessed September 12, 2021.

U.S. Energy Information Administration. 2022. Coal will account for 85% of U.S. electric generating capacity retirements in 2022. Website. Available: https://www.eia.gov/todayinenergy/detail.php?id=50838. Accessed April 4, 2023.

U.S. Environmental Protection Agency (USEPA). 1992. Memo from John S. Seitz, Director, Office of Air Quality Planning and Standards, to regional air quality directors. October 19, 1992. https://www.epa.gov/sites/default/files/2015-07/documents/class1.pdf. Accessed: April 29, 2022.

U.S. Environmental Protection Agency (USEPA). 1997. *User's Guide for Offshore and Coastal Dispersion (OCD) Model, Version 5*. Available: https://gaftp.epa.gov/Air/aqmg/SCRAM/models/preferred/ocd/ocdug.pdf. Accessed: November 11, 2022.

U.S. Environmental Protection Agency (USEPA). 2019. *Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program*. https://www.epa.gov/sites/default/files/2019-05/documents/merps2019.pdf. Accessed: November 11, 2022.

U.S. Environmental Protection Agency (USEPA). 2020a. CO-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool. Available: https://www.epa.gov/statelocalenergy/co-benefits-risk-assessment-cobra-health-impacts-screening-and-mapping-tool. Accessed: September 16, 2021.

U.S. Environmental Protection Agency (USEPA). 2020b. *User's Manual for the CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA)*. Available: https://www.epa.gov/sites/default/files/2020-06/documents/cobra_user_manual_june_2020.pdf. Accessed: September 16, 2021.

U.S. Environmental Protection Agency (USEPA). 2020c. *Greenhouse Gases Equivalencies Calculator—Calculations and References*. Available: https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references#vehicles. Accessed: September 16, 2021.

U.S. Environmental Protection Agency (USEPA). 2021. Nonattainment Areas for Criteria Pollutants (Green Book). Available: https://www.epa.gov/green-book. Accessed: September 13, 2021.

U.S. Environmental Protection Agency (USEPA). 2022. 2017 National Emissions Inventory. Tier 1 Summaries. Available: https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data. Data file: https://gaftp.epa.gov/air/nei/2017/tier_summaries/tier1_summary_2017nei.accdb. Accessed: September 12, 2022.

B.2.3.5. Section 3.5, Bats

Ahlen, I., L. Bach, H. J. Baagoe, and J. Petersson. 2007. Bats and offshore wind turbines studied in southern Scandinavia. Report 5571. Naturvardsverket. Swedish Environmental Protection Agency, Stockholm, Sweden. Available: https://docs.wind-watch.org/SE-EPA-bats-offshore-wind.pdf. Accessed: January 13, 2023.

Arnett, E. B., K. Brown, W. P. Erickson, J. Fiedler, B. L. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kerns, R. R. Kolford, C. P. Nicholson, T. O'Connell, M. Piorkowski, and R. Tankersley, Jr. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. *Journal of Wildlife Management* 72:61–78.

Atlantic Shores Offshore Wind (Atlantic Shores). 2021. *Construction and Operations Plan, Atlantic Shores Offshore Wind*. Volume I. September. Available: https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-construction-and-operations-plan.

Baerwald, E. F., and R. M. R. Barclay. 2009. Geographic Variation in Activity and Fatality of Migratory Bats at Wind Energy Facilities. *Journal of Mammalogy* 90:1341–1349.

Brabant, R., Y. Laurent, B. Jonge Poerink, and S. Degraer. 2021. The Relation between Migratory Activity of *Pipistrellus* Bats at Sea and Weather Conditions Offers Possibilities to Reduce Offshore Wind Farm Effects. *Animals* 2021(11):3457.

Bureau of Ocean Energy Management (BOEM). 2015. *Virginia Offshore Wind Technology Advancement Project on the Atlantic Outer Continental Shelf Offshore Virginia: Revised Environmental Assessment*. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2015-031. Accessed: September 1, 2020. Available: https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/VA/VOWTAP-EA.pdf.

Bureau of Ocean Energy Management (BOEM). 2019. *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Continental Shelf*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Sterling, VA. OCS Study BOEM 2019- 036. May 2019.

Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: https://www.boem.gov/vineyard-wind. Accessed August 2021.

Bureau of Ocean Energy Management (BOEM). 2022. Ocean Wind Offshore Wind Farm Biological Assessment for the United States Fish and Wildlife Service. May.

Choi, D. Y., T. W. Wittig, and B. M. Kluever. 2020. An Evaluation of Bird and Bat Mortality at Wind Turbines in the Northeastern United States. *PLOS ONE* 15(8): e0238034. Available: https://doi.org/10.1371/journal.pone.0238034.

Cryan P. M., M. Gorresen, C. D. Hein, M. R. Schirmacher, R. H. Diehld, M. M. Husoe, D. T. S. Hayman, P. D. Fricker, F. J. Bonaccorso, D. H. Johnson, K. Heist, and D. C. Dalton. 2014. Behavior of Bats at Wind Turbine. *Proceedings of the National Academy of Sciences* 11(42): 15126–15131.

Cryan, P. M. 2007. Mating Behavior as a Possible Cause of Bat Fatalities at Wind Turbines. *Journal of Wildlife Management* 72(3):845–849; 2008) DOI: 10.2193/2007-37.

Cryan, P. M., and A. C. Brown. 2007. Migration of Bats Past a Remote Island Offers Clues Toward the Problem of Bat Fatalities at Wind Turbines. *Biological Conservation* 139:1–11.

Cryan, P. M., and R. M. R. Barclay. 2009. Causes of Bat Fatalities at Wind Turbines: Hypotheses and Predictions. *Journal of Mammalogy* 90:1330–1340.

Dowling, Z., P. R. Sievert, E. Baldwin, L. Johnson, S. von Oettingen, and J. Reichard. 2017. *Flight Activity and Offshore Movements of Nano-Tagged Bats on Martha's Vineyard, MA*: Final Report. OCS Study BOEM 2017-054. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Sterling, Virginia. June. Available: https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/Flight-Activity-and-Offshore-Movements-of-Nano-Tagged-Bats-on-Martha%27s-Vineyard%2C-MA.pdf.

Erickson, W. P., G. D. Johnson, M. D. Strickland, D. P. Young, Jr., K. J. Sernka, R. E. Good, M. Bourassa, K. Bay, and K. Sernka. 2002. *Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and existing Wind Developments*. Bonneville Power Administration, Portland, Oregon, USA.

Fiedler, Jenny K. 2004. "Assessment of Bat Mortality and Activity at Buffalo Mountain Windfarm, Eastern Tennessee." Master's Thesis, University of Tennessee, 2004. Available: https://trace.tennessee.edu/cgi/viewcontent.cgi?article=3488&context=utk_gradthes. Accessed: September 1, 2020.

Haddaway, L., and L. P. McGuire. 2022. Seasonal and nightly activity patterns of migrating silver-haired bats (Lasionycteris noctivagans) compared to non-migrating big brown bats (*Eptesicus fuscus*) at a fall migration stopover site. *Acta Chiropterologica* 24:83–90.

Hamilton, R. M. 2012. *Spatial and Temporal Activity of Migratory Bats at Landscape Features*. Electronic Thesis and Dissertation Repository. 886.

Hann, Z. A., M. J. Hosler, and P. R. Mooseman, Jr. 2017. Roosting Habits of Two Lasiurus borealis (eastern red bat) in the Blue Ridge Mountains of Virginia. *Northeastern Naturalist* 24 (2): N15–N18.

Hatch, S. K., E. E. Connelly, T. J. Divoll, I. J. Stenhouse, and K. A. Williams. 2013. Offshore observations of eastern red bats (*Lasiurus borealis*) in the mid-Atlantic United States using multiple survey methods. *PLOS ONE* 8(12):e83803. DOI:10.1371/journal.pone.0083803.

Hein, C., K. A. Williams, and E. Jenkins. 2021. *Bat Workgroup Report for the State of the Science Workshop on Wildlife and Offshore Wind Energy 2020: Cumulative Impacts*. Report to the New York State Energy Research and Development Authority (NYSERDA). Albany, NY. 21 pp. Available: https://tethys.pnnl.gov/sites/default/files/publications/Bat-Workgroup-Report.pdf. Accessed: March 25, 2022.

Johnson J. B., J. E. Gates, and N. P. Zegre. 2011. Monitoring seasonal bat activity on a coastal barrier island in Maryland, USA. *Environmental Monitoring and Assessment* 173:685–699.

Johnson, L., and A. Ostroski. 2022. *Acoustic Bat Surveying at Oyster Creek in Waretown, Ocean Township, Ocean City, NJ and B.L. England in Marmora, Upper Township, Cape May County, NJ*. Prepared for Ocean Wind by Environmental Consulting Services, Inc.

Kerns, J., W. P. Erickson, and E. B. Arnett. 2005. "Bat and bird fatality at wind energy facilities in Pennsylvania and West Virginia." Pages 24–95 in B. Arnett, editor, *Relationships Between Bats and Wind Turbines in Pennsylvania and West Virginia: An Assessment of Bat Fatality Search Protocols, Patterns of Fatality, and Behavioral Interactions with Wind Turbines*. A final report submitted to the Bats and Wind Energy Cooperative, pp 24–95. Bat Conservation International, Austin, Texas, USA. Available: http://centrostudinatura.it/public2/documenti/687-50647.pdf. Accessed: October 19, 2020.

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007. Ecological Impacts of Wind Energy Development on Bats: Questions, Research Needs, and Hypotheses. *Frontiers in Ecology and the Environment* 5:315–324.

Maine Department of Inland Fisheries and Wildlife. 2021. "Bats." Available: https://www.maine.gov/ifw/fish-wildlife/wildlife/species-information/mammals/bats.html. Accessed: August 27, 2021.

New Hampshire Fish and Game. No date. "Bats of New Hampshire." Available: https://wildlife.state.nh.us/nongame/bats-nh.html. Accessed: August 27, 2021.

New Jersey Department of Environmental Protection (NJDEP). 2010. NJDEP Digital Data Downloads in Personal Geo-Database Format (version 9.3.1): Ocean/Wind Power Baseline Ecological Studies Data Downloads. Available: https://www.nj.gov/dep/gis/windpower.html. Accessed: September 16, 2021.

New Jersey Department of Environmental Protection (NJDEP). 2013. Special Status Review of Terrestrial Mammals. Presented to the NJ Endangered Nongame Species Advisory Committee on September 26, 2012, and March 20, 2013. Available: https://www.nj.gov/dep/fgw/ensp/pdf/mammal_status_rprt.pdf. Accessed: June 2, 2022.

New Jersey Division of Fish and Wildlife. 2019. *Nuisance Wildlife Control Guidelines for Bats*. Endangered and Nongame Species Program. Available: https://www.njfishandwildlife.org/ensp/pdf/bat_control.pdf. Accessed: August 27, 2021.

North Carolina Wildlife Resources Commission. 2017. Bats of North Carolina. Available: https://www.ncwildlife.org/Portals/0/Conserving/documents/Bats_Species_Profile.pdf. Accessed: August 27, 2021.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Pelletier, S. K., K. Omland, K. S. Watrous, and T. S. Peterson. 2013. *Information Synthesis on the Potential for Bat Interactions with Offshore Wind Facilities*–Final Report. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM No. 2013-01163. Available: https://tethys.pnnl.gov/sites/default/files/publications/BOEM_Bat_Wind_2013.pdf. Accessed: September 1, 2020.

Rhode Island Department of Environmental Management. No date. *Bats of Rhode Island*. Available: http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/bat.pdf. Accessed: August 27, 2021.

Schaub, A., J. Ostwald, and B. M. Siemers. 2008. Foraging Bats Avoid Noise. *Journal of Experimental Biology* 211:3147–3180.

Simmons, A. M., K. N. Horn, M. Warnecke, and J. A. Simmons. 2016. Broadband Noise Exposure Does Not Affect Hearing Sensitivity in Big Brown Bats (*Eptesicus fuscus*). *Journal of Experimental Biology* 219:1031–1040.

Sjollema, A. L., J. E. Gates, R. H. Hilderbrand, and J. Sherwell. 2014. Offshore Activity of Bats along the Mid-Atlantic Coast. *Northeastern Naturalist* 21(2):154–163.

Smith, A., and S. McWilliams. 2016. Bat Activity During Autumn Relates to Atmospheric Conditions: Implications for Coastal Wind Energy Development. *Journal of Mammalogy*, 97(6):1565–1577.

Stantec Consulting Services (Stantec). 2016. *Long-Term Bat Monitoring on Islands, Offshore Structures, and Coastal Sites in the Gulf of Maine, Mid-Atlantic, and Great Lakes*—Final Report. Prepared for the U.S. Department of Energy. Available: https://tethys.pnnl.gov/sites/default/files/publications/Stantec-2016-Bat-Monitoring.pdf. Accessed: October 30, 2018.

Stantec Consulting Services (Stantec). 2020. *Avian and Bat Acoustic Survey Final Post-Construction Monitoring Report, 2017–2020; Block Island Wind Farm, Rhode Island*. November 25.

True, M. C., R. J. Reynolds, and W. M. Ford. 2021. Monitoring and Modeling Tree Bat (Genera: *Lasiurus*, *Lasionycteris*) Occurrence Using Acoustics on Structures off the Mid-Atlantic Coast – Implications for Offshore Wind Development. *Animals* 11(11):31416. November.

U.S. Fish and Wildlife Service (USFWS). 2015. *White Nose Syndrome: The devastating disease of hibernating bats in North America*. Available: https://www.fws.gov/mountain-prairie/pressrel/2015/WNS%20Fact%20Sheet%20Updated%2007012015.pdf. Accessed: September 20, 2021.

U.S. Fish and Wildlife Service (USFWS). 2021a. Information for Planning and Consultation (IPaC): list of federally listed threatened, endangered, and proposed species in the Ocean Wind offshore and onshore project components. List generated on July 1.

U.S. Fish and Wildlife Service (USFWS). 2021b. "Midwest Species on the National Listing Work Plan 2021 to 2025. April 26." Available: https://www.fws.gov/midwest/Endangered/listing/MidwestNLP.html. Accessed: August 25, 2021.

Virginia Department of Wildlife Resources. 2021. "Bats." Available: https://dwr.virginia.gov/wildlife/nuisance/bats/. Accessed: August 27, 2021.

Voigt, C., K. Schneeberger, S. Voigt-Heucke, and D. Lewanzik. 2011. Rain Increases the Energy Cost of Bat Flight. *Biology Letters* 7(5). May. Available: https://royalsocietypublishing.org/doi/10.1098/rsbl.2011.0313. Accessed: January 13, 2023.

Whitaker, J. O., Jr. 1998. Life History and Roost Switching in Six Summer Colonies of Eastern Pipistrelles in Buildings. *Journal of Mammalogy* 79(2):651–659.

Whitenosesyndrom.org. 2021. "Where is WNS Now?" Available: https://www.whitenosesyndrome.org/where-is-wns. Accessed: August 27, 2021.

B.2.3.6. Section 3.6, Benthic Resources

Adams, T., R. G. Miller, D. Aleynik, and M. T. Burrows. 2014. Offshore marine renewable energy devices as stepping stones across biogeographical boundaries. *Journal of Applied Ecology* 51:330–338.

Albert, L., F. Deschamps, A. Jolivet, F. Olivier, L. Chauvaud, and S. Chauvaud. 2020. A current synthesis on the effects of electric and magnetic fields emitted by submarine power cables on invertebrates. *Marine Environmental Research* 159:104958. DOI: 10.1016/j.marenvres.2020.104958.

Almeda, R, C. Hyatt, and E. Buskey. 2014a. Toxicity of dispersant Corexit 9500A and crude oil to marine microzooplankton. *Ecotoxicology and environmental safety*. 106C. 76–85. 10.1016/ j.ecoenv.2014.04.028.

Almeda, R., S. Bona, C. R. Foster, and E. J. Buskey. 2014b. Dispersant Corexit 9500A and chemically dispersed crude oil decreases the growth rates of meroplanktonic barnacle nauplii (*Amphibalanus improvisus*) and tornaria larvae (*Schizocardium* sp.). *Marine Environmental Research* 99:212–217.

Arveson, P., and D. Vendittis. 2000. Radiated noise characteristics of a modern cargo ship. *Journal of the Acoustical Society of America* 2000(107):118–129.

Barnegat Bay Partnership. 2021. *2021 Comprehensive Conservation and Management Plan for the Barnegat Bay-Little Egg Harbor Estuary*. Available: https://www.barnegatbaypartnership.org/wp-content/uploads/2021/12/BBP-CCMP-Updated-Dec-2021-forScreens.pdf.

Beatrice Offshore Windfarm. 2016. UXO Clearance Marine License – Environmental Report. 89 pages. Available: https://marine.gov.scot/sites/default/files/00506118.pdf.

Bejarano, Adriana, Jacqueline Michel, Jill Rowe, Zhengkai Li, Deborah French McCay, and Dagmar Schmidt Etkin. 2013. *Environmental Risks, Fate, and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-213. Available: https://espis.boem.gov/final%20reports/5330.pdf. Accessed: October 11, 2021.

Berry, W. J., N. I. Rubinstein, E. K. Hinchey, G. Klein-MacPhee, and D. G. Clarke. 2011. Assessment of Dredging-Induced Sedimentation Effects on Winter Flounder (*Pseudopleuronectes americanus*) Hatching Success: Results of Laboratory Investigations. Proceedings of the Western Dredging Association Technical Conference and Texas A&M Dredging Seminar, Nashville, Tennessee, June 5–8, 2011.

Bilinski, J. 2021. *Review of the Impacts to Marine Fauna from Electromagnetic Frequencies (EMF) Generated by Energy Transmitted through Undersea Electric Transmission Cables*. NJDEP – Division of Science and Research. Available: https://www.nj.gov/dep/offshorewind/docs/njdep-marine-fauna-review-impacts-from-emf.pdf. Accessed: April 8, 2022.

Bologna, Paul A. X., and Michael S. Sinnema. 2012. Restoration of Seagrass Habitat in New Jersey, United States. *Journal of Coastal Research*. January.

Boyd, S. E., D. S. Limpenny, H. L. Rees, and K. M. Cooper. 2005. "The Effects of Marine Sand and Gravel Extraction on the Macrobenthos at a Commercial Dredging Site (Results 6 Years Post-dredging)." *ICES Journal of Marine Science* 62:145–162.

Bray, L., D. Kassis, and J. M. Hall-Spencer. 2017. Assessing larval connectivity for marine spatial planning in the Adriatic. *Marine Environmental Research* 125:73–81.

Brand, A. R., and U. A. W. Wilson. 1996. *Seismic surveys and scallop fisheries: A report on the impact of a seismic survey on the 1994 Isle of Man queen scallop fishery*. Report to a consortium of oil companies by Port Erin Marine Laboratory, University of Liverpool, Port Erin, Isle of Man.

Brooks, R., C. N. Purdy, S. S. Bell, and K. J. Sulak. 2005. *The benthic community of the eastern US continental shelf: A literature synopsis of benthic faunal resources*. USGS Staff – Published Research. 1051. Available: http://digitalcommons.unl.edu/usgsstaffpub/1051.

Brothers, C. J., J. Harianto, J. B. McClintock, and M. Byrne. 2016. “Sea Urchins in a High-CO_2 World: The Influence of Acclimation on the Immune Response to Ocean Warming and Acidification.” *Proceeding of the Royal Society* B 283:20161501. Available: http://dx.doi.org/10.1098/rspb.2016.1501. Accessed: October 11, 2021.

Bureau of Ocean Energy Management (BOEM). 2014. *FINDING OF NO SIGNIFICANT IMPACT for Proposed Geological and Geophysical Activities in the Atlantic OCS to Identify Sand Resources and Borrow Areas*. 5 pages. Available: https://www.boem.gov/sites/default/files/non-energy-minerals/Finding-of-No-Significant-Impact.pdf.

Bureau of Ocean Energy Management (BOEM). 2015. *Virginia Offshore Wind Technology Advancement Project on the Atlantic Outer Continental Shelf Offshore Virginia: Revised Environmental Assessmen*t. OCS EIS/EA BOEM 2015-031. Available: https://www.boem.gov/VOWTAP-EA/. Accessed: October 11, 2021.

Bureau of Ocean Energy Management (BOEM). 2018. *Data Collection and Site Survey Activities for Renewable Energy on the Atlantic Outer Continental Shelf Biological Assessment*. 152 pages. Available: https://www.boem.gov/sites/default/files/documents/renewable-energy/OREP-Data-Collection-BA-Final.pdf.

Bureau of Ocean Energy Management (BOEM). 2019. Office of Renewable Energy Programs. *Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585*. June 2019.

Bureau of Ocean Energy Management (BOEM). 2020a. Office of Renewable Energy Programs. *Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 CFR Part 585*. May 27, 2020.

Bureau of Ocean Energy Management (BOEM). 2020b. Comparison of Environmental Effects from Different Offshore Wind Turbine Foundations. Office of Renewable Energy Programs. OCS Study BOEM 2020-041. 53 pages.

Byrnes, M. R., R. M. Hammer, B. A. Vittor, J. S. Ramsey, D. B. Snyder, J. D. Wood, K. F. Bosma, T. D. Thibaut, and N. W. Phillips. 2000. *Environmental Survey of Potential Sand Resource Sites: Offshore New Jersey*. U.S. Dept. of the Interior, Minerals Management Service, International Activities and Marine Minerals Division (INTERMAR). Herndon, VA. OCS Report MMS 2000-052. Vol I: 380 pp., Vol II: Appendices 291 pp.

Byrnes, M. R., R. M. Hammer, T. D. Thibaut, and D. B. Snyder. 2004. Effects of sand mining on physical processes and biological communities offshore New Jersey, USA. *Journal of Coastal Research* 20(1):25–43.

Carman, M., and D. Grunden. 2019. preliminary assessment of crab predation on epifaunal fouling organisms attached to eelgrass at Martha’s Vineyard, Massachusetts, USA. *Management of Biological Invasions* 10(4):626–640.

Carpenter, J. R., L. Merckelbach, U. Callies, S. Clark, L. Gaslikova, and B. Baschek. 2016. Potential impacts of offshore wind farms on North Sea stratification. *PLOS ONE* 11(8), e0160830.

Carroll, A. G., R. Przeslawski, A. Duncan, M. Gunning, and B. Bruce. 2017. A critical review of the potential impacts of marine seismic surveys on fish & invertebrates. *Marine Pollution Bulletin* 114:9–24.

Causon, P. D., and A. B. Gill. 2018. Linking ecosystem services with epibenthic biodiversity change following installation of offshore wind farms. *Environmental Science and Policy* 89:340–347.

Cazenave, P. W., R. Torres, and J. I. Alen. 2016. Unstructured grid modelling of offshore wind farm impacts on seasonally stratified shelf seas. *Progress in Oceanography* 145(2016):25–41.

Chen, C. 2021. *Assessing Potential Impacts of Offshore Wind Facilities on Regional Sea Scallop Laval and Early Juvenile Transports*. NOAA Grant Number: NA19NMF450023. 19 pages.

Christiansen, Nils, Ute Daewel, Bughsin Djath, and Corinna Schrum. 2022. Emergence of Large-Scale Hydrodynamic Structures Due to Atmospheric Offshore Wind Farm Wakes. *Frontiers in Marine Science* 9. DOI: 10.3389/fmars.2022.818501.

Colarusso, P., and A. Verkade. 2016. *Submerged Aquatic Vegetation Survey Guidance for the New England Region*. Joint Federal Agency Publication including NOAA, EPA, and USACE.

CSA Ocean Sciences, Inc. and Exponent. 2019. *Evaluation of Potential EMF Effects on Fish Species of Commercial or Recreational Fishing Importance in Southern New England*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Headquarters, Sterling, VA. OCS Study BOEM 2019-049.

Dacanay, K. 2015. *Inventory of New Jersey's Estuarine Shellfish Resources: Hard Clam Stock Assessment Barnegat Bay (Survey Year 2012)*. New Jersey Department of Environmental Protection. 54 pp.

Daewel, U., N. Akhtar, N. Christiansen, et al. 2022. Offshore wind farms are projected to impact primary production and bottom water deoxygenation in the North Sea. *Commun Earth Environ* 3:292. Available: https://doi.org/10.1038/s43247-022-00625-0.

Daigle, S. T. 2011. "What is the Importance of Oil and Gas Platforms in the Community Structure and Diet of Benthic and Demersal Communities in the Gulf of Mexico?" Master's Thesis, Louisiana State University. Available: https://core.ac.uk/reader/217380300. Accessed: October 11, 2021.

Dannheim, J., L. Bergström, S. N. R. Birchenough, R. Brzana, A. R. Boon, J. W. P. Coolen, J.-C. Dauvin, I. De Mesel, J. Derweduwen, A. B. Gill, Z. L. Hutchison, A. C. Jackson, U. Janas, G. Martin, A. Raoux, J. Reubens, L. Rostin, J. Vanaverbeke, T. A. Wilding, D. Wilhelmsson, and S. Degraer. 2019. Benthic effects of offshore renewables: identification of knowledge gaps and urgently needed research. *ICES Journal of Marine Science* 77:1092–1108.

Dernie, K. M., M. J. Kaiser, E. A. Richardson, and R. M. Warwick. 2003. "Recovery Rates of Benthic Communities Following Physical Disturbance." *Journal of Animal Ecology* 72:1043–1056.

Dorrell, R. M., C. J. Lloyd, B. J. Lincoln, T. P. Rippeth, J. R. Taylor, C. P. Caulfield, J. Sharples, J. A. Polton, B. D. Scannell, D. M. Greaves, R. A. Hall, and J. H. Simpson. 2022. Anthropogenic mixing in seasonally stratified shelf seas by offshore wind farm infrastructure. *Frontiers in Marine Science* 9:830927.

Duarte, M. 2002. The future of seagrass meadows. *Environmental Conservation* 29(2):192–206. Foundation for Environmental Conservation.

Duarte, C. M., J. J. Middelburg, and N. Caraco. 2005. Major role of marine vegetation on the oceanic carbon cycle. *Biogeosciences* 2:1–8.

Duarte, C., T. Sintes, and N. Marba. 2013. Assessing the CO_2 capture potential of seagrass restoration projects. *Journal of Applied Ecology* 50:1341–1349.

Duarte, C. M., and D. Krause-Jensen. 2017. Export from seagrass meadows contributes to marine carbon sequestration. *Frontiers in Marine Science* 4:13.

English, P. A., T. I. Mason, J. T. Backstrom, B. J. Tibbles, A. A. Mackay, M. J. Smith, and T. Mitchell. 2017. *Improving Efficiencies of National Environmental Policy Act Documentation for Offshore Wind Facilities Case Studies Report*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2017-026. Available: https://tethys.pnnl.gov/sites/default/files/publications/English-et-al-2017-BOEM.pdf. Accessed: October 11, 2021.

Essink, K. 1999. “Ecological Effects of Dumping of Dredged Sediments; Options for Management.” *Journal of Coastal Conservation* 5:69–80.

Exponent Engineering, P.C. (Exponent). 2018. *Deepwater Wind South Fork Wind Farm. Offshore Electric and Magnetic Field Assessment*. May 24.

Field, C., M. Behrenfeld, J. Randerson, and P. Falkowski. 1998. Primary Production of the Biosphere: Integrating Terrestrial and Oceanic Components. *Science* 281:237–240.

Floeter, J., T. Pohlmann, A. Harmer, and C. Mollmann. 2022. Chasing the offshore wind farm wind-wake-induced upwelling/downwelling dipole. *Frontiers in Marine Science* 9:884943.

Ford, S. E. 1997. History and Present Status of Molluscan Shellfisheries from Barnegat Bay to Delaware Bay. In: *The History, Present Condition, and Future of the Molluscan Fisheries of North and Central American and Europe*. NOAA Technical Report NMFS 127; September 1997. 499p.

Gilbert, P. M., C. J. Madden, W. Boynton, D. Flemer, C. Heil, and J. Sharp. 2010. *Nutrients in Estuaries: A Summary Report of the National Estuarine Experts Workgroup 2005–2007*.

Gill, A. B. and M. Desender. 2020. Risk to Animals from Electromagnetic Fields Emitted by Electric Cables and Marine Renewable Energy Devices. In A.E. Copping and L.G. Hemery (Eds.), *OES-Environmental 2020 State of the Science Report: Environmental Effects of Marine Renewable Energy Development Around the World.* Report for Ocean Energy Systems (OES). (pp. 86–103). DOI:10.2172/1633088.

Graham, O. J., L. R. Aoki, T. Stephens, J. Stokes, S. Dayal, B. Rappazzo, C. P. Gomes, and C. D. Harvell. 2021. Effects of seagrass wasting disease on eelgrass growth and belowground sugar in natural meadows. *Frontiers in Marine Science* 8:768668.

Greene, J. K., M. G. Anderson, J. Odell, and N. Steinberg, eds. 2010. *The Northwest Atlantic Marine Ecoregional Assessment: Species, Habitats and Ecosystems. Phase One*. The Nature Conservancy, Eastern U.S. Division, Boston, MA.

Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, and E. Estela-Gomez. 2017. *Habitat Mapping and Assessment of Northeast Wind Energy Areas*. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088.

Harsanyi, P., K. Scott, B. A. A. Easton, G. de la Cruz Ortiz, E. C. N. Chapman, A. J. R. Piper, C. M. V. Rochas, and A. R. Lyndon. 2022. The effects of anthropogenic electromagnetic fields (EMF) on the early development of two commercially important crustaceans, European Lobster, *Homarus gammarus* (L.) and Edible Crab, *Cancer pagurus* (L.). 2022. *Journal of Marine Science and Engineering* 10:564.

Hawkins, A., R. Hazelwood, and A. Popper et al. 2021. Substrate vibrations and their potential effects upon fishes and invertebrates. *The Journal of the Acoustical Society of America* 149:2782. DOI: 10.1121/10.0004773.

Henderson, D., B. Hu, and E. Bielefeld. 2008. Patterns and mechanisms of noise-induced cochlear pathology. Pp. 195–217 in: National Marine Fisheries Service (NMFS). 2018. 2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. National Oceanic and Atmospheric Administration Technical Memorandum NMFS-OPR-59. U.S. Department of Commerce, National Oceanographic and Atmospheric Administration.

Howard, J., A. Sutton-Grier, D. Herr, J. Kleypas, E. Landis, E. Mcleod, E. Pidgeon, and S. Simpson. 2017. Clarifying the role of coastal and marine systems in climate mitigation. *Frontiers in Ecology and Environment* 15(1)*:*1–9.

Hutchison, Z. L., D. H. Secor, and A. B. Gill. 2020. The interaction between resource species and electromagnetic fields associated with electricity production by offshore wind farms. *Oceanography* 33(4):96–107.

Hutchison, Z. L., P. Sigray, H. He, A. B. Gill, J. King, and C. Gibson. 2018. *Electromagnetic Field (EMF) Impacts on Elasmobranch (Shark, Rays, and Skates) and American Lobster Movement and Migration from Direct Current Cables*. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-003.

Inspire Environmental (Inspire). 2021. *Ocean Wind Offshore Wind Farm Benthic Habitat Mapping and Benthic Assessment to Support Essential Fish Habitat Consultation*. Prepared for HDR Engineering. June 2021. Ocean Wind COP Appendix E Supplement.

Inspire Environmental (Inspire). 2022a. *Ocean Wind Offshore Wind Farm Benthic Habitat Mapping and Benthic Assessment to Support Essential Fish Habitat Consultation*. Prepared for HDR Engineering.

Inspire Environmental (Inspire). 2022b. *Ocean Wind Offshore Wind Farm Submerged Aquatic Vegetation Monitoring Plan*. Prepared for Ocean Wind, Ørsted US. Submitted by Inspire Environmental. June 15, 2022.

Jakubowska, M., B. Urban-Malinga, Z. Otremba, and E. Andrulewicz. 2019. Effect of low frequency electromagnetic field on the behavior and bioenergetics of the polychaete Hediste diversicolor. *Marine Environmental Research* 150:104766.

Johnson, T., J. van Berkel, L. Mortensen, M. Bell, I. Tiong, B. Hernandez, D. Snyder, F. Thomsen, and O. Petersen. 2021. *Hydrodynamic modeling, particle tracking, and agent-based modeling of larvae in the U.S. mid-Atlantic bight*. OCS Study BOEM 2021-049. Prepared under 140M120C0004 By DHI Water & Environment, Inc. Lakewood, Colorado 80235 USA.

Kennish, M. J., S. B. Bricker, W. C. Dennison, P. M. Glibert, R. J. Livingston, K. A. Moore, R. T. Noble, H. W. Paerl, J. M. Ramstack, S. Seitzinger, D. A. Tomasko, and I. Valiela. 2007. Barnegat Bay–Little Egg Harbor Estuary: case study of a highly eutrophic coastal bay system. *Ecological Applications* 17(sp5):S3–S16.

Kennish, M. J., and V. N. de Jonge. 2011. Chemical introductions to the systems: Diffuse and nonpoint source pollution from chemicals (nutrients: eutrophication). In: M. J. Kennish and M. Elliott, eds., *Treatise on Estuarine and Coastal Science*, Vol. 8, Human-induced Problems (Uses and Abuses). Treatise on Estuarine and Coastal Science, Elsevier, Oxford, England, pp. 113-148.

Kirchgeorg, T., I. Weinberg, M. Hornig, R. Baier, M. J. Schmid, and B. Brockmeyer. 2018. Emissions from corrosion protection systems of offshore wind farms: evaluation of the potential impact on the marine environment. *Marine Pollution Bulletin* 136:257–268.

Kurihara, H. 2008. Effects of CO_2-driven ocean acidification on the early developmental stages of invertebrates. *Marine Ecology Progress Series* 373:275–284.

Küsel, E., M. Werathmueller, K. Zammit, M. Reeve, S. Dufault, K. Limpert, and D. Zeddies. 2021. *Underwater Acoustic Analysis and Exposure Modeling Revolution Wind: Impact Pile Driving during Foundation Installation*. Prepared by JASCO Applied Sciences, Inc. for Revolution Wind. 169 pages. Available: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/App_P3%20Underwater%20Acoustic%20Modeling%20Report.pdf.

Langhamer, O., H. Holand, and G. Rosenqvist. 2016. Effects of an Offshore Wind Farm (OWF) on the Common Shore Crab Carcinus maenas: Tagging Pilot Experiments in the Lillgrund Offshore Wind Farm (Sweden). *PLOS ONE* 11(10): e0165096. DOI:10.1371/journal.pone.0165096.

Lathrop, R. G., and S. Haag. 2011. *Assessment of Seagrass Status in the Barnegat Bay-Little Egg Harbor Estuary System: 2003–2009*. CRSSA Technical Report, Rutgers University, New Brunswick, NJ, 56 pp. Available: http://crssa.rutgers.edu/projects/coastal/sav/downloads.htm.

Lefaible, N., L. Colson, U. Braeckman, and T. Moens. 2019. "Evaluation of Turbine-Related Impacts on Macrobenthic Communities Within Two Offshore Wind Farms During the Operational Phase." In *Memoirs on the Marine Environment: Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea*. S. Degraer, R. Brabant, B. Rumes, and L. Vigin, eds. 73–84. Brussels: Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management. Available: https://odnature.naturalsciences.be/downloads/mumm/windfarms/winmon_report_2019_final.pdf. Accessed: October 11, 2021.

Lefcheck, J. S., B. B. Hughes, A. J. Johnson, B. W. Pfirrmann, D. B. Rasher, A. R. Smyth, B. L. Williams, M. W. Beck, and R. J. Orth. 2019. Are coastal habitats important nurseries? A meta-analysis. *Conservation Letters* 12(4):e12645.

Lewis, L. J., J. Davenport, and T. C. Kelly. 2002. "A Study of the Impact of a Pipeline Construction on Estuarine Benthic Invertebrate Communities." *Estuarine Coastal and Shelf Science* 55(2):213–221.

Lewis III, R. R. R., and P. L. Erftemeijer. 2006. Environmental impacts of dredging on seagrasses: a review. *Marine Pollution Bulletin* 52(12):1553–1572.

Lloret, J., A. Turiel, J. Sole, E. Berdalet, A. Sabates, A. Olivares, J. Gili, J. Vila-Subiros, and R. Sarda. 2022. Unravelling the ecological impacts of large-scale offshore wind farms in the Mediterranean Sea. *Science of the Total Environment* 824:153803.

Love, M. S., M. M. Nishimoto, S. Clark, M. McCrea, and A. S. Bull. 2017. Assessing potential impacts of energized submarine power cables on crab harvests. *Continental Shelf Research* 151:23–29. DOI:10.1016/j.csr.2017.10.002.

Macreadie, P. I., A. Anton, J. A. Raven, N. Beaumont, R. M. Connolly, D. A. Friess, J. J. Kelleway, H. Kennedy, T. Kuwae, P. S. Lavery, C. E. Lovelock, D. A. Smale, E. T. Apostolaki, T. B. Atwood, J. Baldock, T. S. Bianchi, G. L. Chmura, B. D. Eyre, J. W. Fourqurean, J. M. Hall-Spencer, M. Huxham, I. E. Hendriks, D. Krause-Jensen, D. Laffoley, T. Luisetti, N. Marba, P. Masque, K. J. McGlathery, J. P. Megonigal, D. Murdiyarso, B. D. Russell, R. Santos, O. Serrano, B. R. Silliman, K. Watanabe, and C. M. Duarte. 2019. The future of Blue Carbon science. *Nature Communications* 10:3998. Available: https://doi.org/10.1038/s41467-019-11693-w.

Mcleod, E., G. L. Chmura, S. Bouillon, R. Salm, M. Bjork, et al. 2011. A blueprint for blue carbon: toward an improvement understanding of the role of vegetated coastal habitats in sequestering CO_2. *Front Ecol Environ* 9:552–560. DOI: https://doi.org/10.1890/110004.

Merson, R. R., and H. L. Pratt. 2007. Sandbar shark nurseries in New Jersey and New York: evidence of northern pupping grounds along the United States east coast. In *American Fisheries Society Symposium* (50):35.

Minerals Management Service (MMS). 2009. Cape *Wind Energy Project Final Environmental Impact Statement*. January 2009. U.S. Department of the Interior. OCS Publication No. 2008-040. Available: https://www.energy.gov/sites/prod/files/DOE-EIS-0470-Cape_Wind_FEIS_2012.pdf. Accessed: October 11, 2021.

Nascimento, F. J. A., M. Dahl, D. Deyanova, L. D. Lyimo, H. M. Bik, T. Schuelke, T. J. Pereira, M. Björk, S. Creer, and M. Gullström. 2019. Above-below surface interactions mediate effects of seagrass disturbance on meiobenthic diversity, nematode and polychaete trophic structure. *Communications Biology* 2:362.

National Oceanic and Atmospheric Administration (NOAA). 2022. *2022 State of the Ecosystem Mid-Atlantic*. NOAA Fisheries. Available: https://www.fisheries.noaa.gov/new-england-mid-atlantic/ecosystems/state-ecosystem-reports-northeast-us-shelf. Accessed: April 6, 2022.

Neckles, Hilary A., Angela D. Brewer, John W. Sowles, Seth Barker, Curtis C. Bohlen, Matthew Craig, Michael Doan, and Sandra Lary. 2015. "Update on a Continuing Saga: Eelgrass and Green Crabs in Casco Bay, Maine (Poster)." *Graphics, Maps, and Posters* 36. Available: https://digitalcommons.usm.maine.edu/cbep-graphics-maps-posters/36.

New Jersey Department of Environmental Protection (NJDEP). 1979. Submerged Aquatic Vegetation Distribution Map 040 – Marmora. Available: https://www.nj.gov/dep/landuse/download/map_040.jpg.

New Jersey Department of Environmental Protection (NJDEP). 1986. Submerged Aquatic Vegetation Distribution Map 024 – Island Beach. Available: https://www.nj.gov/dep/landuse/download/map_024.pdf.

New Jersey Department of Environmental Protection (NJDEP). 2012. *Hard clam distribution for central Barnegat Bay, 2012*. Available: https://www.nj.gov/dep/landuse/shellfish.html.

New York State Energy Research and Development Authority (NYSERDA). 2019. *Geotechnical and Geophysical Desktop Study to Support Offshore Wind Energy Development in the New York Bight Final Report*. Report Number 19-19. NYSERDA Contract 135752. 70 pages.

Normandeau Associates, Inc., Exponent, Inc., T. Tricas, and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species.* Final Report. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09. Available: https://espis.boem.gov/final%20reports/5115.pdf. Accessed: October 11, 2021.

Novak, A. B., M. C. Pelletier, P. Colarusson, J. Simpson, M. N. Guiterrez, A. Arias-Ortiz, M. Charpentier, P. Masque, and P. Vella. 2020. Factors influencing carbon stocks and accumulation rates in eelgrass meadows across New England, USA. *Estuaries and Coasts* 43:2076–2091.

Ocean Wind LLC (Ocean Wind). 2022. *Ocean Wind Submerged Aquatic Vegetation Preliminary Mitigation Plan*. December 2022.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Orth, R. J., J. S. Lefcheck, and D. J. Wilcox. 2017. Boat propeller scarring of seagrass beds in lower Chesapeake Bay, USA: Patterns, causes, recovery, and management. *Estuaries and Coasts* 40(6):1666–1676.

Pendleton, L., D. C. Donato, B. C. Murray, S. Crooks, W. A. Jenkins, S. Sifleet, C. Craft, J. W. Fourqurean, J. B. Kauffman, N. Marba, P. Megonigal, E. Pidgeon, D. Herr, D. Gordon, and A. Baldera. 2012. Estimating global "Blue Carbon" emissions from conversion and degradation of vegetated coastal ecosystems. *PLOS ONE* 7(9):e43542. DOI:10.1371/journal.pone.0043542.

Pezy, J. P., A. Raoux, J. C. Dauvin, and S. Degraer. 2018. "An Ecosystem Approach for Studying the Impact of Offshore Wind Farms: A French Case Study." *ICES Journal of Marine Science*, fsy125, September 12, 2018. Available: https://academic.oup.com/icesjms/article-abstract/77/3/1238/5096674. Accessed: October 11, 2021.

Pickens, B. A., J. C. Taylor, and D. Hansen. 2020. Volume 1: Fish habitat associations and the potential effects of dredging on the Atlantic and Gulf of Mexico Outer Continental Shelf, literature synthesis and gap analysis. In: Pickens, B. A., and J. C. Taylor, editors. *Regional Essential Fish Habitat geospatial assessment and framework for offshore sand features*. Sterling (VA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2020-002 and NOAA NCCOS Technical Memorandum 270. Available: https://doi.org/10.25923/akzd-8556.

Popper, A. N., L. Hice-Dunton, and E. Jenkins. 2022. Offshore wind energy development: Research priorities for sound and vibration effects on fishes and aquatic invertebrates. *Journal of the Acoustical Society of America* 151:205–215.

Popper, A. N., A. D. Hawkins, R. R. Fay, D. Mann, S. Bartol, T. Carlson, S. Coombs, W. T. Ellison, R. Gentry, M. B. Halvorsen, S. Løkkeborg, P. Rogers, B. L. Southall, D. Zeddies, and W. N. Tavolga. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI*. Springer Briefs in Oceanography, Springer International Publishing, and ASA Press, Cham, Switzerland.

Raoux, A., S. Tecchio, J. P. Pezy, G. Lassalle, S. Degraer, S. Wilhelmsson, M. Cachera, B. Ernande, C. Le Guen, M. Haraldsson, K. Grangeré, F. Le Loc'h, J. C. Dauvin, and N. Niquil. 2017. "Benthic and Fish Aggregation Inside an Offshore Wind Farm: Which Effects on the Trophic Web Functioning?" *Ecological Indicators* 72, January 2017:33–46. Available: https://hal.archives-ouvertes.fr/hal-01398550/document. Accessed: October 11, 2021.

Rico-Martínez, R., T. W. Snell, and T. L. Shearer. 2012. Synergistic toxicity of Macondo crude oil and dispersant Corexit 9500A® to the *Brachionus plicatilis* species complex (Rotifera). *Environmental Pollution* 173:5–10. Available: https://doi.org/10.1016/j.envpol.2012.09.024.

Roberts, L., H. R. Harding, I. Voellmy, R. Bruintjes, S. D. Simpson, A. N. Radford, T. Breithaupt, and M. Elliott. 2016. Exposure of benthic invertebrates to sediment vibration: From laboratory experiments to outdoor simulated pile-driving. *Proceedings of Meetings on Acoustics* 27:010029.

Rutecki, D., T. Dellapenna, E. Nestler, F. Scharf, J. Rooker, C. Glass, and A. Pembroke. 2014. *Understanding the Habitat Value and Function of Shoals and Shoal Complexes to Fish and Fisheries on the Atlantic and Gulf of Mexico Outer Continental Shelf*. Literature Synthesis and Gap Analysis. Prepared for the U.S. Department of the Interior, Bureau of Ocean Energy Management. Contract # M12PS00009. BOEM 2015-012.

Salo, T., and M. Pedersen. 2014. Synergistic Effects of Altered Salinity and Temperature on Estuarine Eelgrass (Zostera marina) Seedlings and Clonal Shoots. *J. Exp. Mar. Biol. Ecol.* 457:143–150. DOI: 10.1016/j.jembe.2014.04.008.

Schultz, I. R., D. L. Woodruff, K. E. Marshall, W. J. Pratt, and G. Roesijadi. 2010. *Effects of Electromagnetic Fields on Fish and Invertebrates*. Task 2.1. 3: Effects on Aquatic Organisms-Fiscal Year 2010 Progress Report- Environmental Effects of Marine and Hydrokinetic Energy (No. PNNL-19883 Final). Pacific Northwest National Laboratory, Richland, Washington.

Segtnan, O. H., and K. Christakos. 2015. Effect of offshore wind farm design on the vertical motion of the ocean. In *Proceedings of the 12th Deep Sea Offshore Wind R&D Conference, EERA DeepWind 2015*. *Energy Procedia* 80:213–222.

Short, Frederick T. 2016. *Eelgrass Distribution and Biomass in the Great Bay Estuary for 2015*. PREP Reports & Publications. 354. Available: https://scholars.unh.edu/prep/354.

Siddagangaiah, S., C.-F. Chen, W.-C. Hu, and N. Pieretti. 2022. Impact of pile-driving and offshore windfarm operational noise on fish chorusing. *Remote Sens Ecol Conserv* 8:119–134. Available: https://doi.org/10.1002/rse2.231.

Slacum, H. W., W. H. Burton, E. T. Methratta, E. D. Weber, R. J. Llanso, and J. Dew-Baxter. 2010. Assemblage structure in shoal and flat-bottom habitats on the inner continental shelf of the Middle Atlantic Bight, USA. *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science* 2:277–298.

Snyder, D. B., W. H. Bailey, K. Palmquist, B. R. T. Cotts, and K. R. Olsen. 2019. Evaluation of Potential EMF Effects on Fish Species of Commercial or Recreational Fishing Importance in Southern New England. BOEM report 2019-049. Available: https://espis.boem.gov/final%20reports/BOEM_2019-049.pdf.

Taghon, G. L., P. A. Ramey, C. M. Fuller, R. F. Petrecca, J. P. Grassle, and T. J. Belton. 2017. Benthic invertebrate community composition and sediment properties in Barnegat Bay, New Jersey, 1965–2014. In: Buchanan, G. A., T. J. Belton, and B. Paudel (eds.), A Comprehensive Assessment of Barnegat Bay–Little Egg Harbor, New Jersey. *Journal of Coastal Research*, Special Issue No. 78, pp. 169–183. Coconut Creek (Florida), ISSN 0749-0208.

Tagliabue, A., L. Kwiatkowski, L. Bopp, M. Butenschon, W. Cheung, M. Lengiagne, and J. Vialard. 2021. Persistent uncertainties in ocean net primary production climate change projections at regional scales raise challenges for assessing impacts on ecosystem services. *Frontiers in Climate* 3:738224.

Taormina B., J. Bald, A. Want, G. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. “A Review of Potential Impacts of Submarine Cables on the Marine Environment: Knowledge Gaps, Recommendations, and Future Directions.” *Renewable and Sustainable Energy Reviews* 96:380–391. Available: https://hal.archives-ouvertes.fr/hal-02405630/document. Accessed: October 11, 2021.

Tougaard, J., L. Hermannsen, and P. T. Madsen. 2020. How loud is the underwater noise from operating offshore wind turbines? *Journal of the Acoustical Society of America* 148(5):2885–2893.

U.S. Environmental Protection Agency (USEPA). 2009. National Estuary Program Booklet. Available: https://www.epa.gov/nep/national-estuary-program-booklet.

U.S. Offshore Wind Synthesis of Environmental Effects Research (SEER). 2022. Benthic Disturbance from Offshore Wind Foundations, Anchors, and Cables.

Van Dalfsen, J. A., and K. Essink. 2001. “Benthic Community Response to Sand Dredging and Shoreface Nourishment in Dutch Coastal Waters.” *Senckenbergiana Maritima* 31(2):329–332.

van der Molen, J., H. C. M. Smith, P. Lepper, S. Limpenny, and J. Rees. 2014. Predicting the large-scale consequences of offshore wind turbine array development on a North Sea ecosystem. *Cont. Shelf Res.* 85:60–72.

Vasslides, J., and K. Able. 2008. Importance of shoreface sand ridges as habitat for fishes off the northeast coast of the United States. *Fishery Bulletin* 106:93–107.

Veirs, S., V. Veirs, and J. D. Wood. 2016. Ship noise extends to frequencies used for echolocation by endangered killer whales. *PeerJ* 4:e1657. Available: https://doi.org/10.7717/peerj.1657.

Virginia Institute of Marine Science (VIMS). 2000. *Environmental survey of potential sand resources sites, offshore Delaware and Maryland*: Final Report. OCS Study 2000-05. Virginia Institute of Marine Science, College of William and Mary. Available: http://dx.doi.org/doi:10.21220/m2-mtx7-mn42.

Waycott, M., C. Duarte, T. Carruthers, R. Orth, et al. 2009. Accelerating loss of seagrasses across the globe threatens coastal ecosystems. *Proceedings of the National Academy of Sciences* 106:12377–12381.

Wilber, D. H., and D. G. Clarke. 2007. Defining and Assessing Benthic Recovery Following Dredging and Dredged Material Disposal. Presentation from the 2007 WODCON XVIII Conference in Lake Buena Vista, FL. Available: https://www.westerndredging.org/phocadownload/ConferencePresentations/2007_WODA_Florida/Session3D-EnvironmentalAspectsOfDredging/3%20-%20Wilber%20-%20Defining%20Assessing%20Benthic%20Recovery%20Following%20Dredged%20Material%20Disposal.pdf. Accessed: October 11, 2021.

Wilding, T. A., A. B. Gill, A. Boon, E. Sheehan, J. Dauvin, J. Pezy, F. O'Beirn, U. Janas, L. Rostin, and I. De Mesel. 2017. Turning of the DRIP ('Data-rich, information-poor') – rationalizing monitoring with a focus on marine renewable energy developments and the benthos. *Renewable and Sustainable Energy Reviews* 74:848–859.

Wong, M., and B. Vercaemer. 2012. Effects of invasive colonial tunicates and a native sponge on the growth, survival, and light attenuation of eelgrass (*Zostera marina*) *Aquatic Invasions* 7(3):315–326. DOI: http://dx.doi.org/10.3391/ai.2012.7.3.003.

Woodruff, D. L., I. R. Schultz, K. E. Marshall, J. A. Ward, and V. Cullinan. 2012. *Effects of Electromagnetic Fields on Fish and Invertebrates*. Task 2.1.3: Effects on Aquatic Organisms – Fiscal Year 2011 Progress Report. PNNL-20813, Pacific Northwest National Laboratory, Richland, Washington.

Woodruff, D. L., I. R. Schultz, K. E. Marshall, J. A. Ward, and V. I. Cullinan. 2013. *Effects of Electromagnetic Fields on Fish and Invertebrates*: Task 2.1.3: Effects on Aquatic Organisms-Fiscal Year 2011 Progress Report- Environmental Effects of Marine and Hydrokinetic Energy (No. PNNL-20813 Final). Pacific Northwest National Laboratory, Richland, Washington.

B.2.3.7. Section 3.7, Birds

Abdulle, S. A., and K. C. Fraser. 2018. Does wind speed and direction influence timing and route of a trans-hemispheric migratory songbird (purple martin) at a migration barrier? *Animal Migration* 5(1):49–58.

Ainley, D. G., E. Porzig, D. Zajanc, and L. B. Spear. 2015. Seabird flight behavior in response to altered wind strength and direction. *Marine Ornithology* 43:25–36.

Avian Power Line Interaction Committee (APLIC). 2012. *Reducing Avian Collisions with Power Lines: The State of the Art in 2012*. Edison Electric Institute and APLIC. Washington D.C. Available: http://www.aplic.org/uploads/files/15518/Reducing_Avian_Collisions_2012watermarkLR.pdf. Accessed: October 20, 2021.

Bayne, E. M., L. Habib, and S. Boutin. 2008. Impacts of Chronic Anthropogenic Noise from Energy-sector Activity on Abundance of Songbirds in the Boreal Forest. *Conservation Biology* 22(5):1186–1193.

Bloch, R., and B. Bruderer. 1982. The Air Speed of Migrating Birds and Its Relationship to the Wind. *Behavioral Ecology and Sociobiology* 11:19–24.

Briggs, K. T., M. E. Gershwin, and D. W. Anderson. 1997. Consequences of petrochemical ingestion and stress on the immune system of seabirds. *ICES Journal of Marine Science* 54:718–725.

Bruderer, B., and A. Boldt. 2001. Flight characteristics of birds. *International Journal of Avian Science* 143:178–204.

Bureau of Ocean Energy Management (BOEM). 2012. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts: Environmental Assessment*. OCS EIS/EA BOEM 2012-087. Available: https://www.boem.gov/sites/default/files/uploadedFiles/BOEM/BOEM_Newsroom/Library/Publications/2012/BOEM-2012-087.pdf. Accessed: September 1, 2020.

Bureau of Ocean Energy Management (BOEM). 2014a. *Atlantic OCS Proposed Geological and Geophysical Activities: Mid-Atlantic and South Atlantic Planning Areas Final Programmatic Environmental Impact Statement*. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2014-001. February 2014. Available: https://www.boem.gov/oil-gas-energy/atlantic-geological-and-geophysical-gg-activities-programmatic-environmental-impact. Accessed: October 19, 2020.

Bureau of Ocean Energy Management (BOEM). 2014b. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts: Revised Environmental Assessment*. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2014-603. Available: https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/MA/Revised-MA-EA-2014.pdf. Accessed: September 1, 2020.

Bureau of Ocean Energy Management (BOEM). 2016. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New York: Environmental Assessment*. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2016-042. June 2016. Available: https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NY/NY-Public-EA-June-2016.pdf. Accessed: September 1, 2020.

Bureau of Ocean Energy Management (BOEM). 2018. *Vineyard Wind Offshore Wind Energy Project Draft Environmental Impact Statement*. OCS EIS/EA BOEM 2018-060. Available: https://www.boem.gov/Vineyard-Wind-EIS/. Accessed: September 21, 2021.

Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: https://www.boem.gov/vineyard-wind. Accessed: August 2021.

Bureau of Ocean Energy Management (BOEM). 2021c. *Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development*. April 2021.

Bureau of Ocean Energy Management (BOEM). 2022. Ocean Wind Offshore Wind Farm Biological Assessment for the United States Fish and Wildlife Service. May.

Causon, Paul D., and Andrew B. Gill. 2018. Linking Ecosystem Services with Epibenthic Biodiversity Change Following Installation of Offshore Wind Farms. *Environmental Science and Policy* 89:340–347.

Chapman, J. W., C. Nilsson, K. S. Lim, J. Backman, D. R. Reynolds, and T. Alerstam. 2016. Adaptive Strategies in nocturnally migrating insects and songbirds: contrasting responses to wind. *Journal of Animal Ecology* 85(1):115–124. DOI: 10.1111/1365-2656.12420. Epub 2015 Aug 17. PMID: 26147535.

Choi, D. Y., T. W. Wittig, and B. M. Kluever. 2020. An Evaluation of Bird and Bat Mortality at Wind Turbines in the Northeastern United States. *PLOS ONE* 15(8): e0238034. Available: https://doi.org/10.1371/journal.pone.0238034.

Cook, A. S. C. P., and N. H. K. Burton. 2010. A Review of Potential Impacts of Marine Aggregate Extraction on Seabirds. Marine Environment Protection Fund Project 09/P130. Available: https://www.bto.org/sites/default/files/shared_documents/publications/research-reports/2010/rr563.pdf. Accessed: February 25, 2020.

Cornell University. 2019. “Golden Eagle Identification.” Available: https://www.allaboutbirds.org/guide/Golden_Eagle/id. Accessed: August 19, 2021.

Desholm, M., and J. Kahlert. 2005. “Avian Collision Risk at an Offshore Wind Farm.” *Biology Letters* 1 (3):296–298. DOI:10.1098/rsbl.2005.0336.

Dierschke, V., R. W. Furness, and S. Garthe. 2016. Seabirds and Offshore Wind Farms in European Waters: Avoidance and Attraction. *Biological Conservation* 202:59–68.

Dolbeer, R. A., M. J. Begier, P. R. Miller, J. R. Weller, and A. L. Anderson. 2019. *Wildlife Strikes to Civil Aircraft in the United States, 1990–2018*. Federal Aviation Administration National Wildlife Strike Database Serial Report Number 25. 95 pp. + Appendices.

Drewitt, Allan L., and Rowena H. W. Langston. 2006. “Assessing the Impacts of Wind Farms on Birds.” *Ibis* 148:29–42. Available: https://doi.org/10.1111/j.1474-919X.2006.00516.x.

English, P. A., T. I. Mason, J. T. Backstrom, B. J. Tibbles, A. A. Mackay, M. J. Smith, and T. Mitchell. 2017. *Improving Efficiencies of National Environmental Policy Act Documentation for Offshore Wind Facilities Case Studies Report*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2017-026.

Fox, A. D., Mark Desholm, Johnny Kahlert, Thomas Kjaer Christensen, and Ib Krag Peterson. 2006. “Information Needs to Support Environmental Impact Assessment of the Effects of European Marine Offshore Wind Farms on Birds.” *Ibis* 148:129–144.

Furness, B., and H. Wade. 2012. *Vulnerability of Scottish Seabirds to Offshore Wind Turbines*. Marine Scotland Report. Available: https://tethys.pnnl.gov/sites/default/files/publications/Furness%20and%20Wade%202012.pdf. Accessed: September 23, 2020.

Furness, R. W., H. M. Wade, and E. Masden. 2013. Assessing Vulnerability of Marine Bird Populations to Offshore Wind Farms. *Journal of Environmental Management* 119:56–66.

Garthe, S., and O. Hüppop. 2004. Scaling Possible Adverse Effects of Marine Wind Farms on Seabirds: Developing and Applying a Vulnerability Index. *Journal of Applied Ecology* 41:724–734.

Goodale, M. Wing, and Anita Millman. 2016. "Cumulative Adverse Effects of Offshore Wind Energy Development on Wildlife." *Journal of Environmental Planning and Management* 59(1):1–29. DOI: 10.1080/09640568.2014.973483.

Goodwin, S. E., and W. G. Shriver. 2010. Effects of Traffic Noise on Occupancy Patterns of Forest Birds. *Conservation Biology* 25(2):406–411.

Haney, J. C., P. G. R. Jodice, W. A. Montevecchi, and D. C. Evers. 2017. Challenges to Oil Spill Assessments for Seabirds in the Deep Ocean. Archives of *Environmental Contamination and Toxicology* 73:33–39.

Hatch, J. M. 2017. Comprehensive Estimates of Seabird-Fishery Interactions for the U.S. Northeast and Mid-Atlantic. *Aquatic Conservation: Marine and Freshwater Ecosystems* 28(1):182–193.

Hodos, W. 2003. *Minimization of Motion Smear: Reducing Avian Collisions with Wind Turbines*. Prepared for the National Renewable Energy Laboratory. NREL/SR-500-33249. Golden, CO.

Hüppop, O., J. Dierschke, K. Exo, E. Frerich, and R. Hill. 2006. Bird Migration and Potential Collision Risk with Offshore Wind Turbines. *Ibis* 148:90–109.

Johnston, A., A. S. C. P. Cook, L. J. Wright, E. M. Humphreys, and N. H. K. Burton. 2014. Modeling Flight Heights of Marine Birds to More Accurately Assess Collision Risk with Offshore Wind Turbines. *Journal of Applied Ecology* 51:31–41.

Kerlinger, P. 1985. Water-crossing behavior of raptors during migration. *Wilson Bulletin* 97:109–113.

Kerlinger, P., J. L. Gehring, W. P. Erickson, R. Curry, A. Jain, and J. Guarnaccia. 2010. Night Migrant Fatalities and Obstruction Lighting at Wind Turbines in North America. *The Wilson Journal of Ornithology* 122(4):744–754.

Leopold, M. F., E. M. Dijkman, and L. Teal. 2011. *Local Birds in and around the Offshore Wind Farm Egmond aan Zee (OWEZ) (T-0 & T-1, 2002-2010)*. Report C187/11. IMARES Wageningen UR, Texel, the Netherlands. Appendices.

Leopold, M. F., R. S. A. van Bemmelen, and A. F. Zuur. 2013. *Responses of Local Birds to the Offshore Wind Farms PAWP and OWEZ off the Dutch mainland coast*. Report C151/12. IMARES Wageningen UR, Texel, the Netherlands.

Lindeboom, H. J., H. J. Kouwenhoven, M. J. N. Bergman, S. Bouma, S. Brasseur, R. Daan, R. C. Fijn, D. de Haan, S. Dirksen, R. van Hal, R. Hille Ris Lambers, R. ter Hofstede, K. L. Krijgsveld, M. Leopold, and M. Scheidat. 2011. Short-term Ecological Effects of an Offshore Wind Farm in the Dutch Coastal Zone; a compilation. *Environmental Research Letters* 6:1–13.

Madsen, A. M., R. Reeve, M. Desholm, A. D. Fox, R. W. Furness, and D. T. Haydon. Assessing the Impact of Marine Wind Farms on Birds Through Movement Modelling. *Journal of the Royal Society Interface*. May 2.

Maggini, I., L. V. Kennedy, A. Macmillan, K. H. Elliot, K. Dean, and C. G. Guglielmo. 2017. Light Oiling of Feathers Increases Flight Energy Expenditure in a Migratory Shorebird. *Journal of Experimental Biology* 220:2372–2379.

McLaughlin, K. E., and H. P. Kunc. 2013. Experimentally Increased Noise Levels Change Spatial and Singing Behavior. *Biology Letters* 9:20120771.

National Audubon Society (Audubon). 2019. "Survival by Degrees: 389 Species on the Brink." Available: https://www.audubon.org/climate/survivalbydegrees.

New Jersey Audubon Society. Undated. Avalon Seawatch. Available: https://njaudubon.org/watches/avalon-seawatch/. Accessed: January 17, 2023.

New Jersey Bureau of GIS. 2018. "Landscape 3.3 Regions of New Jersey." Available: https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::landscape-3-3-regions-of-new-jersey/explore?location=39.344761%2C-74.511322%2C11.60. Accessed: August 19, 2021.

New Jersey Department of Environmental Protection (NJDEP). 2018. *New Jersey's Wildlife Action Plan*. Division of Fish and Wildlife. March. Available: https://www.nj.gov/dep/fgw/ensp/wap/pdf/wap_plan18.pdf. Accessed: July 8, 2021.

North American Bird Conservation Initiative (NABCI), U.S. Committee. 2016. *The State of the Birds 2016: Report on Public Lands and Waters*. U.S. Department of the Interior. Washington, DC. Available: https://www.stateofthebirds.org/2016/wpcontent/uploads/2016/05/SoNAB-ENGLISH-web.pdf. Accessed: September 1, 2020.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Orr, Terry L., Susan M. Herz, and Darrell L. Oakley. 2013. *Evaluation of Lighting Schemes for Offshore Wind Facilities and Impacts to Local Environments*. Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-0116. Available: https://espis.boem.gov/final%20reports/5298.pdf. Accessed: September 1, 2020.

Ørsted Wind Power North America, LLC (Ørsted). 2022. Personal communications. Email providing information on WTG cut-in speed and rotations per minute.

Paleczny, M., E. Hammill, V. Karpouzi, and D. Pauly. 2015. Population Trend of the World's Monitored Seabirds, 1950–2010. *PLOS ONE* 10(6): e0129342. Available: https://doi.org/10.1371/journal.pone.0129342.

Panuccio, M., G. Dell'Omo, G. Bogliani, C. Catoni, and N. Sapir. 2019. "Migrating Birds Avoid Flying Through Fog and Low Clouds." *International Journal of Biometeorology* 63:231–239. January 28, 2019. Available: https://doi.org/10.1007/s00484-018-01656-z.

Paruk, J. D., E. M. Adams, H. Uher-Koch, K .A. Kovach, D. Long, IV, C. Perkins, N. Schoch, and D. C. Evers. 2016. Polycyclic Aromatic Hydrocarbons in Blood Related to Lower Body Mass in Common Loons. *Science of the Total Environment* 565:360–368.

Percival, S. 2010. *Kentish Flats Offshore Wind Farm: Diver Surveys 2009–2010*. Ecology Consulting Report to Vattenfall Wind Energy.

Petersen, Ib Krag, Thomas Kjær Christensen, Johnny Kahlert, Mark Desholm, and Anthony D. Fox. 2006. *Final Results of Bird Studies at the Offshore Wind Farms at Nysted and Horns Rev, Denmark*. National Environmental Research Institute, Ministry of the Environment, Denmark. Available: https://tethys.pnnl.gov/sites/default/files/publications/NERI_Bird_Studies.pdf. Accessed: September 1, 2020.

Pettersson, J. 2005. *The Impact of Offshore Wind Farms on Bird Life in Southern Kalmar Sound, Sweden: a Final Report Based on Studies 1999–2003*. Report for the Swedish Energy Agency, Lund University, Lund, Sweden.

Pezy, J. P., A. Raoux, J. C. Dauvin, and Steven Degraer. 2018. "An Ecosystem Approach for Studying the Impact of Offshore Wind Farms: A French Case Study." *ICES Journal of Marine Science*, fsy125, September 12, 2018.

Plonczikier, P., and I. C. Simms. 2012. Radar Monitoring of Migrating Pink-footed Geese: Behavioral Responses to Offshore Wind Farm Development. *Journal of Applied Ecology* 49:1187–1194.

Raoux, A., S. Tecchio, J. P. Pezy, G. Lassalle, S. Degraer, S. Wilhelmsson, M. Cachera, B. Ernande, C. Le Guen, M. Haraldsson, K. Grangere, F. Le Loc'h, J. C. Dauvin, and N. Niquil. 2017. Benthic and Fish Aggregation Inside an Offshore Wind Farm: Which Effects on the Trophic Web Functioning? *Ecological Indicators* 72:33–46.

Regular, P., W. Montevecchi, A. Hedd, G. Roberson, and S. Wilhelm. 2013. "Canadian Fisheries Closure Provides a Large-scale Test of the Impact of Gillnet Bycatch on Seabird Populations." *Biology Letters* 9(4): 20130088. Available: https://royalsocietypublishing.org/doi/pdf/10.1098/rsbl.2013.0088. Accessed: September 1, 2020.

Roberts, A. J. 2019. *Atlantic Flyway Harvest and Population Survey Data Book*. U.S. Fish and Wildlife Service, Laurel, MD.

Robinson Willmott, J., and G. Forcey. 2014. *Acoustic Monitoring of Temporal and Spatial Abundance of Birds near Outer Continental Shelf Structures: Synthesis Report*. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Herndon, VA. BOEM 2014-004. 172 pp. Available: https://espis.boem.gov/final%20reports/5349.pdf. Accessed: September 7, 2020.

Robinson Willmott, J., G. Forcey, and A. Kent. 2013. *The Relative Vulnerability of Migratory Bird Species to Offshore Wind Energy Projects on the Atlantic Outer Continental Shelf: An Assessment Method Database*. Final report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2013-207. Available: https://espis.boem.gov/final%20reports/5319.pdf. Accessed: September 7, 2020.

Roman, L., B. D. Hardesty, M. A. Hindell, and C. Wilcox. 2019. A Quantitative Analysis Linking Seabird Mortality and Marine Debris Ingestion. *Scientific Reports* 9(1):1–7.

Sigourney, D. B., C. D. Orphanides, and J. M. Hatch. 2019. *Estimates of Seabird Bycatch in Commercial Fisheries off the East Coast of the United States from 2015-2016*. NOAA Technical Memorandum NMFS-NE-252. Woods Hole, Massachusetts. 27 pp.

Skov, H., S. Heinanen, T. Norman, R. M. Ward, S. Mendez-Roldan, and I. Ellis. 2018. *ORJIP Bird Collision and Avoidance Study*. Final report. The Carbon Trust. United Kingdom. April 2018.

Stabile, Frank A., Gregory J. Watkins-Colwell, Jon A. Moore, Michael Vecchione, and Edward H. Burtt Jr. 2017. "Observations of Passerines and a Falcon from a Research Vessel in the Western North Atlantic Ocean." *The Wilson Journal of Ornithology* 129(2):349–353.

U.S. Fish and Wildlife Service (USFWS). 2018. "Wind Turbines." Available: https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds/collisions/wind-turbines.php. Accessed: August 20, 2021.

U.S. Fish and Wildlife Service (USFWS). 2021a. Information for Planning and Consultation (IPaC): list of federally listed threatened, endangered, and proposed species in the Ocean Wind offshore and onshore project components. List generated on July 1.

U.S. Fish and Wildlife Service (USFWS). 2021b. Birds of Conservation Concern 2021, Migratory Bird Program. Available: https://www.fws.gov/sites/default/files/documents/birds-of-conservation-concern-2021.pdf. Accessed: March 21, 2022.

U.S. Fish and Wildlife Service (USFWS). 2021c. "Threats to Birds: Migratory Bird Mortality – Questions and Answers." Available: https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php. Accessed: August 20, 2021.

Vattenfall. 2023. *AOWFL-Resolving Key Uncertainties of Seabird Flight and Avoidance Behaviours at Offshore Wind Farms*. Final report for the study period 2020–2021. Prepared by RPS. February 20.

Vilela, R., C. Burger, A. Diederichs, F. E. Bachl, L. Szostek, A. Freund, A. Braasch, J. Bellebaum, B. Beckers, W. Piper, and G. Nehls. 2021. Use of an INLA Latent Gaussian Modeling Approach to Assess Bird Population Changes Due to the Development of Offshore Wind Farms. *Front. Mar. Sci*. 8:701332. DOI: 10.3389/fmars.2021.701332.

Wang, J., X. Zou, W. Yu, D. Zhang, and T. Wang. 2019. Effects of Established Offshore Wind Farms on Energy Flow of Coastal Ecosystems: A Case Study of the Rudong Offshore Wind Farms in China. *Ocean & Coastal Management* 171:111–118.

Watts, Bryan D. 2010. *Wind and Waterbirds: Establishing Sustainable Mortality Limits within the Atlantic Flyway*. Center for Conservation Biology Technical Report Series, CCBTR-10-15. College of William and Mary/Virginia Commonwealth University, Williamsburg, VA. 43 pp. Available: https://www.ccbbirds.org/wp-content/uploads/2013/12/ccbtr-10-05_Watts-Wind-and-waterbirds-Establishing-sustainable-mortality-limits-within-the-Atlantic-Flyway.pdf. Accessed: September 1, 2020.

Winship, A. J., B. P. Kinlan, T. P. White, J. B. Leirness, and J. Christensen. 2018. Modeling At-Sea Density of Marine Birds to Support Atlantic Marine Renewable Energy Planning: Final Report. OCS Study BOEM 2018-010. Sterling, VA. 67 pp. Available: https://coastalscience.noaa.gov/data_reports/modeling-at-sea-density-of-marine-birds-to-support-atlantic-marine-renewable-energy-planning-final-report/. Accessed: September 7, 2020.

B.2.3.8. Section 3.8, Coastal Habitat and Fauna

Atlantic Shores Offshore Wind (Atlantic Shores). 2021. *Construction and Operations Plan, Atlantic Shores Offshore Wind*. Volume I. September. Available: https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-construction-and-operations-plan.

Bureau of Ocean Energy Management. 2022. *Ocean Wind Offshore Wind Farm Biological Assessment for the United States Fish and Wildlife Service.* May.

Carroll, R. P. 2019. Direct and indirect effects of anthropogenic land use on bobcats (*Lynx rufus*) in New England. University of New Hampshire, Durham. Available: https://scholars.unh.edu/cgi/viewcontent.cgi?article=3438&context=dissertation. Accessed: November 24, 2021.

City of Ocean City. 2016. *City of Ocean City Beach Management Plant For the Protection of Federally and State-Listed Species*. January.

Conserve Wildlife Foundation of New Jersey. 2019. *Major Increase of Endangered Seabeach Amaranth South of Sandy Hook*. December 26, 2019. Available: http://www.conservewildlifenj.org/blog/2019/12/26/major-increase-of-endangered-seabeach-amaranth-plants-south-of-sandy-hook/.

Conserve Wildlife Foundation of New Jersey. 2021. *New Jersey Endangered and Threatened Species Field Guide*. Available: http://www.conservewildlifenj.org/species/fieldguide/.

Island Beach State Park. 2017. *Island Beach State Park Beach Management Plan For the Protection of Federally and State-Listed Species*. February.

Kennish, M. J., editor. No date. *The Scientific Characterization of the Barnegat Bay—Little Egg Harbor Estuary and Watershed*. Available: https://www.barnegatbaypartnership.org/wp-content/uploads/wpallimport/files/The%20Scientific%20Characterization%20of%20the%20Barnegat%20Bay-Little%20Egg%20Harbor%20Watershed.pdf. Accessed: October 6, 2021.

New Jersey Department of Environmental Protection (NJDEP). 2020. *New Jersey Scientific Report on Climate Change*, Version 1.0. (Eds. R. Hill, M. M. Rutkowski, L. A. Lester, H. Genievich, N. A. Procopio). Trenton, NJ. 184 pp.

New Jersey Division of Fish and Wildlife (NJDFW). 2017a. NJDEP Species Based Habitat, Atlantic Coastal Region, Version 3.3. New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Division of Information Technology, Bureau of Geographic Information Systems. Published online at *NJDEP Landscape 3.3 Viewer*. Available: https://www.arcgis.com/apps/webappviewer/index.html?id=0e6a44098c524ed99bf739953cb4d4c7. Accessed: November 22, 2021.

New Jersey Division of Fish and Wildlife (NJDFW). 2017b. NJDEP Species Based Habitat, Pinelands Region, Version 3.3. New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Division of Information Technology, Bureau of Geographic Information Systems. Published online at *NJDEP Landscape 3.3 Viewer*. Available: https://www.arcgis.com/apps/webappviewer/index.html?id=0e6a44098c524ed99bf739953cb4d4c7. Accessed: November 22, 2021.

New Jersey Sea Grant Consortium. No date. *Dune Manual*. Available: https://njseagrant.org/wp-content/uploads/2016/07/Dune-Manual-Pgs-compressed.pdf. Accessed: September 9, 2021.

Ocean County Planning Department. 1976. *Natural Resource Inventory for Long Beach Island, Ocean County, New Jersey*. Revised May 1976.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Ocean Wind LLC (Ocean Wind). 2023. Citing Atlantic County. 1973. *Atlantic County Environmental Inventory*. Prepared by John G. Reutters Associates.

Sacatelli, R., R. G. Lathrop, and M. Kaplan. 2020. Impacts of Climate Change on Coastal Forests in the Northeast US. Rutgers Climate Institute, Rutgers University, New Brunswick, NJ. 48 p. DOI: https://doi.org/doi:10.7282/t3-n4tn-ah53. Available: https://www.sas.rutgers.edu/cms/climate/images/Impacts_of_Climate_Change_on_Coastal_Forests_in_the_Northeast_US__Sacatelli_R._Lathrop_R.G._and_Kaplan_M_2020_December_FINAL.pdf. Accessed: November 22, 2021.

Save Barnegat Bay. 2019. "Herbarium and Janet's Garden." Available: https://www.savebarnegatbay.org/educate/herbarium-and-janets-garden/. Accessed: October 6, 2021.

Sordello, R., R. Ophélie, F. F. De Lachapelle, C. Leger, A. Dambry, and S. Vanpeene. 2020. *Environmental Evidence* 9(20). Available: https://environmentalevidencejournal.biomedcentral.com/track/pdf/10.1186/s13750-020-00202-y.pdf. Accessed: November 23, 2019

State of New Jersey Pinelands Commission. 2021. Pinelands Interactive Map. Available: https://njpines.maps.arcgis.com/apps/webappviewer/index.html?id=28ef313eb49f4e8f96ca249d871d06fe.

U.S. Department of Agriculture, Natural Resources Conservation Service (USDA NRCS). 2006. *Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin*. U.S. Department of Agriculture Handbook 296.

U.S. Fish and Wildlife Service (USFWS). 2023. New Jersey Field Office. Featured Species, Federally Listed and Candidate Species Occurring in New Jersey.

Wootton, L., J. Miller, C. Miller, M. Peek, A. Williams, and P. Rowe. 2016. *New Jersey Sea Grant Consortium Dune Manual*. Available: https://secureservercdn.net/198.71.233.83/bge.b67.myftpupload.com/wp-content/uploads/2016/07/Dune-Manual-Pgs-compressed.pdf. Accessed: October 22, 2021.

B.2.3.9. Section 3.9, Commercial Fisheries and For-Hire Recreational Fishing

Andersson, M. H., E. Dock-Åkerman, R. Ubral-Hedenberg, M.C. Öhman, and P. Sigray. 2007. Swimming behavior of roach (*Rutilus rutilus*) and three-spined stickleback (*Gasterosteus aculeatus*) in response to wind power noise and single-tone frequencies. AMBIO 36(8):636–638.

Atlantic States Marine Fisheries Commission (ASMFC). 2021. Fisheries Management. Available: http://www.asmfc.org/fisheries-management/program-overview.

Atlantic States Marine Fisheries Commission (ASMFC). 2023. Atlantic Menhaden. Available: http://www.asmfc.org/species/atlantic-menhaden. Accessed: January 6, 2023.

Bald, J., C. Hernández, A. Uriarte, J. A. Castillo, P. Ruiz, N. Ortega, Y. T. Enciso, and D. Marina. 2015. Acoustic Characterization of Submarine Cable Installation in the Biscay Marine Energy Platform (BIMEP). [Presentation]. Presented at Bilbao Marine Energy Week, Bilbao, Spain.

Barange, M., T. Bahri, M. Beveridge, K. Cochrane, S. Funge-Smith, and F. Poulain. 2018. *Impacts of Climate Change on Fisheries and Aquaculture: Synthesis of Current Knowledge, Adaptation and Mitigation Options*. FAO Fisheries and Aquaculture Technical Paper 627. Rome, Italy.

Barton, B. A. 2002. Stress in fishes: A diversity of responses with particular reference to changes in circulating corticosteroids. *Integrative and Comparative Biology* 42:517–525.

Bureau of Ocean Energy Management (BOEM). 2018. Commercial Fishing Frequently Asked Questions. Wind Energy on the Outer Continental Shelf. Available: https://www.boem.gov/sites/default/files/uploadedFiles/BOEM-Fishing%20FAQs.pdf.

Bureau of Ocean Energy Management (BOEM). 2019. *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf*. OCS Study BOEM 2019-036. May 2019. 201 pp. Available: https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/IPFs-in-the-Offshore-Wind-Cumulative-Impacts-Scenario-on-the-N-OCS.pdf. Accessed: October 8, 2021.

Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: https://www.boem.gov/vineyard-wind. Accessed: August 2021.

Bureau of Ocean Energy Management (BOEM). 2021b. *South Fork Wind Farm and South Fork Export Cable Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2020-057. Available: https://www.boem.gov/renewable-energy/state-activities/sfwf-feis.

Bureau of Ocean Energy Management (BOEM). 2022. Revenue exposure analysis results for Ocean Wind 1 No Action Alternative. Personal communication between Ursula Howson (BOEM) and Spence Smith (WSP). May 8.

Claesson, S., R. Robertson, and M. Hall-Arber. 2006. Fishing Heritage Festivals, Tourism, and Community Development in the Gulf of Maine. *Proceedings of the 2005 Northeastern Recreation Research Symposium.* GTR-NE-341.

Clay, P. M., and Colburn, L. L. 2020. *A Practitioner's Handbook for Fisheries Social Impact Assessment*. U.S. Department of Commerce – National Oceanic and Atmospheric Administration – National Marine Fisheries Service. NOAA Technical Memorandum NMFS-F-SPO-212. December. Available: https://spo.nmfs.noaa.gov/content/tech-memo/practitioners-handbook-fisheries-social-impact-assessment.

Colburn, L. L., M. Jepson, C. Weng, T. Seara, J. Weiss, and J. A. Hare. 2016. Indicators of climate change and social vulnerability in fishing dependent communities along the eastern and Gulf Coasts of the United States. *Marine Policy* 74 (December):323–333.

Curtis, T. 2023. Personal communication between T. Curtis with NMFS and Ursula Howson with BOEM. January 2023.

Debusschere, E., K. Hostens, D. Adriaens, B. Ampre, D. Botteldooren, G. De Boeck, A. De Muynck, A. Kumar Sinha, S. Vandendriessche, L. Van Hoorebeke, M. Vincx, and S. Degraer. 2016. Acoustic stress responses in juvenile sea bass *Dicentrarchus labrax* induced by offshore pile driving. *Environmental Pollution* 208:747–757.

Denes, S. L., D. G. Zeddies, and M. M. Weirathmueller. 2021. *Turbine Foundation and Cable Installation at South Fork Wind Farm: Underwater Acoustic Modeling of Construction Noise*. Appendix J1 in Construction and Operations Plan South Fork Wind Farm. Silver Spring, Maryland: JASCO Applied Sciences.

DNV-GL. 2021. *South Fork Wind Farm Navigation Safety Risk Assessment*. Appendix M in Construction and Operations Plan South Fork Wind Farm. Prepared for Deepwater Wind, LLC. Document No. 10057311-HOU-R-01. Medford, Massachusetts: DNV-GL.

Elliot, J., A. A. Khan, Ying-Tsong, L., T. Mason, J. H. Miller, A. E. Newhall, G. R. Potty, and K. J. Vigness-Raposa. 2019. *Field Observations during Wind Turbine Operations at the Block Island Wind Farm, Rhode Island*. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2019-028.

English, P. A., T. I. Mason, J. T. Backstrom, B. J. Tibbles, A. A. Mackay, M. J. Smith, and T. Mitchell. 2017. *Improving Efficiencies of National Environmental Policy Act Documentation for Offshore Wind Facilities Case Studies Report*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2017-026.

Fabrizio, M. C., J. P. Manderson, and J. P. Pessutti. 2014. "Home Range and Seasonal Movements of Black Sea Bass (*Centropristis striata*) During their Inshore Residency at a Reef in the Mid-Atlantic Bight." *Fishery Bulletin* 112:82–97 (2014). DOI: 10.7755/FB.112.1.5.

Hall-Arber, M., C. Dyer, J. Poggie, J. McNally, and R. Gagne. 2001. *New England's Fishing Communities.* MIT Sea Grant College Program (MITSG 01-15). January.

Hare, J. A., W. E. Morrison, M. W. Nelson, M. M. Stachura, E. J. Teeters, R. B. Griffis, M. A. Alexander, J. D. Scott, L. Alade, and R. J. Bell. 2016. *A vulnerability assessment of fish and invertebrates to climate change on the Northeast US Continental Shelf*. *PLOS ONE* 11(2):e0146756.

Hastings, M., and A. Popper. 2005. *Effects of Sound on Fish.* Final Report # CA05-0537 – Project P476 Noise Thresholds for Endangered Fish. California Department of Transportation. January 28, 2005 (August 23, 2005 [Revised Appendix B]).

Hicks, C. C., A. Levine, A. Agrawal, X. Basurto, S. J. Breslow, C. Carothers, S. Charnley, S. Coulthard, N. Dolsak, J. Donatuto, C. Garcia-Quijano, M. B. Mascia, K. Norman, M. B. Poe, T. Satterfield, K. St. Martin, and P. S. Levin. 2016. Social Science and Sustainability: "Engage key social concepts for sustainability – Social indicators, both mature and emerging, are underused." Published by the American Association for the Advancement of Science (AAAS). *Science* 352(6281).

Hiddink, J. G., S. Jennings, M. Sciberrasa, C. L. Szosteka, K. M. Hughes, N. Ellisd, A. D. Rijnsdorpe, R. A. McConnaughey, T. Mazord, R. Hilborng, J. S. Collieh, C. R. Pitcherd, R. O. Amorosoi, A. M. Parmai, P. Suuronenj, and M. J. Kaisera. 2017. Global analysis of depletion and recovery of seabed biota after bottom trawling disturbance. Proceedings of the National Academy of Sciences, 114, 8301–8306. Available: https://doi.org/10.1073/pnas.1618858114.

Jepson, M., and L. L. Colburn. 2013. *Development of Social Indicators of Fishing Community Vulnerability and Resilience in the U.S. Southeast and Northeast Regions*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. NOAA Technical Memorandum NMFS-F/SPO-129. April.

Jones, I. T., J. A. Stanley, and T. A. Mooney. 2020. Impulsive pile driving noise elicits alarm responses in squid (Doryteuthis pealeii). *Marine Pollution Bulletin* 150:110792. DOI:10.1016/ j.marpolbul.2019.110792.

Kirkpatrick, A. J., S. Benjamin, G. S. DePiper, S. S. T. Murphy, and C. Demarest. 2017. *Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic*. Vol. II—Appendices. U.S. Department of the Interior, Bureau of Ocean Energy Management, Atlantic OCS Region. Washington, D.C.

Küsel, E. T., M. J. Weirathmueller, K. E. Zammit, S. J. Welch, K. E. Limpert, and D. G. Zeddies. 2022. *Underwater Acoustic and Exposure Modeling*. Document 02109, Version 1.0 DRAFT. Technical report by JASCO Applied Sciences for Ocean Wind LLC.

Madsen, P. T., M. Wahlberg, J. Tougaard, K. Lucke, and P. Tyack. 2006. Wind turbine underwater noise and marine mammals: implications of current knowledge and data needs. *Marine Ecology Progress Series* 309:279–295.

McCauley, R. D., J. Fewtrell, A. J. Duncan, C. Jenner, M. N. Jenner, J. Penrose, R. I. T. Prince, A. Adhitya, J. Murdoch, and K. McCabe. 2000. Marine seismic surveys – a study of environmental implications. *Australian Petroleum Production Exploration Association Journal* 40:692–708.

McClenachan, L., J. Grabowski, M. Marra, C. S. McKeon, B. P. Neal, N. R. Record, and S. B. Scyphers. 2019. Shifting perceptions of rapid temperature changes' effects on marine fisheries, 1945–2017. *Fish and Fisheries* 2019(00):1–13. DOI: 10.1111/faf.12400.

McCreary, S., and B. Brooks. 2019. Atlantic Large Whale Take Reduction Team Meeting: Key Outcomes Meeting. April 23–26, 2019. Providence, Rhode Island. Available: https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-mammal-protection/atlantic-large-whale-take-reduction-plan.

Mid-Atlantic Fishery Management Council (MAFMC). 2021. Fishery Management Plans and Amendments. Available: https://www.mafmc.org/fishery-management-plans.

Moser, J., and G. R. Shepherd. 2009. "Seasonal Distribution and Movement of Black Sea Bass (*Centropristis striata*) in the Northwest Atlantic as Determined from a Mark-Recapture Experiment." *J. Northw. Atl. Fish. Sci.* 40:17–28. DOI:10.2960/J.v40.m638.

Mueller-Blenkle, C., P. K. McGregor, A. B. Gill, M. H. Andersson, J. Metcalfe, V. Bendall, P. Sigray, D. T. Wood, and F. Thomsen. 2010. *Effects of Pile-driving Noise on the Behaviour of Marine Fish*. COWRIE Ref: Fish 06-08; Cefas Ref: C3371. 62 p.

Murray, G., T. Johnson, B. J. McCay, M. Danko, K. St. Martin, and S. Takahashi. 2010. Creeping enclosure, cumulative effects and the marine commons of New Jersey. *International Journal of the Commons* 4(1):367–389.

National Academies of Sciences, Engineering, and Medicine 2022. *Wind Turbine Generator Impacts to Marine Vessel Radar*. Washington, DC: The National Academies Press.

National Marine Fisheries Service (NMFS). 2006. *Consolidated Atlantic Highly Migratory Species Management Plan*. Available: https://www.fisheries.noaa.gov/management-plan/consolidated-atlantic-highly-migratory-species-management-plan. Accessed: January 24, 2023.

National Marine Fisheries Service (NMFS). 2019. Vessel Activity by Vessel Speed and VMS Activity by Course, OCS-A-0498, Ocean Wind, January 2014 to August 2019.

National Marine Fisheries Service (NMFS). 2020. The Economic Importance of Seafood. Available: https://www.fisheries.noaa.gov/feature-story/economic-importance-seafood. Accessed: November 5, 2020.

National Marine Fisheries Service (NMFS). 2021a. Commercial Fisheries Statistics. Available: https://www.fisheries.noaa.gov/national/sustainable-fisheries/commercial-fisheries-landings. Accessed: November 2021.

National Marine Fisheries Service (NMFS). 2021b. *Descriptions of Selected Fishery Landings and Estimates of Vessel Revenue from Areas: A Planning-level Assessment*. Ocean Wind 1. July 6, 2021. Available: https://www.greateratlantic.fisheries.noaa.gov/ro/fso/reports/WIND/WIND_AREA_REPORTS/Ocean_Wind_1.html. Accessed October 9, 2021.

National Marine Fisheries Service (NMFS). 2021c. Consolidated Atlantic Highly Migratory Species Management Plan. Available: https://www.fisheries.noaa.gov/management-plan/consolidated-atlantic-highly-migratory-species-management-plan. Accessed October 15, 2021.

National Marine Fisheries Service (NMFS). 2021d. Program Glossary. Available: https://www.st.nmfs.noaa.gov/st1/recreational/overview/glossary.html.

National Marine Fisheries Service (NMFS). 2021e. *Socioeconomic Impacts of Atlantic Offshore Wind Development*. Available: https://www.fisheries.noaa.gov/resource/data/socioeconomic-impacts-atlantic-offshore-wind-development.

National Marine Fisheries Service (NMFS). 2022a. Commercial Fisheries Statistics. Available: https://www.fisheries.noaa.gov/national/sustainable-fisheries/commercial-fisheries-landings. Accessed: December 2022.

National Marine Fisheries Service (NMFS). 2022b. *Descriptions of Selected Fisher Landings and Estimates of Vessel Revenue from Areas: A Planning-level Assessment.* Ocean Wind (OCS-A 0498. November 28, 2022. Available: https://www.fisheries.noaa.gov/resource/data/socioeconomic-impacts-atlantic-offshore-wind-development. Accessed: January 26, 2023.

National Oceanic and Atmospheric Administration (NOAA) Fisheries Office of Science and Technology. 2021. NOAA Fisheries Social Indicators for Coastal Communities. (last updated August 19, 2021). Available: https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities. Accessed: December 11, 2021.

Nedwell, J., and D. Howell. 2004. A *Review of Offshore Windfarm Related Underwater Noise Sources*. Final Report submitted to COWRIE (Collective Offshore Wind Energy Research into the Environment). 57 pp.

New England Fishery Management Council (NEFMC). 2021. Management Plans. Available: https://www.nefmc.org/management-plans.

New Jersey Department of Environmental Protection (NJDEP). 2010. *Ocean/Wind Power Ecological Baseline Studies January 2008–December 2009*. Final Report. Prepared for New Jersey Department of Environmental Protection Office of Science by Geo-Marine, Inc., Plano, Texas. Available: https://tethys.pnnl.gov/sites/default/files/publications/Ocean-Wind-Power-Baseline-Volume1.pdf.

Northeast Ocean Data. 2023. Vessel Activity for Scallop, Surfclam, and Ocean Quahog (2015 to 2019). Available: https://www.northeastoceandata.org/data-explorer/?commercial-fishing|vessel-activity.

O'Farrell, S., I. Chollett, J. N. Sanchirico, and L. Perruso. 2019. Classifying fishing behavioral diversity using high-frequency movement data. *Proceedings of the National Academy of Sciences of the United States of America* 116(34):16811–16816.

Ocean Wind LLC (Ocean Wind). 2021. *Ocean Wind Offshore Wind Farm, Supplemental COP Information.* November.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Ocean Wind LLC (Ocean Wind). 2023. Citing National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries). No date. Commercial Fisheries Statistics. Office of Science and Technology. Available: https://www.st.nmfs.noaa.gov/commercial-fisheries/commercial landings/annual-landings-with-group-subtotals/index.

Ocean Wind LLC (Ocean Wind). 2023. Citing New Jersey Department of Fish and Wildlife (NJDFW). No date. Blue Claws: Crabbing in New Jersey. Available: https://www.njfishandwildlife.com/blueclaw.htm.

Papaioannou, E. A., R. L. Selden, J. Olson, B. J. McCay, M. L. Pinsky, and K. St. Martin. 2021. Not All Those Who Wander Are Lost – Responses of Fishers' Communities to Shifts in the Distribution and Abundance of Fish. *Frontiers in Marine Science* 8 (July):1–25.

Popper, A. N., and M. C. Hastings. 2009. The effects of anthropogenic sources of sound on fishes. *Journal of Fish Biology* 75:455–489.

Purser, J., and A. N. Radford. 2011. Acoustic noise induces attention shifts and reduces foraging performance in three-spined sticklebacks (*Gasterosteus aculeatus*). *PLOS ONE* 6(2):e17478.

Responsible Offshore Development Alliance (RODA). 2021. Comment letter RE: Notice of intent to prepare an Environmental Impact Statement for Ocean Wind, LLC's Proposed Wind Energy Facility Offshore New Jersey; Docket No. BOEM-2021-0652. Dated April 29, 2021.

Roberts, L. and M. Elliott. 2017. Good or bad vibrations? Impacts of anthropogenic vibration on the marine epibenthos. *Science of the Total Environment* 595:255–268.

Rogers, L. A., R. Griffin, T. Young, E. Fuller, K. S. Martin, and M. L. Pinsky. 2019. Shifting habitats expose fishing communities to risk under climate change. *Nature Climate Change* 9 (7):512–516.

Scyphers, S. B., J. S. Picou, and J. H. Grabowski. 2019. Chronic social disruption following a systemic fishery failure. *PNAS* 116(46):22912–22914. November 12.

Secor, D. H., F. Zhang, M. H. P. O'Brien, and M. Li. 2018. "Ocean Destratification and Fish Evacuation Caused by a Mid-Atlantic Tropical Storm." *ICES Journal of Marine Science* 76(2):573–584. Available: https://doi.org/10.1093/icesjms/fsx241.

Shelledy, K., B. Phelan, J. Stanley, and H. Soulen. 2018. *Could Offshore Wind Energy Construction Affect Black Sea Bass Behavior?*

Siddagangaiah, S., C.-F. Chen, W.-C. Hu, R. Danovaro, and N. Pieretti. 2021. Silent winters and rock-and-roll summers: The long-term effects of changing oceans on marine fish vocalization. *Ecological Indicators* 125:107456.

Silva, A., L. E. Gentile, M. J. Cutler, and L. L. Colburn. 2021. *A Comparison of Waves I (2012/2013) and II (2018/2019) of the Survey on the Socio-Economic Aspects of Commercial Fishing Crew in the Northeast U.S*. U.S. Department of Commerce – National Oceanic and Atmospheric Administration. NOAA Technical Memorandum NMFS-NE-274. October.

Skalski, J. R., W. H. Pearson, and C. I. Malme. 1992. Effects of Sound from a Geophysical Survey Device on Catch-Per-Unit-Effort in a Hook-and-Line Fishery for Rockfish (*Sebastes* spp.). *Canadian Journal of Fisheries and Aquatic Sciences* 49:1357–1365.

Slabbekoorn, H., N. Bouton, I. van Opzeeland, A. Coers, C. Ten Cate, and A. N. Popper. 2010. A noisy spring: the impact of globally rising underwater sound levels on fish. *Trends in Ecology and Evolution* 25:419–427.

Steinback, S., and A. Brinson. 2013. The Economics of the Recreational For-hire Fishing Industry in the Northeast United States. US Dept. Commerce, Northeast Fisheries Science Center, Ref Doc. 13-03; 49 p. Available: https://www.savingseafood.org/images/recreational_econ.pdf.

Stöber, U., and F. Thomsen. 2021. How could operational underwater sound from future offshore wind turbines impact marine life? *The Journal of the Acoustical Society of America* 149:1791–1795.

Taormina B., J. Bald, A. Want, G. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. A Review of Potential Impacts of Submarine Cables on the Marine Environment: Knowledge Gaps, Recommendations, and Future Directions. *Renewable and Sustainable Energy Reviews* 96:380–391.

ten Brink, T. S., and T. Dalton. 2018. Perceptions of Commercial and Recreational Fishers on the Potential Ecological Impacts of the Block Island Wind Farm (US). *Frontiers in Marine Science* 5 (November):1–13.

Thompson, C., T. Johnson, and S. Hanes. 2016. Vulnerability of Fishing Communities Undergoing Gentrification. *Journal of Rural Studies* 45:165–174.

Van Holt, T., W. Weisman, J. C. Johnson, S. Käll, J. Whalen, B. Spear, and P. Sousa. 2016. A Social Wellbeing in Fisheries Tool (SWIFT) to Help Improve Fisheries Performance. *MDPI – Sustainability.* Published 25 July 2016.

Wahlberg, M., and H. Westerberg. 2005. Hearing in fish and their reactions to sounds from offshore wind farms. *Marine Ecology Progress Series* 288:295–309.

Wilson, Alissa. 2022. New Jersey Department of Environmental Protection. Personal communication transmitted via cooperating agency review comments on the Ocean Wind 1 Preliminary Draft EIS.

Wysocki, L. E., S. Amoser, and F. Ladich. 2007. Diversity in ambient noise in European freshwater habitats: Noise levels, spectral profiles, and impact on fishes. *Journal of the Acoustical Society of America* 121(5):2559–2566.

B.2.3.10. Section 3.10, Cultural Resources

Bureau of Ocean Energy Management (BOEM). 2012. *Inventory and analysis of archaeological site occurrence on the Atlantic outer continental shelf*. Prepared by TRC Environmental Corporation for the U.S. Dept. of the Interior, Bureau of Ocean Energy, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2012-008. 324 pp.

Bureau of Ocean and Energy Management (BOEM). 2020. *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585*. May 27. Available: https://www.boem.gov/sites/default/files/documents/about-boem/Archaeology%20and%20Historic%20Property%20Guidelines.pdf. Accessed: November 7, 2021.

Bureau of Ocean Energy Management (BOEM). 2023. *Cumulative Historic Resources Visual Effects Analysis*. February.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

B.2.3.11. Section 3.11, Demographics, Employment, and Economics

American Wind Energy Association (AWEA). 2020. U.S. Offshore Wind Power Economic Impact Assessment. Accessed September 30, 2021. Available: https://supportoffshorewind.org/wp-content/uploads/sites/6/2020/03/AWEA_Offshore-Wind-Economic-ImpactsV3.pdf.

Bureau of Ocean Energy Management (BOEM). 2017. *Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic.* Volume I—Report Narrative. Available: https://espis.boem.gov/final%20reports/5580.pdf.

Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: https://www.boem.gov/vineyard-wind. Accessed: August 2021.

BVG Associates Limited. 2017. U.*S. Job Creation in Offshore Wind: A Report for the Roadmap Project for Multi-State Cooperation on Offshore Wind*. Final Report. Report No. 17-22. Report for New York State Energy Research and Development Authority (NYSERDA). Available: https://tethys.pnnl.gov/sites/default/files/publications/NYSERDA-Report-2017-OSW-Jobs.pdf. Accessed: October 7, 2021.

Cape May County. 2005. *Cape May County Comprehensive Plan 2005*. Available: https://capemaycountynj.gov/DocumentCenter/View/422/Comprehensive-Plan-2002-PDF?bidId.

Cape May County. 2013. Summer Population Estimate: 2013. Available: https://capemaycountynj.gov/DocumentCenter/View/441/Summer-Populations-2013-PDF.

E2. 2018. *Offshore Wind: Generating Economic Benefits on the East Coast*. Prepared by BW Research. August. Available: https://www.e2.org/wp-content/uploads/2018/08/E2-OCS-Report-Final-8.30.18.pdf.

Georgetown Economic Services, LLC. 2020. *Potential Employment Impact from Offshore Wind in the United States: The Mid-Atlantic and New England Region*. July 27, 2020.

Gould, Ross, and Eliot Cresswell. 2017. *New York State and the Jobs of Offshore Wind Energy*. Workforce Development Institute, New York.

Hoagland, P., T. M. Dalton, D. Jin, and J. B. Dwyer. 2015. An Approach for Analyzing the Spatial Welfare and Distributional Effects of Ocean Wind Power Siting: The Rhode Island/Massachusetts Area of Mutual Interest. *Marine Policy* (58):51–59. ISSN 0308-597X. Available: https://doi.org/10.1016/j.marpol.2015.04.010.

Moser, S. C., M. A. Davidson, P. Kirshen, P. Mulvaney, J. F. Murley, J. E. Neumann, L. Petes, and D. Reed. 2014. Ch. 25: *Coastal Zone Development and Ecosystems. Climate Change Impacts in the United States: The Third National Climate Assessment*. J. M. Melillo, Terese (T. C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 579–618. DOI:10.7930/J0MS3QNW. Available: https://nca2014.globalchange.gov/downloads/low/NCA3_Full_Report_25_Coasts_LowRes.pdf.

National Oceanic and Atmospheric Administration (NOAA). 2021a. Quick Report Tool of Socioeconomic Data: Ocean Economy (Employment data). Available: https://coast.noaa.gov/quickreport/#/index.html. Accessed: September 14, 2021.

National Oceanic and Atmospheric Administration (NOAA). 2021b. "NOAA Report on the U.S. Marine Economy." Charleston, SC: NOAA Office for Coastal Management. Available: http://coast.noaa.gov/digitalcoast/training/econreport.html.

National Renewable Energy Laboratory (NREL). 2022. U.S. Offshore Wind Workforce Assessment. Available: https://www.nrel.gov/docs/fy23osti/81798.pdf. Accessed: November 11, 2022.

New Jersey Office of the Governor. 2019. New Jersey Board of Public Utilities Awards Historic 1,100 MW Offshore Wind Solicitation to Ørsted's Ocean Wind Project. Available: https://www.nj.gov/governor/news/news/562019/20190621d.shtml. Accessed: November 11, 2021.

Ocean Wind LLC (Ocean Wind). 2021. Response to the Bureau of Ocean Energy Management, Request for Information #8, Ocean Wind Construction and Operations Plan. September 17.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Parsons, George, and Jeremy Firestone. 2018. *Atlantic Offshore Wind Energy Development: Values and Implications for Recreation and Tourism*. U.S. Department of the Interior, Bureau of Ocean Energy Management. Available: https://www.semanticscholar.org/paper/Atlantic-Offshore-Wind-Energy-Development%3A-Values-Parsons-Firestone/91b0ede146b8701cb44d72c58f09b29533df3cdf.

Parsons, G., J. Firestone, L. Yan, and J. Toussaint. 2020. The effect of offshore wind power projects on recreational beach use on the east coast of the United States: Evidence from contingent-behavior data. *Energy Policy* 144:111659.

The White House. 2021. FACT SHEET: Biden Administration Jumpstarts Offshore Wind Energy Projects to Create Jobs. Available: https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/29/fact-sheet-biden-administration-jumpstarts-offshore-wind-energy-projects-to-create-jobs/. Accessed: October 5, 2022.

U.S. Bureau of Economic Analysis. 2021. Current-Dollar Gross Domestic Product (GDP) by State and Region, 2020. Available: https://apps.bea.gov/itable/iTable.cfm?ReqID=70&step=1&acrdn=1. Accessed: September 30, 2021.

U.S. Bureau of Labor Statistics. 2019. Quarterly Census of Employment and wages. Available: https://data.bls.gov/cew/apps/data_views/data_views.htm#tab=Tables. Accessed: April 1, 2022.

U.S. Bureau of Labor Statistics. 2021. Local Area Unemployment Statistics. Available: https://www.bls.gov/lau/#tables. Accessed: September 13, 2021.

U.S. Census Bureau. 2021a. ACS People and Population Estimates. 2015–2019 American Community Survey 5-Year Estimates. Available: https://data.census.gov/cedsci/all?q=&t=Populations%20and%20People. Accessed: September 15, 2021.

U.S. Census Bureau. 2021b. ACS Income and Earnings Estimates. 2015–2019 American Community Survey 5-Year Estimates. Available: https://data.census.gov/cedsci/all?q=&t=Income%20and%20Earnings%3AIncome%20and%20Poverty. Accessed: September 15, 2021.

U.S. Census Bureau. 2021c. ACS Housing Estimates. 2015–2019 American Community Survey 5-Year Estimates. Available: https://data.census.gov/cedsci/advanced?t=Housing. Accessed: September 15, 2021.

U.S. Census Bureau. 2021d. ACS Industry Estimates. 2015–2019 American Community Survey 5-Year Estimates. Available: https://data.census.gov/cedsci/all?q=&t=Industry. Accessed: September 15, 2021.

U.S. Census Bureau. 2021e. ACS Employment and Industry Estimates. 2015–2019 American Community Survey 5-Year Estimates. Available: https://data.census.gov/cedsci/advanced?text=at-place%20employment&t=Industry. Accessed: September 15, 2021.

U.S. Census Bureau. 2021f. ACS Age and Sex Estimates. 2015-2019 American Community Survey 5-Year Estimates. Available: https://data.census.gov/cedsci/all?q=&t=Age%20and%20Sex. Accessed: September 15, 2021.

U.S. Census Bureau. 2022a. ACS Employment Status Estimates. 2015-2019 American Community Survey 5-Year Estimates. Available: https://data.census.gov/cedsci/table?q=s2301&g=0400000US34,45,51_0500000US34001,34009,34011,34015,34029,34033,45019,51710&tid=ACSST5Y2019.S2301. Accessed: March 23, 2022.

U.S. Census Bureau. 2022b. ACS Selected Economic Characteristics. 2015-2019 American Community Survey 5-Year Estimates. Available: https://data.census.gov/cedsci/table?q=dp03&g=0400000US34,45,51_0500000US34001,34009,34011,34015,34029,34033,45019,51710&tid=ACSDP5Y2019.DP03. Accessed: April 13, 2022.

University of Delaware. 2021. *Supply Chain Contracting Forecast for U.S. Offshore Wind Power*. Special Initiative on Offshore Wind. October 2021.

B.2.3.12. Section 3.12, Environmental Justice

Buonocore, Jonathan J., Patrick Luckow, Jeremy Fisher, Willett Kempton, and Jonathan L. Levy. 2016. "Health and Climate Benefits of Offshore Wind Facilities in the Mid-Atlantic United States." Environmental Research Letters 11 074019. July 14, 2016. Available: https://iopscience.iop.org/article/10.1088/1748-9326/11/7/074019/pdf. Accessed: November 2021.

Chesapeake Bay Program. 2021. "Indigenous Peoples of the Chesapeake." Available: https://www.chesapeakebay.net/discover/history/archaeology_and_native_americans. Accessed: October 21, 2021.

Council on Environmental Quality (CEQ). 1997. *Environmental Justice: Guidance Under the National Environmental Policy Act*. Available: https://www.epa.gov/sites/default/files/2015-02/documents/ej_guidance_nepa_ceq1297.pdf. Accessed: September 20, 2021.

Jimenez, R. 2021. Social Indicators of Gentrification Pressure: How Gentrification is Affecting 29 Fishing Communities in the Northeast United States. Available: https://storymaps.arcgis.com/stories/56781eb366f1485e8ffd7c96b16f133f?utm_medium=email&utm_source=govdelivery. Accessed: August 17, 2021.

Nansemond Indian Nation. No date. "History." Available: https://nansemond.org/history/. Accessed: October 21, 2021.

National Oceanic and Atmospheric Administration (NOAA). 2022a. *Social Indicators for Coastal Communities.* Available: https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-coastal-communities. Accessed: April 1, 2022.

National Oceanic and Atmospheric Administration (NOAA). 2022b. Marine Recreational Information Program. Available: https://www.st.nmfs.noaa.gov/msd/html/siteRegister.jsp. Accessed: September 26, 2022.

New Jersey Department of Environmental Protection (NJDEP). 2021. "Environmental Justice Overburdened Communities." Available: https://www.nj.gov/dep/ej/communities.html. Accessed: 2021-09-20.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Salem County. 2021. "Native Americans in Salem County." Available: https://visitsalemcountynj.com/about-salem-county/salem-county-history-project/native-americans-in-salem-county/. Accessed: October 21, 2021.

Silva, A., L. E. Gentile, M. J. Cutler, and L. L. Colburn. 2021. *Comparison of Waves I (2012/2013) and II (2018/2019) of the Survey on the Socio-Economic Aspects of Commercial Fishing Crew in the Northeast U.S.* NOAA Technical Memorandum NMFS-NE-274. Woods Hole, Massachusetts: National Marine Fisheries Service Northeast Fisheries Science Center. October.

South Carolina Commission for Minority Affairs. 2021. "South Carolina's Recognized Native American Indian Entities." Available: https://cma.sc.gov/minority-population-initiatives/native-american-affairs/south-carolinas-recognized-native-american-indian-entities. Accessed: October 21, 2021.

State of New Jersey. 2021. Department of State. "New Jersey Commission on American Indian Affairs." Available: https://www.nj.gov/state/njcaia.shtml. Accessed: October 21, 2021.

Thind, Maninder P.S., Christopher W. Tessum, Ines L. Azevedo, and Julian D. Marshall. 2019. Fine Particulate Air Pollution from Electricity Generation in the US: Health Impacts by Race, Income, and Geography. *Environmental Science & Technology*. DOI: 10.1021/acs.est.9b02527. Available: https://depts.washington.edu/airqual/Marshall_117.pdf. Accessed: November 7, 2021.

U.S. Census Bureau (USCB). 2000a. 2000 Decennial Census, Summary File 1. Table ID: P004. HISPANIC OR LATINO, AND NOT HISPANIC OR LATINO BY RACE [73]. Available: https://data.census.gov/cedsci/. Accessed: September 21, 2021.

U.S. Census Bureau (USCB). 2000b. 2000 Decennial Census, Summary File 3. Available: https://data.census.gov/cedsci/. Accessed: September 20, 2021.

U.S. Census Bureau (USCB). 2010. Table S1701: POVERTY STATUS IN THE PAST 12 MONTHS. 2010: ACS 1-year Estimates Subject Table. Available: https://data.census.gov/cedsci/.

U.S. Census Bureau (USCB). 2019. Table S1701: POVERTY STATUS IN THE PAST 12 MONTHS. 2019: ACS 5-year Estimates Subject Table. Available: https://data.census.gov/cedsci/.

U.S. Department of Transportation. 2021. National Transportation Statistics 2021. Available: https://www.bts.gov/sites/bts.dot.gov/files/2021-12/NTS-50th-complete-11-30-2021.pdf.

U.S. Environmental Protection Agency (USEPA). 2016. *Promising Practices for EJ Methodologies in NEPA Reviews: Report for the Federal Interagency Working Group on Environmental Justice & NEPA Committee*. Available: https://www.epa.gov/sites/default/files/2016-08/documents/nepa_promising_practices_document_2016.pdf. Accessed: September 20, 2021.

U.S. Environmental Protection Agency (USEPA). 2021a. EJSCREEN: Environmental Justice Screening and Mapping Tool. Available: https://www.epa.gov/ejscreen/download-ejscreen-data. Accessed: August 27, 2021.

U.S. Environmental Protection Agency (USEPA). 2021b. "Federally-Recognized Tribes in EPA's Mid-Atlantic Region." Available: https://www.epa.gov/tribal/federally-recognized-tribes-epas-mid-atlantic-region. Accessed: October 21, 2021.

Wang. Y., I. Kloog, B. A. Coull, A. Kosheleva, A. Zanobetti, and J. D. Schwartz. 2016. Estimating causal effects of long-term $PM_{2.5}$ exposure on mortality in New Jersey. *Environ Health Perspect.* 124:1182–1188. Available: https://ehp.niehs.nih.gov/doi/pdf/10.1289/ehp.1409671. Accessed: November 2021.

Wassamasaw Tribe of Varnertown Indians. 2016. "Community." Available: http://www.wassamasawtribe.com/community/. Accessed: October 21, 2021.

B.2.3.13. Section 3.13, Finfish, Invertebrates, and Essential Fish Habitat

Able, K. W., J. M. Smith, and J. F. Caridad. 2015. American eel supply to an estuary and its tributaries: spatial variation in Barnegat Bay, New Jersey. *Northeastern Naturalist* 22(1):53–68.

Adair, R. K. 1998. Extremely Low Frequency Electromagnetic Fields Do Not Interact Directly with DNA. *Bioelectromagnetics* 19:136–137. Available: http://dx.doi.org/10.1002/(SICI)1521-186X(1998)19:2<136::AID-BEM14>3.0.CO;2-O.

Aimon, C., S. D. Simpson, R. A. Hazelwood, R. Bruintjes, and M. A. Urbina. 2021. Anthropogenic underwater vibrations are sensed and stressful for the shore crab *Carcinus maenas. Environmental Pollution* 285:117148.

Albert, L., F. Deschamps, A. Jolivet, F. Olivier, L. Chauvaud, and S. Chauvaud. 2020. A current synthesis on the effects of electric and magnetic fields emitted by submarine power cables on invertebrates. *Marine Environmental Research* 159:104958. DOI: 10.1016/j.marenvres.2020.104958.

Almeda, R., E. Buskey, and C. J. Hyatt. 2014. Toxicity of dispersant Corexit 9500A and crude oil to marine microzooplankton. Ecotoxicology and Environmental Safety. DOI: 10.1016/ j.ecoserv2014.008.

Alzieu, C., J. Sanjuan, J. P. Deltreil, and B. Borel. 1986. Tin contamination in Aareachon Bay: effects on oyster shell anomalies. *Marine Pollution Bulletin* 17:494–498.

Atlantic States Marine Fisheries Commission (ASMFC). 1997. Atlantic Coastal Submerged Aquatic Vegetation: A Review of its Ecological Role, Anthropogenic Impacts, State Regulation, and Value to Atlantic Coastal Fish Stocks. ASMFC Habitat Management Series #1. Available: http://www.asmfc.org/uploads/file/sav.pdf#page=15.

Atlantic States Marine Fisheries Commission (ASMFC). 2012. *Habitat Addendum IV to Amendment I to the Interstate Fishery Management Plan for Atlantic Sturgeon*. 16 pp. Available: http://www.asmfc.org/uploads/file/sturgeonHabitatAddendumIV_Sept2012.pdf.

Atlantic States Marine Fisheries Commission (ASMFC). 2022. Stock Assessments. Available: http://www.asmfc.org/fisheries-science/stock-assessments#Documents. Accessed: April 2022.

Atlantic Sturgeon Status Review Team (ASSRT). 2007. Status Review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007. 174 pp.

Armstrong, J. D., D. C. Hunter, R. J. Fryer, P. Rycroft, and J. E. Orpwood. 2015. Behavioural responses of Atlantic salmon to mains frequency magnetic fields. *Scottish Marine and Freshwater Science* 6(9):67.

Bachman, M., and J. Coutour. 2022. Habitat Committee report. Staff presentation to the New England Fishery Management Council. June 30, 2022. Portland, Maine.

Balazik, M., K. Reine, A. Spells, C. Fredrickson, M. Fine, G. Garman, and S. McIninch. 2012. The Potential for Vessel Interactions with Adult Atlantic Sturgeon in the James River, Virginia. *North American Journal of Fisheries Management* 32(6):1062–1069.

Balazik, M., M. Barber, S. Altman, K. Reine, A. Katzenmeyer, A. Bunch, and G. Garman. 2020. Dredging activity and associated sound have negligible effects on adult Atlantic sturgeon migration to spawning habitat in a large coastal river. *PLOS ONE* 15(3):e0230029. DOI: 10.1371/journal.pone.0230029. PMID: 32142543; PMCID: PMC7059921.

Basov, B. M. 1999. Behavior of sterlet Acipenser ruthenus and Russian sturgeon A. gueldenstaedtii in low-frequency electric fields. *J Ichthyol* 39(9):782–787.

Beatrice Offshore Windfarm. 2016. *UXO Clearance Marine License* – Environmental Report. 89 pages. Available: https://marine.gov.scot/sites/default/files/00506118.pdf

Bejarano, A., J. Michel, J. Rowe, Z. Li, D. French McCay, and D. Schmidt Etkin. 2013. *Environmental Risks, Fate, and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-213. Available: https://espis.boem.gov/final%20reports/5330.pdf. Accessed: October 11, 2021.

Bellmann M. A., J. Brinkmann. A. May, T. Wendt, S. Gerlach, and P. Remmers. 2020. *Underwater noise during percussive pile driving: Influencing factors on pile-driving noise and technical possibilities to comply with noise mitigation values*. Supported by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (BMU)), FKZ UM16 881500. Commissioned and managed by the Federal Maritime and Hydrographic Agency (Bundesamt für Seeschifffahrt und Hydrographie (BSH)), Order No. 10036866. Edited by the itap GmbH. Available: https://www.itap.de/media/experience_report_underwater_era-report.pdf.

Bevelhimer, M. S., G. F. Cada, A. M. Fortner, P. E. Schweizer, and K. Riemer. 2013. Behavioral Responses of Representative Freshwater Fish Species to Electromagnetic Fields. *Transactions of the American Fisheries Society* 142(3):802–813.

Bilinski, J. 2021. *Review of the Impacts to Marine Fauna from Electromagnetic Frequencies (EMF) Generated by Energy Transmitted through Undersea Electric Transmission Cables*. NJDEP Division of Science and Research. Available: https://www.nj.gov/dep/offshorewind/docs/njdep-marine-fauna-review-impacts-from-emf.pdf. Accessed: April 2021.

Bologna, P. A. X., J. J. Gaynor, C. L. Barry, and D. J. Restaino. 2017. Top-down impacts of sea nettles (*Chrysaora quinquecirrha*) on pelagic community structure in Barnegat Bay, New Jersey, U.S.A. In: Buchanan, G. A., T. J. Belton, and B. Paudel (eds.), A Comprehensive Assessment of Barnegat Bay–Little Egg Harbor, New Jersey. *Journal of Coastal Research*, Special Issue No. 78:193–204. Coconut Creek (Florida), ISSN 0749-0208.

Bricelj, V. M., J. N. Kraeuter, and G. Flimlin. 2017. Status and trends of hard clam, *Mercenaria mercenaria*, populations in a coastal lagoon ecosystem, Barnegat Bay–Little Egg Harbor, New Jersey. In: Buchanan, G. A., T. J. Belton, and B. Paudel (eds.), A Comprehensive Assessment of Barnegat Bay–Little Egg Harbor, New Jersey. *Journal of Coastal Research*, Special Issue No. 78:193–204. Coconut Creek (Florida), ISSN 0749-0208.

Brouard, D., C. Harvey, D. Goulet, T. Nguyen, R. Champagne, and P. Dubs. 1996. Technical Notes: Evaluation of potential effects of stray voltage generated by alternating current on hatchery raised rainbow trout. *The Progressive Fish-culturist* 58:47–51.

Brown, J. J., and G. W. Murphy. 2010. Atlantic Sturgeon Vessel-Strike Mortalities in the Delaware Estuary. *Fisheries* 35:72–83.

Bruchet, A., et al. 2014. “Leaching of bisphenol A and F from new and old epoxy coatings: Laboratory and field studies.” *Water Science and Technology: Water Supply* 14.3:383–389.

Bureau of Ocean Energy Management (BOEM). 2012. *Effects of Noise on Fish, Fisheries, and Invertebrates in the U.S. Atlantic and Arctic from Energy Industry Sound-Generating Activities*. Prepared under BOEM contract M11PC00031.

Bureau of Ocean Energy Management (BOEM). 2014. *Finding of No Significant Impact: Proposed Geological and Geophysical Activities in the Atlantic OCS to Identify Sand Resources and Borrow Areas*. Available: https://www.boem.gov/sites/default/files/non-energy-minerals/Finding-of-No-Significant-Impact.pdf.

Bureau of Ocean Energy Management (BOEM). 2015. *Virginia Offshore Wind Technology Advancement Project on the Atlantic Outer Continental Shelf Offshore Virginia: Revised Environmental Assessment*. OCS EIS/EA BOEM 2015-031. Available: https://www.boem.gov/VOWTAP-EA/. Accessed: October 11, 2021.

Bureau of Ocean Energy Management (BOEM). 2018. *Electromagnetic Field (EMF) Impacts on Elasmobranch (Shark, Rays, and Skates) and American Lobster Movement and Migration from Direct Current Cables*. OCS Study BOEM 2018-003. Prepared by Hutchison, Z. L., P. Sigray, H. He, A. B. Gill, J. King, and C. Gibson. Available: https://espis.boem.gov/final%20reports/5659.pdf.

Bureau of Ocean Energy Management (BOEM). 2021. *South Fork Wind Farm and South Fork Export Cable Project Biological Assessment*. Prepared for the National Marine Fisheries Service. U.S. Department of the Interior Bureau of Ocean Energy Management, Office of Renewable Energy Programs. Washington, D.C.

Bureau of Ocean Energy Management (BOEM). 2022a. *Ocean Wind Offshore Wind Farm Essential Fish Habitat Assessment for National Marine Fisheries Service.* [Month].

Bureau of Ocean Energy Management. 2022b. *Ocean Wind Offshore Wind Farm Biological Assessment for National Marine Fisheries Service.* [Month].

Byrnes, M. R., R. M. Hammer, B. A. Vittor, J. S. Ramsey, D. B. Snyder, J. D. Wood, K. F. Bosma, T. D. Thibaut, and N. W. Phillips. 2000. *Environmental Survey of Potential Sand Resource Sites: Offshore New Jersey*. U.S. Dept. of the Interior, Minerals Management Service, International Activities and Marine Minerals Division (INTERMAR). Herndon, VA. OCS Report MMS 2000-052. Vol I: 380 pp., Vol II: Appendices 291.

Cameron, I. L., K. R. Hunter, and W. D. Winters. 1985. Retardation of embryogenesis by extremely low frequency 60 Hz electromagnetic fields. *Physiol. Chem. Phys. Med*. NMR 17:135–138.

Carpenter, J. R., L. Merckelbach, U. Callies, S. Clark, L. Gaslikova, and B. Baschek. 2016. Potential impacts of offshore wind farms on North Sea stratification. *PLOS ONE* 11(8):e0160830. DOI:10.1371/journal.pone.0160830.

Carreno, A., and J. Lloret. 2021. Environmental impacts of increasing leisure boating activity in Mediterranean coastal waters. *Ocean and Coastal Management* 209:1. Available: https://www.sciencedirect.com/science/article/pii/S0964569121001770#:~:text=Major%20or%20high%20impacts%20include%20anchoring%20impacts%20on,waters%2C%20air%20pollution%2C%20and%20fuel%20and%20oil%20leaks. Accessed: April 2022.

Cazenave, P. W., R. Torres, and J. I. Allen. 2016. Unstructured grid modelling of offshore wind farm impacts on seasonally stratified shelf seas. *Progress in Oceanography* 145:25–41.

Chen, Z. 2018. *Dynamics and spatio-temporal variability of the mid-Atlantic bight cold pool*. Ph.D. dissertation, Rutgers, The State University of New Jersey, Oceanography. Available: https://rucore.libraries.rutgers.edu/rutgers-lib/58963/PDF/1/play/. Accessed: November 2021.

Christiansen, Nils, Ute Daewel, Bughsin Djath, and Corinna Schrum. 2022. Emergence of Large-Scale Hydrodynamic Structures Due to Atmospheric Offshore Wind Farm Wakes. *Frontiers in Marine Science* 9. DOI: 10.3389/fmars.2022.818501.

Collins, M. R., T. I. J. Smith, W. C. Post, and O. Pashuk. 2000. Habitat utilization and biological characteristics of adult Atlantic sturgeon in two South Carolina rivers. *Transactions of the American Fisheries Society* 129:982–988.

Copping, A., N. Sather, L. Hanna, J. Whiting, G. Zydlewski, G. Staines, A. Gill, I. Hutchison, A. O'Hagan, T. Simas, J. Bald, C. Sparling, J. Wood, and E. Masden. 2016. *Annex IV 2016 State of the Science Report: Environmental Effects of Marine Renewable Energy Development Around the World*.

CSA Ocean Sciences, Inc. and Exponent. 2019. *Evaluation of Potential EMF Effects on Fish Species of Commercial or Recreational Fishing Importance in Southern New England*. OCS Study BOEM 2019-049. Sterling, Virginia: U.S. Department of the Interior, Bureau of Ocean Energy Management.

Cutter, G. R. Jr., and R. J. Diaz. 2000. Benthic resource mapping and resource evaluation of potential sand mining areas, 1998–1999. In *Environmental survey of potential sand resource sites offshore Delaware and Maryland*, part 1. Final Report to the Minerals Management Service, International Activities and Marine Minerals Division, contract 1435-01-97-CT-30853, Herdon, Virginia. Available: http://gomr.mms.gov/homepg/espis/espismaster.asp?appid=-1. Accessed: November 2021.

Dadswell, M. J. 2006. A review of the status of Atlantic sturgeon in Canada, with comparisons to populations in the United States and Europe. *Fisheries* 31:218–229.

Daewel, U., N. Akhtar, N. Christiansen, et al. 2022. Offshore wind farms are projected to impact primary production and bottom water deoxygenation in the North Sea. *Commun Earth Environ* 3:292. https://doi.org/10.1038/s43247-022-00625-0.

Dannheim, J., L. Bergström, S. N. R. Birchenough, R. Brzana, A. R. Boon, J. W. P. Coolen, J. Dauvin, I. De Mesel, J. Derweduwen, A. B. Gill, Z. L. Hutchison, A. C. Jackson, U. Janas, G. Martin, A. Raoux, J. Reubens, L. Rostin, J. Vanaverbeke, T. A. Wilding, D. Wilhelmsson, and S. Degraer. 2020. Benthic effects of offshore renewables: identification of knowledge gaps and urgently needed research. *ICES Journal of Marine Science* 77:1092–1108.

Dawe, E., L. Hendrickson, E. Colbourne, K. Drinkwater, and M. Showell. 2007. Ocean climate effects on the relative abundance of short-finned (*Illex illecebrosus*) and long-finned (*Loligo ealeii*) squid in the northwest Atlantic Ocean. *Fisheries Oceanography* 16(4):303–316.

Degraer, S., D. Carey, J. Coolen, Z. Hutchison, F. Kerckhof, B. Rumes, and J. Vanaverbeke. 2020. Offshore Wind Farm Artificial Reefs Affect Ecosystem Structure and Functioning: A Synthesis. *Oceanography* 33(4):48–57.

Donahue, M. J., A. Nichols, C. A. Santamaria, P. E. League-Pike, C. J. Krediet, K. O. Perez, and M. J. Shulman. 2009. Predation risk, prey abundance, and the vertical distribution of three Brachyuran crabs on Gulf of Maine shores. *Journal of Crustacean Biology* 29:523–531.

Dorrell, R. M., C. J. Lloyd, B. J. Lincoln, T. P. Rippeth, J. R. Taylor, C. P. Caulfield, J. Sharples, J. A. Polton, B. D. Scannell, D. M. Greaves, R. A. Hall, and J. H. Simpson. 2022. Anthropogenic mixing in seasonally stratified shelf seas by offshore wind farm infrastructure. *Frontiers in Marine Science* 9:830927.

Duarte, C. M. 2002. The future of seagrass meadows. *Environmental Conservation* 29:192–206.

Dunton, K. J., A. Jordaan, K. A. McKown, D. O. Conover, and M. G. Frisk. 2010. Abundance and distribution of Atlantic sturgeon (Acipenser oxyrinchus) within the Northwest Atlantic Ocean, determined from five fishery-independent surveys. *Fisheries Bulletin* 108:450–465.

Ecosystem Assessment Program. 2012. *Ecosystem Status Report for the Northeast Shelf Large Marine Ecosystem - 2011*. Northeast Fisheries Science Center Reference Document 12-07.

Erickson, D. L., A. Kahnle, M. J. Millard, E. A. Mora, M. Bryja, A. Higgs, J. Mohler, M. DuFour, G. Kenney, J. Sweka, and E. K. Pikitch. 2011. Use of pop-up satellite archival tags to identify oceanic-migratory patterns for adult Atlantic Sturgeon, Acipenser oxyrinchus Mitchell, 1815. *Journal of Applied Ichthyology* 27:356–365.

Essink, K. 1999. "Ecological Effects of Dumping of Dredged Sediments; Options for Management." *Journal of Coastal Conservation* 5:69–80.

Eyler, S., M. Mangold, and S. Minkkien. 2009. *Atlantic coast sturgeon tagging database*. U.S. Fish and Wildlife Service, Maryland Fishery Resources Office, Summary Report, Annapolis, Maryland.

Fantasia, R. L., V. M. Bricelj, and L. Ren. 2017. Phytoplankton community structure based on photopigment markers in a mid-Atlantic U.S. coastal lagoon: Significance for hard-clam production. In: Buchanan, G. A., T. J. Belton, and B. Paudel (eds.), A Comprehensive Assessment of Barnegat Bay–Little Egg Harbor, New Jersey. *Journal of Coastal Research*, Special Issue No. 78:193–204. Coconut Creek (Florida), ISSN 0749-0208.

Farr, E. R., M. R. Johnson, M. W. Nelson, J. A. Hare, W. E. Morrison, M. D. Lettrich, B. Vogt, C. Meaney, U. A. Howson, P. J. Auster, and F. A. Borsuk. 2021. *An assessment of marine, estuarine, and riverine habitat vulnerability to climate change in the Northeast U.S*. *PLOS ONE* 9; 16(12): e0260654.

Field, C. B., M. J. Behrenfeld, J. T. Randerson, and P. Falkowski. 1998. Primary production to the biosphere: Integrating terrestrial and oceanic components. *Science* 281:237–240.

Fisheries Hydroacoustic Working Group (FHWG). 2008. *Agreement in principle for interim criteria for injury to fish from pile driving activities*. Prepared for FHWG Agreement in Principle Technical/Policy Meeting, June 11, 2008, Vancouver, WA. Available: http://www.dot.ca.gov/hq/env/bio/files/fhwgcriteria_agree.pdf.

Floeter, J., J. E. E. van Beusekom, D. Auch, U. Callies, J. Carpenter, T. Dudeck, S. Eberle, A. Eckhardt, D. Gloe, K. Hänselmann, M. Hufnagl, S. Janßen, H. Lenhart, K. O. Möller, R. P. North, T. Pohlmann, R. Riethmüller, S. Schulz, S. Spreizenbarth, A. Temming, B. Walter, O. Zielinski, and C. Möllmann. 2017. Pelagic effects of offshore wind farm foundations in the stratified North Sea. *Progress in Oceanography* 156:154–173.

Fromentin, J. M. and B. Planque. 1996. *Calanus* and environment in the eastern North Atlantic. II. Influence of the North Atlantic Oscillation on *C. finmarchicus* and *C. helgolandicus*. *Marine Ecology Progress Series* 134:111–118.

Gill, A. B. and M. Desender. 2020. Risk to Animals from Electromagnetic Fields Emitted by Electric Cables and Marine Renewable Energy Devices. In A.E. Copping and L.G. Hemery (Eds.), *OES-Environmental 2020 State of the Science Report: Environmental Effects of Marine Renewable Energy Development Around the World.* Report for Ocean Energy Systems (OES). (pp. 86–103). DOI:10.2172/1633088.

Greene, J. K., M. G. Anderson, J. Odell, and N. Steinberg, eds. 2010. *The Northwest Atlantic Marine Ecoregional Assessment: Species, Habitats and Ecosystems*. Phase One. The Nature Conservancy, Eastern U.S. Division, Boston, MA. Available: https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/Documents/namera-phase1-fullreport.pdf.

Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, and E. Estela-Gomez. 2017. *Habitat Mapping and Assessment of Northeast Wind Energy Areas*. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088. November 1, 2013. Prepared in Collaboration between Gulf of Maine Research Institute and University of Maine.

Hannay, D. E., and M. Zykov. 2022. *Underwater Acoustic Modeling of Detonations of Unexploded Ordnance (UXO) for Orsted Wind Farm Construction, US East Coast*. Document 02604, Version 4.4. Report by JASCO Applied Sciences for Ørsted.

Hare, J. A., W. E. Morrison, M. W. Nelson, M. M. Stachura, E. J. Teeters, R. B. Griffis, M. A. Alexander, J. D. Scott, L. Alade, R. J. Bell, A. S. Chute, K. L. Curti, T. H. Curtis, and C. A. Griswold. 2016. A vulnerability assessment of fish and invertebrates to climate change on the northeast U.S. Continental Shelf. *PLOS ONE* 11(2):e0146756.

Hastings, M. C., and A. N. Popper. 2005. *Effects of Sound on Fish*. California Department of Transportation Contract 43A0139.

Hawkins, Anthony D. 2020. The Potential Impact of Offshore Wind Farms on Fishes and Invertebrates. *Ad Oceanogr & Marine Biol.* 2(3). AOMB.MS.ID.000539. DOI: 10.33552/AOMB.2020.02.000539.

Hemery, L. G. 2020. Changes in Benthic and Pelagic Habitats Caused by Marine Renewable Energy Devises. *OES – Environmental 2020 State of the Science Report: Environmental Effects of Marine Renewable Energy Development Around the World*. Report for Ocean Energy Systems (OES).

Howson, U. A., G. A. Buchanan, and J. A. Nickels. 2017. Zooplankton community dynamics in a western mid-Atlantic lagoonal estuary. In: Buchanan, G. A., T. J. Belton, and B. Paudel (eds.), A Comprehensive Assessment of Barnegat Bay–Little Egg Harbor, New Jersey. *Journal of Coastal Research*, Special Issue No. 78:193–204. Coconut Creek (Florida), ISSN 0749-0208.

Hutchison, Z. L., A. B. Gill, P. Sigray, H. He, and J. W. King. 2020. Anthropogenic electromagnetic fields (EMF) influence the behaviour of bottom-dwelling marine species. *Scientific Reports* 10(1):4219. DOI:10.1038/s41598-020-60793-x. Available: https://www.nature.com/articles/s41598-020-60793-x.pdf.

Ingram, E. C., R. M. Cerrato, K. J. Dunton, and M. G. Frisk. 2019. Endangered Atlantic sturgeon in the New York Wind Energy Area: Implications for future development in an offshore wind energy site. *Scientific Reports*,(2019)9:12432. Available: https://doi.org/10.1038/s41598-019-48818-6.

Inspire Environmental (Inspire). 2021. *Ocean Wind Offshore Wind Farm Benthic Habitat Mapping and Benthic Assessment to Support Essential Fish Habitat Consultation*. Prepared for HDR Engineering. June 2021. Ocean Wind COP Appendix E Supplement.

Inspire Environmental (Inspire). 2022a. *Ocean Wind Offshore Wind Farm Benthic Habitat Mapping and Benthic Assessment to Support Essential Fish Habitat Consultation*. Prepared for HDR Engineering.

Inspire Environmental (Inspire). 2022b. *Ocean Wind Offshore Wind Farm Submerged Aquatic Vegetation Monitoring Plan*. Prepared for Ocean Wind, Ørsted US. Submitted by Inspire Environmental. June 15, 2022.

Jakubowska, M., B. Urban-Malinga, Z. Otremba, and E. Andrulewicz. 2019. Effect of low frequency electromagnetic field on the behavior and bioenergetics of the polychaete Hediste diversicolor. *Marine environmental research* 150:104766.

Jézéquel, Y, I. T. Jones, J. Bonnel, L. Chauvaud, J. Atema, and T. A. Mooney. 2021. Sound detection by the American lobster (*Homarus americanus*). *Journal of Experimental Biology* 224, jeb240747. DOI:10.1242/jeb.240747.

Jivoff, P. R., L. Moritzen, J. Kels, J. McCarthy, A. Young, A. Barton, P. Ferdinando, F. Pandolfo, and C. Tighe. 2017. The relative importance of the Sedge Island Marine Conservation Zone for adult blue crabs in Barnegat Bay, New Jersey. In: Buchanan, G. A., T. J. Belton, and B. Paudel (eds.), A Comprehensive Assessment of Barnegat Bay–Little Egg Harbor, New Jersey. *Journal of Coastal Research*, Special Issue No. 78:193–204. Coconut Creek (Florida), ISSN 0749-0208.

Johnson, J. H., D. S. Dropkin, B. E. Warkentine, J. W. Rachlin, and W. D. Andrews. 1997. Food habits of Atlantic sturgeon off the Central New Jersey Coast. *Trans. Am. Fish. Soc.* 126:166–170.

Jones, I. T., J. A. Stanley, and T. A. Mooney. 2020. Impulsive pile driving noise elicits alarm responses in squid (*Doryteuthis pealeii*). *Marine Pollution Bulletin* 150:110792. doi.org/10.1016/j.marpolbul.2019.110792.

Jones, I. T., J. F. Peyla, H. Clark, Z. Song, J. A. Stanley, and T. A. Mooney. 2021. Changes in Feeding Behavior of Longfin Squid (*Doryteuthis pealeii*) during Laboratory Exposure to Pile Driving Noise. *Marine Environmental Research* 165:105250.

Kahnle, A. W., K. A. Hattala, and K. McKown. 2007. Status of Atlantic Sturgeon of the Hudson River estuary, New York, USA. Page 347–363 in J. Munro, D. Hatin, J. E. Hightower, K. McKown, K. J. Sulak, A. W. Kahnle, and F. Caron, editors. *Anadromous sturgeons: habitats, threats, and management*. American Fisheries Society, Symposium 56, Bethesda, Maryland. Available: https://hero.epa.gov/hero/index.cfm/reference/details/reference_id/7253621.

Katranitsas, A., J. Castritsi-Catharios, and G. Persoone. 2003. “The effects of a copper-based antifouling paint on mortality and enzymatic activity of a non-target marine organism.” *Marine Pollution Bulletin* 46.11:1491–1494.

Kirchgeorg, T., I. Weinberg, M. Hornig, R. Baier, M. J. Schmid, and B. Brockmeyer. 2018. Emissions from corrosion protection systems of offshore wind farms: evaluation of the potential impact on the marine environment. *Marine Pollution Bulletin* 136:257–268.

Küsel, E. T., M. J. Weirathmueller, K. E. Zammit, S. J. Welch, K. E. Limpert, and D. G. Zeddies. 2021. *Underwater Acoustic and Exposure Modeling*. Document 02109, Version 1.0 DRAFT. Technical report by JASCO Applied Sciences for Ocean Wind LLC.

Küsel, E. T., M. J. Weirathmueller, K. E. Zammit, S. J. Welch, K. E. Limpert, and D. G. Zeddies. 2022. *Underwater Acoustic and Exposure Modeling*. Document 02109, Version 1.0 DRAFT. Technical report by JASCO Applied Sciences for Ocean Wind LLC.

Lefcheck, J. S., B. B. Hughes, A. J. Johnson, B. W. Pfirrmann, D. B. Rasher, A. R. Smyth, B. L. Williams, M. W. Beck, and R. J. Orth. 2019. Are coastal habitats important nurseries? A meta-analysis. *Conservation Letters* 12(4):e12645.

Lentz, S. J. 2017. Seasonal warming of the Middle Atlantic Bight Cold Pool. *Journal of Geophysical Research – Ocean* 122(2):941–954.

Li, X., L. Chi, X. Chen, Y. Ren, and S. Lehner. 2014. SAR observation and numerical modeling of tidal current wakes at the East China Sea offshore wind farm. *Journal of Geophysical Research*: Oceans 119(8):4958–4971.

Lloret, J., A. Turiel, J. Sole, E. Berdalet, A. Sabates, A. Olivares, J. Gili, J. Vila-Subiros, and R. Sarda. 2022. Unravelling the ecological impacts of large-scale offshore wind farms in the Mediterranean Sea. *Science of the Total Environment* 824:153803.

Long Island Sound Study. 2003. *Sound Health. A Report on Status and Trends in the Health of the Long Island Sound*. Available: https://longislandsoundstudy.net/wp-content/uploads/2010/03/sound_health_2003.pdf.

Longcore, T. and C. Rich. 2004. Ecological light pollution. *Front Ecol Environ*. 2:191–198.

Love, M. S., M. M. Nishimoto, S. Clark, M. McCrea, and A. S. Bull. 2017. Assessing potential impacts of energized submarine power cables on crab harvests. *Continental Shelf Research* 151:23–29. DOI:10.1016/j.csr .2017.10.002.

Lovell, J. M., M. M. Findlay, R. M. Moate, J. R. Nedwell, and M. A. Pegg. 2005. The inner ear morphology and hearing abilities of the paddlefish (*Polyodon spathula*) and the lake sturgeon (*Acipenser fulvescens*). *Comparative Biochemistry and Physiology Part A: Molecular Integrative Physiology* 142:286–289.

Lyon, Stuart B., R. Bingham, and Douglas J. Mills. 2017. "Advances in corrosion protection by organic coatings: What we know and what we would like to know." *Progress in Organic Coatings* 102:2–7.

Marchesan, M., M. Spoto, L. Verginella, and E. A. Ferrero. 2005. Behavioral effects of artificial light on fish species of commercial interest. *Fisheries Research* 73 (1 and 2):171–185.

Mesel, I. D., F. Kerckhof, A. Norro, and B. Rumes. 2015. Succession and seasonal dynamics of the epifauna community on offshore wind farm foundations and their role as stepping stones for non-indigenous species. *Hydrobiologia* 756(1). DOI: 10.1007/210750-014-2157-1.

Meyer, M., R. R. Fay, and A. N. Popper. 2010. Frequency tuning and intensity coding of sound in the auditory periphery of the lake sturgeon, Acipenser fulvescens. *Journal of Experimental Biology* 213:1567–1578.

Michel, P., and B. Averty. 1999. Contamination of French coastal waters by organotins compounds: 1997 update. *Marine Pollution Bulletin* 38:268–275.

Mid-Atlantic Fishery Management Council (MAFMC). 2016. *Regional use of the habitat area of particular concern (HAPC) designation*. Prepared by the Fisheries Leadership & Sustainability Forum for the MAFMC. 1–43.

Mid-Atlantic Fishery Management Council (MAFMC). 2020. *Fishery Management Plans and Amendments*. Available: https://www.mafmc.org/fishery-management-plans. Accessed October 4, 2021.

Miller, T., and G. Shepard. 2011. *Summary of Discard Estimates for Atlantic sturgeon, August 19, 2011*. Northeast Fisheries Science Center, Population Dynamics Branch.

Minerals Management Service (MMS). 2009. Cape Wind Farm Energy Project Final Environmental Impact Statement. OCS Publication No. 2008-040. U.S. Department of the Interior, Bureau of Ocean Energy Management. Available: https://www.boem.gov/sites/default/files/uploadedFiles/BOEM/Renewable_Energy_Program/Studies/Cape%20Wind%20Energy%20Project%20FEIS.pdf. Accessed: September 2021.

Mooney T. A., M. H. Andersson, and J. Stanley. 2020. Acoustic impacts of offshore wind energy on fishery resources. An evolving source and varied effects across a wind farm's lifetime. *Oceanography* 33:82–95. Available: https://doi.org/10.5670/oceanog.2020.408.

Morley, J. W., R. L. Selden, R. J. Latour, T. L. Frolicher, R. J. Seagraves, and M. L. Pinsky. 2018. *Projecting shifts in thermal habitat for 686 species on the North American continental shelf*. *PLOS ONE* 13(5): e0196127.

Moser, M. L., and S. W. Ross. 1995. Habitat use and movements of shortnose and Atlantic sturgeons in the lower Cape Fear River, North Carolina. *Transactions of the American Fisheries Society* 24:225–234.

Moser, M. L., M. Bain, M. R. Collins, N. Haley, B. Kynard, J. C. O'Herron II, G. Rogers, and T. S. Squiers. 2000. *A Protocol for Use of Shortnose and Atlantic Sturgeons*. NOAA Technical Memorandum-NMFS-PR-18.

Nascimento, J. A., M. Dahl, D. Deyanova, L. D. Lyimo, H. M. Bik, T. Schuelke, T. J. Pereira, M. Bjork, S. Creer, and M. Gullstrom. 2019. Above-below surface interactions mediate effects of seagrass disturbance on meiobenthic diversity, nematode and polychate trophic structure. *Communications Biology* 2:362.

National Marine Fisheries Service (NMFS). 2014. *Draft Programmatic Environmental Assessment for Fisheries Research Conducted and Funded by the Northeast Fisheries Science Center*. December 2014. Prepared by URS Group, Anchorage, Alaska. 657 pp.

National Marine Fisheries Service (NMFS). 2016. Endangered Species Act Section 7 Consultation on the Continued Prosecution of Fisheries and Ecosystem Research Conducted and Funded by the Northeast Fisheries Science Center and the Issuance of a Letter of Authorization under the Marine Mammal Protection Act for the Incidental Take of Marine Mammals Pursuant to those Research Activities PCTS ID: NER-2015-12532. Available: https://media.fisheries.noaa.gov/dam-migration/nefsc_rule2016_biop.pdf.

National Marine Fisheries Service (NMFS). 2021a. Endangered Species Act Section 7 Consultation: Biological Opinion for Construction, Operation, Maintenance, and Decommissioning of the South Fork Offshore Energy Project. October. Available: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/SF-BiOp-Final_0.pdf.

National Marine Fisheries Service (NMFS). 2021b. *Atlantic HMS Fishery Management Plans and Amendments*. Last updated by Office of Sustainable Fisheries on 08/19/2021. Available: https://www.fisheries.noaa.gov/atlantic-highly-migratory-species/atlantic-hms-fishery-management-plans-and-amendments. Accessed: November 23, 2021.

National Marine Fisheries Service (NMFS). 2021c. Essential Fish Habitat Mapper: New England / Mid-Atlantic. Available: https://www.habitat.noaa.gov/apps/efhmapper/?page=page_3. Accessed: November 23, 2021.

National Marine Fisheries Service (NMFS). 2021d. Letter of Concurrence for Offshore Wind Site Assessment Programmatic ESA Consultation. Silver Springs, Maryland. Available: https://media.fisheries.noaa.gov/2021-12/OSW%20surveys_NLAA%20programmatic_rev%201_2021-09-30%20%28508%29.pdf.

National Marine Fisheries Service (NMFS). 2022. Chesapeake Bay Distinct Population Segment of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) 5-Year Review: Summary and Evaluation. Silver Spring, Maryland: National Marine Fisheries Service. Available: https://media.fisheries.noaa.gov/2022-02/Atlantic%20sturgeon%20CB%205-year%20review_FINAL%20SIGNED.pdf.

National Oceanic and Atmospheric Administration (NOAA). 2004. *Essential Fish Habitat Consultation Guidance*, Version 1.1. Silver Spring, Maryland: National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Habitat Conservation. Available: https://repository.library.noaa.gov/view/noaa/4187. Accessed: October 4, 2021.

National Oceanic and Atmospheric Administration (NOAA). 2009. *Ecosystem status report for the Northeast U.S. Continental Shelf large marine ecosystem*. Available: https://www.st.nmfs.noaa.gov/Assets/iea/documents/NEFSC-ESR-2009.pdf. Accessed: November 2021.

National Oceanic and Atmospheric Administration (NOAA). 2013. *Guide to Essential Fish Habitat Designations in the Northeastern United States*. Available: https://www.nrc.gov/docs/ML1409/ML14090A199.pdf. Accessed: October 5, 2021.

National Oceanic and Atmospheric Administration (NOAA). 2019. *U.S. National Bycatch Report First Edition Update 3*. Available: https://media.fisheries.noaa.gov/dam-migration/nbr_update_3.pdf. Accessed: October 2021.

National Oceanic and Atmospheric Administration (NOAA). 2021. *2021 State of the Ecosystem Mid-Atlantic*. April 2021.

National Oceanic and Atmospheric Administration (NOAA). 2022. *2021 State of the Ecosystem Mid-Atlantic*. April 2022.

Nedwell, J. R., A. W. H. Turnpenny, J. Lovell, S. J. Parvin, R. Workman, J. A. L. Spings, and D. Howell. 2007. *A validation of the dBht as a measure of the behavioural and auditory effects of underwater noise*. Subacoustech Report No. 534R1231. Available: https://tethys.pnnl.gov/sites/default/files/publications/Nedwell-et-al-2007.pdf. Accessed: April 2022.

New England Fishery Management Council (NEFMC). 2021. *Fishery Management Plans and Amendments*. Available: https://www.nefmc.org/management-plans. Accessed: October 4, 2021.

New England Fishery Management Council (NEFMC). 2022a. Southern New England Habitat Area of Particular Concern Framework, Northeast Multispecies Fishery Management Plan Framework Adjustment 64, Atlantic Sea Scallop Fishery Management Plan Framework Adjustment 35, Monkfish Fishery Management Plan Framework Adjustment 14, Northeast Skate Complex Fishery Management Plan Framework Adjustment 10, Atlantic Herring Fishery Management Plan Framework Adjustment 10. Draft. Prepared by the New England Fishery Management Council and the National Marine Fisheries Service. March.

New England Fishery Management Council (NEFMC). 2022b. Council Approves HAPC for Southern New England; Previews Northeast Regional Habitat Assessment Data Explorer. Press Release. 18 July. Press contact: J. Plante/ jplante@nefmc.org.

New Jersey Department of Environmental Protection (NJDEP). 2010. *Ocean/Wind Power Ecological Baseline Studies. January 2008–December 2009*. Volume I: Overview Summary, and Application; Volume IV: Fish and Fisheries Studies. Final Report. Prepared by Geo-Marine Inc.

New York State Energy Research and Development Authority (NYSERDA). 2019. *Geotechnical and Geophysical Desktop Study to Support Offshore Wind Energy Development in the New York Bight*. April. NYSERDA Report 19-19. Available: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Offshore-Wind/19-19-Geotechnical-and-Geophysical-Desktop-Study-to-Support-Offshore-Wind-Energy-Development.pdf.

Newcombe, C. P. and D. D. Macdonald. 1991. Effects of Suspended Sediments on Aquatic Ecosystems. *North American Journal of Fisheries Management* 11:72–82.

Normandeau Associates, Inc., Exponent, Inc., T. Tricas, and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species*. Final Report. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09. Available: https://espis.boem.gov/final%20reports/5115.pdf. Accessed: October 11, 2021.

Northeast Fisheries Science Center (NEFSC). 2021. Stock Assessment Review Index (SARI) Search. Available: https://apps-nefsc.fisheries.noaa.gov/saw/reviews_report_options.php.

Northeast Regional Planning Body. 2016. *Northeast Ocean Plan: Full Plan*. Available: https://neoceanplanning.org/wp-content/uploads/2018/01/Northeast-Ocean-Plan_Full.pdf. Accessed: September 2021.

Novak, A., A. Carlson, C. Wheeler, G. wippelhauser, and J. Sulikowski. 2017. Critical Foraging Habitat of Atlantic Sturgeon Based on Feeding Habits, Prey Distribution, and Movement Patterns in the Saco River Estuary, Maine. *Transactions of the American Fisheries Society* 146(2):308–317. Available: https://doi.org/10.1080/00028487.2016.1264472.

Ocean Wind LLC (Ocean Wind). 2022. *Ocean Wind Submerged Aquatic Vegetation Preliminary Mitigation Plan*. December 2022.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Orpwood, J. E., R. J. Fryer, P. Rycroft, and J. D. Armstrong. 2015. Effects of AC magnetic fields (MFs) on swimming activity in European eels Anguilla anguilla. *Scottish Marine and Freshwater Science* 6(8):1–22.

Orr, M. A. 2016. *The Potential Impacts of Submarine Power Cables on Benthic Elasmobranchs*. PhD Thesis. Institute of Marine Science. University of Auckland, New Zealand. 180 pages.

Pederson, J. R. Bullock, J. T. Carlton, J. Dijkstra, N. Dobroski, P. Dyrynda, R. Fishers, L. Harris, N. Hobbs, G. Lambert, E. Lazo-Wasem, A. Mathieson, M. Miglietta, J. Smith, J. Smith III, and M. Tyrrell. 2005. Marine invaders in the northeast: Rapid assessment survey of non-native and naïve marine species of floating dock communities. Publication No. 05-03. Cambridge: Massachusetts Institute of Technology, Sea Grand College Program, 40 pp.

Pickens, B. A., J. C. Taylor, and D. Hansen. 2020. Volume 1: Fish habitat associations and the potential effects of dredging on the Atlantic and Gulf of Mexico Outer Continental Shelf, literature synthesis and gap analysis. In: Pickens, B. A., and J. C. Taylor, editors. *Regional Essential Fish Habitat geospatial assessment and framework for offshore sand features*. Sterling (VA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2020-002 and NOAA NCCOS Technical Memorandum 270. Available: https://doi.org/10.25923/akzd-8556.

Plante, J. 2022. Council Approves HAPC for Southern New England; Previews Northeast Regional Habitat Assessment Data Explorer. Press release. New England Fishery Management Council. July 18. Available: https://www.nefmc.org/news. Accessed: July 25, 2022.

Popper, A., L. Hiice-Dunton, E. Jenkins, et al. 2022. Offshore wind energy development: Research priorities for sound and vibration effects on fishes and aquatic invertebrates. *The Journal of the Acoustical Society of America* 151:205–215. Available: https://doi.org/10.1121/10.0009237.

Popper, A. N., A. D. Hawkins, R. R. Fay, D. Mann, S. Bartol, T. H. Carlson, S. Coombs, W. T. Ellison, R. Gentry, M. B. Halvorsen, S. Løkkeborg, P. Rogers, B. L. Southall, D. G. Zeddies, and W. N. Tavolga. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles*. A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.

Popper, A. N., and A. Hawkins. 2018. The importance of particle motion to fishes and invertebrates. *Journal of the Acoustical Society of America* 143:470.

Popper, A. N., M. Salmon, and K. W. Horch. 2001. Acoustic detection and communication by decapod crustaceans. *Journal of Comparative Physiology* 187:83–89.

Price, Seth J., and Rita B. Figueira. 2017. “Corrosion protection systems and fatigue corrosion in offshore wind structures: current status and future perspectives.” *Coatings* 7.2:25.

Radford, A. N., E. Kerridge, and S. D. Simpson. 2014. Acoustic communication in a noisy world: can fish compete with anthropogenic noise? *Behavioral Ecology* 25(5):1022–1030.

Rajasärkkä, Johanna, et al. 2016. “Drinking water contaminants from epoxy resin-coated pipes: A field study.” *Water research* 103:133–140.

Reine, K., D. Dickerson, and D. Clarke. 1998. “Environmental windows associated with dredging operations in aquatic systems.” Technical Note DOER-E2, U.S. Army Corps of Engineers, Environmental Laboratory, Vicksburg, MS. Available: https://erdc-library.erdc.dren.mil/jspui/bitstream/11681/8735/1/TN-DOER-E2.pdf.

Rezek, R., B. Furman, R. Jung, M. Hall, and S. Bell. 2019. Long-term performance of seagrass restoration projects in Florida, USA. *Nature* 9:15514. https://doi.org/10.1038/s41598-019-51856-9.

Rheuban, J. E., M. T. Kavanaugh, and S. C. Doney. 2017. Implications of future northwest Atlantic bottom temperatures on the American Lobster (*Homarus americanus*) fishery. *Journal of Geophysical Research: Oceans* 122: 9387–9398. DOI: 10.1002/2017JC012949.

Rico-Martinez, R., T. W. Snell, and T. L. Shearer. 2013. Synergistic toxicity of Macondo crude oil and dispersant Corexit 9500A to the Brachionus plicatilis species complex (Rotifera). *Environmental Pollution* 173:5–10.

Roberts, L., and M. Elliott. 2017. Good or bad vibrations? Impacts of anthropogenic vibration on the marine epibenthos. *Science of the Total Environment* 595 (2017):255–268.

Russel, D. J. F., S. M. J. M. Brasseur, D. Thompson, G. D. Hastie, V. M. Janik, G. Aarts, B. T. McClintock, J. Matthiopoulos, S. E. W. Moss, and B. McConnel. 2014. Marine mammals trace anthropogenic structures at sea. *Current Biology* 24(14):R638–R639.

Rutecki, D., T. Dellapenna, E. Nestler, F. Scharf, J. Rooker, C. Glass, and A. Pembroke. 2014. *Understanding the Habitat Value and Function of Shoals and Shoal Complexes to Fish and Fisheries on the Atlantic and Gulf of Mexico Outer Continental Shelf*. Literature Synthesis and Gap Analysis. Prepared for the U.S. Department of the Interior, Bureau of Ocean Energy Management. Contract # M12PS00009. BOEM 2015-012.

Savarese, M. No date. Habitats: Southwest Florida Shelf Coastal Marine Ecosystem – Habitats; Inshore Flats. Available: https://www.aoml.noaa.gov/ocd/ocdweb/docs/MARES/MARES_SWFS_ICEM_20130913_Appendix_InshoreFlats.pdf. Accessed: April 2022.

Schultz, I. R., D. L. Woodruff, K. E. Marshall, W. J. Pratt, and G. Roesijadi. 2010. *Effects of Electromagnetic Fields on Fish and Invertebrates*. Task 2.1. 3: Effects on Aquatic Organisms-Fiscal Year 2010 Progress Report- Environmental Effects of Marine and Hydrokinetic Energy (No. PNNL-19883 Final). Pacific Northwest National Laboratory, Richland, Washington.

Schultze, L. K. P., L. M. Merckelbach, J. Horstmann, S. Raasch, and J. R. Carpenter. 2020. Increased mixing and turbulence in the wake of offshore wind farm foundations. *Journal of Geophysical Research: Oceans* 125(8).

Siddagangaiah, S., C.-F. Chen, W.-C. Hu, and N. Pieretti. 2021. Impact of pile-driving and offshore windfarm operational noise on fish chorusing. *Remote Sensing in Ecology and Conservation* 8:1–16. Available: https://www.researchgate.net/publication/353472018_Impact_of_pile-driving_and_offshore_windfarm_operational_noise_on_fish_chorusing.

Sigray, P., and M. H. Andersson. 2011. Particle motion measured at an operational wind turbine in relation to hearing sensitivity in fish. *J Acoust Soc Am.* 130(1):200–207. DOI: 10.1121/1.3596464. PMID: 21786890.

Slacum, H. W., W. H. Burton, E. T. Methratta, E. D. Weber, R. J. Llanso, and J. Dew-Baxter. 2010. Assemblage Structure in Shoal and Flat-Bottom Habitats on the Inner Continental Shelf of the Middle Atlantic Bight, USA. *Marine and Coastal Fisheries* 2:1, 277–298. DOI: 10.1577/C09-012.1.

Smith, T. I. J. 1985. The fishery, biology, and management of Atlantic sturgeon, *Acipenser oxyrhynchus*, in North America. *Environ. Biol. Fishes* 14:61–72.

Snyder, D. B., W. H. Bailey, K. Palmquist, B. R. T. Cotts, and K. R. Olsen. 2019. *Evaluation of Potential EMF Effects on Fish Species of Commercial or Recreational Fishing Importance in Southern New England.* BOEM report 2019-049. Available: https://espis.boem.gov/final%20reports/BOEM_2019-049.pdf.

Solé, M., S. De Vreese, J. Fortuño, M. Schaar, A. Sánchez, and M. André. 2022. Commercial cuttlefish exposed to noise from offshore windmill construction show short-range acoustic trauma. *Environmental Pollution* 312:119853. ISSN 0269-7491. Available: https://doi.org/10.1016/j.envpol.2022.119853.

Stanley, J. A., P. E. Caiger, B. Phelan, K. Shelledy, T. A. Mooney, and S. M. Van Parijs. 2020. Ontogenetic variation in the auditory sensitivity of black sea bass (Centropristis striata) and the implications of anthropogenic sound on behavior and communication. *The Journal of Experimental Biology* 223.

Staudinger, M. D., H. Goyert, J. J. Suca, K. Coleman, L. Welch, J. K. Llopiz, D. Wiley, I. Altman, A. Applegate, P. Auster, H. Baumann, J. Beaty, D. Boelke, L. Kaufman, P. Loring, J. Moxley, S. Paton, K. Powers, D. Richardson, J. Robbins, J. Runge, B. Smith, C. Spiegel, and H. Steinmetz. 2020. The role of sand lances (*Ammodytes* sp.) in the Northwest Atlantic Ecosystem: A synthesis of current knowledge with implications for conservation and management. *Fish and Fisheries* 21(3):522–556. DOI 10.1111/faf.12445.

Stein, B. S., K. D. Friedland, and M. R. Sutherland. 2004. Atlantic sturgeon marine distribution and habitat use along the northeastern coast of the United States. *Transactions of the American Fisheries Society* 133:527–537.

Stöber, U., and F. Thomsen. 2021. How could operational underwater sound from future offshore wind turbines impact marine life? *Journal of the Acoustical Society of America* 149(3):1791–1795.

Tagliabue, A., L. Kwiatkowski, L. Bopp, M. Butenschon, W. Cheung, M. Lengiagne, and J. Vialard. 2021. Persistent uncertainties in ocean net primary production climate change projections at regional scales raise challenges for assessing impacts on ecosystem services. *Frontiers in Climate* 3:738224.

Tamsett, A., K. B. Heinonen, and P. J. Auster. 2010. *Dynamics of hard substratum communities inside and outside of a fisheries habitat closed area in Stellwagen Bank National Marine Sanctuary (Gulf of Maine, NW Atlantic)*. DU.S. Department of Commerce, NOAA. Available: https://nmssanctuaries.blob.core.windows.net/sanctuaries-prod/media/archive/science/conservation/pdfs/tamsett.pdf. Accessed: April 2022.

Taormina B., J. Bald, A. Want, G. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. "A Review of Potential Impacts of Submarine Cables on the Marine Environment: Knowledge Gaps, Recommendations, and Future Directions." *Renewable and Sustainable Energy Reviews* 96:380–391. Available: https://hal.archives-ouvertes.fr/hal-02405630/document. Accessed: October 11, 2021.

Taylor, A. H. and J. A. Stephens. 1998. The North Atlantic Oscillation and the latitude of the Gulf Stream. *Tellus* 50A:134–142.

Thomsen, F., A. B. Gill, M. Kosecka, M. Andersson, M. André, S. Degraer, T. Folegot, J. Gabriel, A. Judd, T. Neumann, A. Norro, D. Risch, P. Sigray, D. Wood, and B. Wilson. 2015. "MaRVEN—Environmental Impacts of Noise, Vibrations and Electromagnetic Emissions from Marine Renewable Energy." DOI:10.2777/272281. Luxembourg: Publications Office of the European Union, 2015. Available: https://www.researchgate.net/publication/301296662_MaRVEN_-_Environmental_Impacts_of_Noise_Vibrations_and_Electromagnetic_Emissions_from_Marine_Renewable_Energy. Accessed: October 11, 2021.

Tougaard, J., L. Hermannsen, and P. T. Madsen. 2020. How loud is the underwater noise from operating offshore wind turbines? *Journal of the Acoustical Society of America* 148(5):2885–2893.

U.S. Army Corps of Engineers (USACE). 2015. New York and New Jersey Harbor Deepening Project. *Dredge Plume Dynamics in New York/New Jersey Harbor*. Summary of Suspended Sediment Plume Surveys Performed During Harbor Deepening. April 2015. New York.

U.S. Army Corps of Engineers (USACE). 2020. *South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States*. 646 pp. Available: https://media.fisheries.noaa.gov/dam-migration/sarbo_acoustic_revision_6-2020-opinion_final.pdf. Accessed: November 16, 2021.

U.S. Environmental Protection Agency (USEPA). 2003. Brayton Point Station Fact Sheet: Final National Pollutant Discharge Elimination System (NPDES) Permit.

U.S. Offshore Wind Synthesis of Environmental Effects Research (SEER). 2022. *Benthic Disturbance from Offshore Wind Foundations, Anchors, and Cables*.

Valenti, J. L., T. M. Grothues, and K. W. Able. 2017. Estuarine Fish Communities along a Spatial Urbanization Gradient. *Journal of Coastal Research* SI 78:254–268.

van Berkel, J., H. Burchard, A. Christensen, L. O. Mortensen, O. S. Petersen, and F. Thomsen. 2020. The effects of offshore wind farms on hydrodynamics and implications for fishes. *Oceanography* 33(4):108–117.

van der Molen, J., H. C. M. Smith, P. Lepper, S. Limpenny, and J. Rees. 2014. Predicting the large-scale consequences of offshore wind turbine array development on a North Sea ecosystem. *Cont. Shelf Res.* 85:60–72.

Vanhellemont, Q., and K. Ruddick. 2014. Turbid wakes associated with offshore wind turbines observed with Landsat 8. *Remote Sensing of Environment* 145:105–115.

Vasslides, J. M. 2007. *Fish assemblages and habitat use across a shoreface sand ridge in southern New Jersey*. M.S. thesis, 106 pp. Rutgers University, New Brunswick, NJ.

Vasslides, J. M., and K. W. Able. 2008. Importance of shoreface sand ridges as habitat for fishes off the northeast coast of the United States. *Fish Bull.* 106:93–107.

Virginia Institute of Marine Science (VIMS). 2000. *Environmental survey of potential sand resources sites, offshore Delaware and Maryland*: Final Report. OCS Study 2000-05. Virginia Institute of Marine Science, College of William and Mary. Available: http://dx.doi.org/doi:10.21220/m2-mtx7-mn42.

Washington State Department of Transportation (WSDOT). 2020. Construction noise impact assessment. In *Biological Assessment Preparation Manual.* August. Available: https://wsdot.wa.gov/sites/default/files/2021-10/Env-FW-BA_ManualCH07.pdf.

Waycott, M., C. M. Duarte, T. J. B. Carruthers, R. J. Orth, W. C. Dennison, S. Olyarnik, A. Calladine, J. W. Fourqurean, K. L Heck, Jr., R. Hughes, G. A. Kendrick, W. J. Kenworthy, F. T. Short, and S. L. Williams. 2022. Accelerated loss of seagrasses across the globe threatens coastal ecosystems. *PNAS* 106(30):12377–12381.

Weilgart, L. 2018. *The Impact of Ocean Noise Pollution on Fish and Invertebrates*. Oceancare and Dalhousie University. Available: https://www.oceancare.org/wp-content/uploads/2017/10/OceanNoise_FishInvertebrates_May2018.pdf. Accessed: September 2021.

Wilber, D. H., and D. G. Clarke. 2007. Defining and Assessing Benthic Recovery Following Dredging and Dredged Material Disposal. Presentation from the 2007 WODCON XVIII Conference in Lake Buena Vista, FL. Available: https://www.westerndredging.org/phocadownload/ConferencePresentations/2007_WODA_Florida/Session3D-EnvironmentalAspectsOfDredging/3%20-%20Wilber%20-%20Defining%20Assessing%20Benthic%20Recovery%20Following%20Dredged%20Material%20Disposal.pdf. Accessed: October 11, 2021.

Woodruff, D. L., I. R. Schultz, K. E. Marshall, J. A. Ward, and V. Cullinan. 2012. *Effects of Electromagnetic Fields on Fish and Invertebrates*. Task 2.1.3: Effects on Aquatic Organisms – Fiscal Year 2011 Progress Report. PNNL-20813, Pacific Northwest National Laboratory, Richland, Washington.

Woodruff, D. L., I. R. Schultz, K. E. Marshall, J. A. Ward, and V. I. Cullinan. 2013. *Effects of Electromagnetic Fields on Fish and Invertebrates*: Task 2.1. 3: Effects on Aquatic Organisms-Fiscal Year 2011 Progress Report- Environmental Effects of Marine and Hydrokinetic Energy (No. PNNL-20813 Final). Pacific Northwest National Laboratory, Richland, Washington.

Zhang, X., H. Guo, J. Chen, K. Xu, J. Lin, and S. Zhang. 2021. Potential effects of underwater noise from wind turbines on the marbled rockfish (Sebasticus marmoratus). *J Appl Ichthyol.* 2021(00):1–9. https://doi.org/10.1111/jai.14198.

B.2.3.14. Section 3.14, Land Use and Coastal Infrastructure

Atlantic City. 2006. Atlantic City Municipal Zoning Boundaries, Atlantic City, NJ. Available: https://www.atlantic-county.org/gis/pdfs/SmartGrowth/ATC_ZoneBuildout.pdf.

Atlantic Shores Offshore Wind (Atlantic Shores). 2021. *Construction and Operations Plan, Atlantic Shores Offshore Wind*. Volume I. September. Available: https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-construction-and-operations-plan.

Borough of Paulsboro. 2010. Zoning Map, Borough of Paulsboro. Available: https://taxmaps.info/docs/zoning/0814_Zoning_Map.pdf.

City of Charleston. 2012. Interactive Zoning Map. Available: https://gis.charleston-sc.gov/interactive/zoning/.

City of Elizabeth. 2000. Zone Map. Available: https://elizabethnj.org/DocumentCenter/View/1351/Elizabeth-Zoning-Map-?bidId=.

City of Norfolk. 2021. Zoning Ordinance. Available: https://www.norfolk.gov/DocumentCenter/View/35581/Adopted-Zoning-Ordinance?bidId=.

Kleiner, A. 2021. Island Beach State Park and Sea Level Rise. December 19. Available: https://storymaps.arcgis.com/stories/b02bf0aaef62464ab17b5d8621d7497c. Accessed: October 7, 2022.

New Jersey Department of Environmental Protection (NJDEP). 2015. Land Use/Land Cover 2012 Update (Generalized), Edition 20150217 (Land_lu_2012_gen). Available: https://njdep.maps.arcgis.com/apps/webappviewer/index.html?id=02251e521d97454aabadfd8cf168e44d. Accessed: March 30, 2022.

New Jersey Pinelands Commission. 2021. Pinelands Interactive Map. Available: https://njpines.maps.arcgis.com/apps/webappviewer/index.html?id=28ef313eb49f4e8f96ca249d871d06fe. Accessed: October 18, 2021.

New Jersey Pinelands Commission. 2022. Pinelands Comprehensive Management Plan. Available: https://www.nj.gov/pinelands/cmp/CMP.pdf.

New Jersey Wind Port. 2021. "About the New Jersey Wind Port." Available: https://nj.gov/windport/about/index.shtml. Accessed: July 16, 2021.

Ocean City. 2014. Zoning Map. Available: https://imageserv11.team-logic.com/mediaLibrary/242/Zoning_Map_eff_10_15_14.pdf.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Parsons, George, and Jeremy Firestone. 2018. *Atlantic Offshore Wind Energy Development: Values and Implications for Recreation and Tourism*. U.S. Department of the Interior, Bureau of Ocean Energy Management. Available: https://www.semanticscholar.org/paper/Atlantic-Offshore-Wind-Energy-Development%3A-Values-Parsons-Firestone/91b0ede146b8701cb44d72c58f09b29533df3cdf.

State of New Jersey. 2020. Governor Murphy Announces $250 Million Total Investment in State-of-the-Art Manufacturing Facility to Build Wind Turbine Components to Serve Entire U.S. Offshore Wind Industry. December 21. Available: https://www.nj.gov/governor/news/news/562020/20201222a.shtml. Accessed: July 22, 2021.

Township of Lacey. 2009. Part II, General Legislation / Zoning: Article IX: Zone Regulations. § 335-65.1 M-100 Industrial Zone. Added 12-22-2009 by Ord. No. 2009-23. Available: https://ecode360.com/14253903.

Township of Lower Alloways Creek. 2014. Zoning Map. Available: https://www.lowerallowayscreek-nj.gov/sites/g/files/vyhlif3381/f/uploads/p_28000-28499_28081.00_cadd_dwg_28081.00_zoning_map_color_1.pdf.

Township of Upper. 2020. Chapter 20: Zoning. § 20-4.22 “WTC” Waterfront Town Center. Added 5-26-2020 by Ord. No. 005-2020. Available: https://ecode360.com/36660451.

Township of Upper. 2021. Zoning Map. Available: https://uppertownship.com/wp-content/uploads/2021/08/UT-Zoning-Map-2021.pdf.

U.S. Army Corps of Engineers (USACE). No date. Charleston District. Charleston Harbor Post 45 Overview. Available: https://www.sac.usace.army.mil/Missions/Civil-Works/Charleston-Harbor-Post-45/

U.S. Army Corps of Engineers (USACE). 2021. *Newark Bay, New Jersey Federal Navigation Project Maintenance Dredging*. Public Notice No. Newark Bay, NJ FY21. May.

U.S. Fish and Wildlife Service (USFWS). 2014. John H. Chafee Coastal Barrier Resources System, Island Beach Unit NJ-05P. Available: https://www.fws.gov/cbra/maps/effective/34-006A.pdf. Accessed: March 30, 2022.

U.S. Fish and Wildlife Service (USFWS). 2021. FWS National Realty Approved Acquisition Boundaries. Available: https://www.arcgis.com/home/item.html?id=dae48a3dcd654e7ea09d386cae052eab. Accessed: March 30, 2022.

U.S. National Park Service (USNPS). 2016. Great Egg Harbor River. Available: https://www.nps.gov/greg/index.htm. Accessed: April 1, 2022.

Virginia Port Authority. 2021. Dredging to Make Virginia the East Coast’s Deepest Port is Underway. Port of Virginia Press Release. Contact Joseph D. Harris. Available: https://www.portofvirginia.com/who-we-are/newsroom/dredging-to-make-virginia-the-east-coasts-deepest-port-is-underway/. Accessed: July 22, 2021.

B.2.3.15. Section 3.15, Marine Mammals

Allen, M. C., A. J. Read, J. Gaudet, and L. S. Sayigh. 2001. Fine-scale habitat selection of foraging bottlenose dolphins Tursiops truncates near Clearwater, Florida. *Marine Ecology Progress Series* 222:253–264.

Arveson, P., and D. Vendittis. 2000. Radiated noise characteristics of a modern cargo ship. *Journal of the Acoustical Society of America* 2000(107):118–129.

Atlantic Shores Offshore Wind (Atlantic Shores). 2021. *Construction and Operations Plan, Atlantic Shores Offshore Wind*. Volume I. September. Available: https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-construction-and-operations-plan.

Atlantic Shores Offshore Wind (Atlantic Shores). 2022. *Application for Marine Mammal Protection Act (MMPA) Rulemaking and Letter of Authorization*. September.

Au, W. W. L., and M. C. Hastings. 2008. *Principles of Marine Bioacoustics*. New York: Springer.

Austin, M. E., D. E. Hannay, and K. C. Bröker. 2018. Acoustic characterization of exploration drilling in the Chukchi and Beaufort seas. *Journal of the Acoustical Society of America* 144:115–123. DOI: 10.1121/1.5044417.

Azzara, A., W. M. von Zharen, and J. Newcomb. 2013. Mixed-methods analytic approach for determining potential impacts of vessel noise on sperm whale click behavior. *Journal of the Acoustical Society of America*. 2013(136):4566–4574. October.

Balcomb, K. C., and D. E. Claridge. 2001. A mass stranding of cetaceans caused by naval sonar in the Bahamas. *Bahamas J. Sci.* 8:1–12.

Baulch, S., and C. Perry. 2014. Evaluating the impacts of marine debris on cetaceans. *Marine Pollution Bulletin* 80:210–221.

Bejarano, Adriana, Jacqueline Michel, Jill Rowe, Zhengkai Li, Deborah French McCay, and Dagmar Schmidt Etkin. 2013. *Environmental Risks, Fate, and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf*. OCS Study BOEM 2013-213.

Bellmann, M. A., A. May, T. Wendt, S. Gerlach, P. Remmers, and J. Brinkmann. 2020. *Underwater noise during percussive pile driving: Influencing factors on pile-driving noise and technical possibilities to comply with noise mitigation values*. Supported by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (BMU)), FKZ UM16 881500. Commissioned and managed by the Federal Maritime and Hydrographic Agency (Bundesamt für Seeschifffahrt und Hydrographie (BSH)), Order No. 10036866. Edited by the itap GmbH. Available: https://www.itap.de/media/experience_report_underwater_era-report.pdf.

Benhemma-Le Gall, A., I. Graham, N. Merchant, and P. Thompson. 2021. Broad-Scale Responses of Harbor Porpoises to Pile-Driving and Vessel Activities During Offshore Windfarm Construction. *Frontiers in Marine Science* 8:664724. DOI: 10.3389/fmars.2021.664724.

Benjamins, S., V. Harnois, H. C. M. Smith, L. Johanning, L. Greenhill, C. Carter, and B. Wilson. 2014. *Understanding the potential for marine megafauna entanglement risk from marine renewable energy developments*. Scottish Natural Heritage Commissioned Report No. 791.

Bilinski, J. 2021. *Review of the Impacts to Marine Fauna from Electromagnetic Frequencies (EMF) Generated by Energy Transmitted through Undersea Electric Transmission Cables*. NJDEP Division of Science and Research. Available: https://www.nj.gov/dep/offshorewind/docs/njdep-marine-fauna-review-impacts-from-emf.pdf.

Blackwell, S. B., C. S. Nations, A. M. Thode, M. E. Kauffman, A. S. Conrad, R. G. Norman, and K. H. Kim. 2017. Effects of tones associated with drilling activities on bowhead whale calling rates. *PLOS ONE* 12(11):e0188459. Available: https://doi.org/10.1371/journal.pone.0188459.

Blackwell, S. B., C. S. Nations, T. L. McDonald, C. R. Greene, A. M. Thode, M. Guerra, and A. M. Macrander. 2013. Effects of airgun sounds on bowhead whale calling rates in the Alaskan Beaufort Sea. *Marine Mammal Science* 29(4):E342-E365. DOI:10.1111/mms.12001.

Blackwell, S. B., C. S. Nations, T. L. McDonald, A. M. Thode, D. Mathias, K. H. Kim, C. R. Greene, and A. M. Macrander. 2015. Effects of Airgun Sounds on Bowhead Whale Calling Rates: Evidence for Two Behavioral Thresholds. *PLOS ONE* 10(6): e0125720. DOI:10.1371/journal.pone.0125720.

Brandt, M. J., A. Diederichs, K. Betke, and G. Nehls. 2011. Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea. *Marine Ecology Progress Series* 421(2011):205–216.

Brandt, M. J., A. Dragon, A. Diederichs, A. Schubert, V. Kosarev, G. Nehls, V. Wahl, A. Michalik, A. Braasch, C. Hinz, C. Ketzer, D. Todeskino, M. Gauger, M. Laczny, and W. Piper. 2016. *Effects of offshore pile driving on harbour porpoise abundance in the German Bight: Assessment of Noise Effects Final Report.* Prepared for Offshore Forum Windenergie. June.

Branstetter, B. K, V. F. Bowman, and D. S. Houser. 2018. Effects of Vibratory pile driver noise on echolocation and vigilance in bottlenose dolphins (Tursiops truncates). *The Journal of Acoustical Society of America* 143:429. DOI: 10.1121/1.5021555.

Broström, G. 2008. On the influence of large wind farms on the upper ocean circulation. *J. Mar. Syst.* 74:585–591. DOI: 10.1016/j.jmarsys.2008.05.001.

Brown, D. M., P. L. Sieswerda, and E. C. M. Parsons. 2019. Potential encounters between humpback whales (*Megaptera novaeangliae*) and vessels in the New York Bight apex, USA. *Marine Policy* 106:103527.

Browne, M. A., A. J. Underwood, M. G. Chapman, R. Williams, R. C. Thompson, and J. A. van Franeker. 2015. "Linking Effects of Anthropogenic Debris to Ecological Impacts." *Proceedings of the Royal Society* B 282:20142929.

Bryant P. J., C. M. Lafferty, and S. K. Lafferty. 1984. 15 - Reoccupation of Laguna Guerrero Negro, Baja California, Mexico, by Gray Whales. In: Mary Lou Jones, Steven L. Swartz, Stephen Leatherwood (eds.), *The Gray Whale: Eschrichtius Robustus*, Academic Press. Pages 375–387. Available: https://doi.org/10.1016/B978-0-08-092372-7.50021-2.

Buckstaff, Kara. 2004. Effects of Watercraft Noise on the Acoustic Behavior of Bottlenose Dolphins, Tursiops Truncatus, in Sarasota Bay, Florida. *Marine Mammal Science* 20(4):709–725.

Bureau of Ocean Energy Management (BOEM). 2014. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts: Revised Environmental Assessment*. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2014-603. Available: https://www.boem.gov/sites/default/files/renewable-energyprogram/State-Activities/MA/Revised-MA-EA-2014.pdf.

Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement, Volume 1*. OCS EIS/EA BOEM 2021-0012.

Bureau of Ocean Energy Management (BOEM). 2021b. *South Fork Wind Farm and South Fork Export Cable Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2020-057. Available: https://www.boem.gov/renewable-energy/state-activities/sfwf-feis.

Bureau of Ocean Energy Management (BOEM). 2021c. *Project Design Criteria and Best Management Practices for Protected Species Associated with Offshore Wind Data Collection*. Revised November 22, 2021. Available: https://www.boem.gov/sites/default/files/documents//PDCs%20and%20BMPs%20for%20Atlantic%20Data%20Collection%2011222021.pdf.

Carpenter, J. R., L. Merckelbach, U. Callies, S. Clark, L. Gaslikova, and B. Baschek. 2016. *Potential Impacts of Offshore Wind Farms on North Sea Stratification*. *PLOS ONE* 11:e0160830. DOI: 10.1371/journal.pone.016 0830.

Castellote, M., C. W. Clark, and M. O. Lammers. 2012. Acoustic and behavioral changes by fin whales (Balaenoptera physalus) in response to shipping and airgun noise. *Biological Conservation* 157:115–122. DOI: 10.1016/j.biocon.2011.12.021.

Cerchio, S., S. Strindberg, T. Collins, C. Bennett, and H. Rosenbaum. 2014. Seismic surveys negatively affect humpback whale singing activity off northern Angola. *PLOS ONE* 9(3):e86464. DOI:10.1371/journal.pone.0086464.

Cholewiak, D., A. I. DeAngelis, D. Palka, P. J. Corkeron, and S. M. Van Parijs. 2017. "Beaked Whales Demonstrate a Marked Acoustic Response to the Use of Shipboard Echosounders." *R Soc Open Sci* 4(12):170940. DOI: https://doi.org/10.1098/rsos.170940. Available: https://www.ncbi.nlm.nih.gov/pubmed/29308236.

Christiansen, N., U. Daewel, B. Djath, and C. Schrum. 2022. Emergence of Large-Scale Hydrodynamic Structures Due to Atmospheric Offshore Wind Farm Wakes. *Front. Mar. Sci.* 9:818501. DOI: 10.3389/fmars.2022.818501.

Clark, C. W., W. T. Ellison, B. L. Southall, L. Hatch, S. M. Van Parijs, A. Frankel, and D. Ponirakis. 2009. Acoustic masking in marine ecosystems: institutions, analysis, and implication. *Marine Ecology Progress Series* 395:201–222. DOI: 10.3354/meps08402.

Conn, P. B., and G. K. Silber. 2013. Vessel speed restrictions reduce risk of collision mortality for North Atlantic right whales. *Ecosphere* 4.4 (2013):1–16.

Conserve Wildlife Foundation of New Jersey (CWF). 2023. Harbor Seals in New Jersey. Available: https://conservewildlife.maps.arcgis.com/apps/MapJournal/index.html?appid=d2266f32c36449e0b9630453e56c3888&webmap=564588c5cff04fa990aab644400475f9.

Corkeron, P., P. Hamilton, J. Bannister, P. Best, C. Charlton, K. R. Groch, K. Findlay, V. Rowntree, E. Vermeulen, and R. M. Pace. 2018. The recovery of North Atlantic right whales, Eubalaena glacialis, has been constrained by human-caused mortality. *Royal Society Open Science* 5:180892.

Costello, C., L. Cao, S. Gelcich, M. A. Cisneros-Mata, C. M. Free, H. E. Froehlich, C. D. Golden, G. Ishimura, J. Maier, I. Macadam-Somer, T. Mangin, M. C. Melnychuk, M. Miyahara, C. L. de Moor, R. Naylor, L. Nøstbakken, E. Ojea, E. O'Reilly, A. M. Parma, A. J. Plantinga, S. H. Thilsted, and J. Lubchenco. 2020. The future of food from the sea. *Nature*. 588:95–100.

Cox, T. M., T. J. Ragen, A. J. Read, E. Vos, R. W. Baird, K. Balcomb, J. Barlow, J. Caldwell, T. Cranford, L. Crum, A. D'Amico, G. D'Spain, A. Fernández, J. Finneran, R. Gentry, W. Gerth, F. Gulland, J. Hildebrand, D. Houser, T. Hullar, P. D. Jepson, D. Ketten, C. D. MacLeod, P. Miller, S. Moore, D. Mountain, D. Palka, P. Ponganis, S. Rommel, T. Rowles, B. Taylor, P. Tyack, D. Wartzok, R. Gisiner, J. Mead, and L. Benner. 2006. Understanding the impacts of anthropogenic sound on beaked whales. *J. Cetacean Res. Manage.* 7(3):177–187.

Cranford, T. W., and P. Krysl. 2015. Fin Whale Sound Reception Mechanisms: Skull Vibration Enables Low-Frequency Hearing. *PLOS ONE* 10(1): e0116222.

Crocker, S. E., and F. D. Fratantonio. 2016. *Characteristics of Sounds Emitted During High-Resolution Marine Geophysical Surveys*. NUWC-NPT Technical Report 12,203. Report by Naval Undersea Warfare Center Division, Newport, RI, USA. 266 p. Available: https://apps.dtic.mil/dtic/tr/fulltext/u2/1007504.pdf.

CSA Ocean Sciences, Inc. 2021. *Assessment of Impacts to Marine Mammals, Sea Turtles, and Sturgeon*. Appendix P1 in Construction and Operations Plan South Fork Wind Farm. Stuart, Florida.

D'Amico, A. D., R. C. Gisiner, D. R. Ketten, J. A. Hammock, C. Johnson, P. L. Tyack, and J. Mead. 2009. Beaked whale strandings and naval exercises. *Aquatic Mammals* 35:452–472.

Dahlheim, M. E., and D. K. Ljungblad. 1990. Preliminary hearing study on gray whales (*Eschrichtius robustus*) in the field. In: J. A. Thomas, editor; and R. A. Kastelein, editor, *Sensory Abilities of Cetaceans/Laboratory and Field Evidence*. Plenum, New York. pp. 335–346.

Dahne, M., J. Tougaard, J. Carstensen, A. Rose, and J. Nabe-Nielsen. 2017. Bubble curtains attenuate noise from offshore wind farm construction and reduce temporary habitat loss for harbour porpoises. *Marine Ecology Progress Series* 580:221–237. Available: https://doi.org/10.3354/meps12257.

Dam, M., and D. Bloch. 2000. Screening of mercury and persistent organochlorine pollutants in long-finned pilot whale (*Globicephala melas*) in the Faroe Islands. *Marine Pollution Bulletin* 40(12):1090–1099.

Davis, G. E., M. F. Baumgartner, J. M. Bonnell, J. Bell, C. Berchok, J. B. Thornton, S. Brault, G. Buchanan, R. A. Charif, D. Cholewiak, and C. W. Clark. 2017. Long-term passive acoustic recordings track the changing distribution of North Atlantic right whales (*Eubalaena glacialis*) from 2004 to 2014. *Scientific Reports* 7:13460.

Davis, G. E., M. F. Baumgartner, P. J. Corkeron. 2020. Exploring movement patterns and changing distributions of baleen whales in the western North Atlantic using a decade of passive acoustic data. *Global Change Biology* 26:4812–4840.

Degraer, S., D. Carey, J. Coolen, Z. Hutchison, F. Kerckhof, B. Rumes, and J. Vanaverbeke. 2020. Offshore Wind Farm Artificial Reefs Affect Ecosystem Structure and Functioning: A Synthesis. *Oceanography* 33(4):48–57.

Denes, S. L., D. G. Zeddies, and M. M. Weirathmueller. 2021. *Turbine Foundation and Cable Installation at South Fork Wind Farm: Underwater Acoustic Modeling of Construction Noise*. Appendix J1 in Construction and Operations Plan South Fork Wind Farm. Silver Spring, Maryland: JASCO Applied Sciences.

Di Iorio, L., and C. W. Clark. 2010. Exposure to seismic survey alters blue whale acoustic communication. *Biology Letters* 6(1):51–54.

Diederichs, A., M. Brandt, and G. Nehls. 2010. Does sand extraction near Sylt affect harbour porpoises? *Wadden Sea Ecosystem* 26:199–203.

Discovery of Sound in the Sea (DOSITS). 2019. Homepage. Available: https://dosits.org/.

Dolman,, S. J., E. Pinna, R. J. Reid, J. P. Barleya, R. Deaville, P. D. Jepson, M. O'Connell, S. Berrow, R. S. Penrose, P. T. Stevick, S. Calderan, K. P. Robinson, R. A. Brownell, Jr., M. P. and Simmonds. 2010. A note on the unprecedented strandings of 56 deep-diving whales along the UK and Irish coast. *Marine Biodiversity Records* 3:e16.

Dolman, S., V. Williams-Grey, R. Asmutis-Silvia, and S. Isaac. 2006. *Vessel collisions and cetaceans: what happens when they don't miss the boat*. A WDCS Science Report.

Dominion Energy. 2022a. *Coastal Virginia Offshore Wind Commercial Project, Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf within Lease OCS-A 0483 and the Associated Offshore Export Cable Route Corridor.*

Dominion Energy. 2022b. *Coastal Virginia Offshore Wind Commercial Project, Construction and Operations Plan.* May. Available: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Public_Sec%201-3.pdf.

Dorrell, R. M., C. J. Lloyd, B. J. Lincoln, T. P. Rippeth, J. R. Taylor, C. C. P. Caulfield, J. Sharples, J. A. Polton, B. D. Scannell, D. M. Greaves, R. A. Hall, and J. H. Simpson. 2022. Anthropogenic Mixing in Seasonally Stratified Shelf Seas by Offshore Wind Farm Infrastructure. *Front. Mar. Sci.* 9:830927. DOI: 10.3389/fmars.2022.830927.

Dunlop, R. A., M. J. Noad, R. D. McCauley, L. Scott-Hayward, E. Kniest, R. Slade, D. Paton, and D. H. Cato. 2017. Determining the behavioural dose-response relationship of marine mammals to air gun noise and source proximity. *Journal of Experimental Biology* 220(16):2878–2886. Available: https://doi.org/10.1242/jeb.160192.

Elliot, J., K. Smith, D. R. Gallien, and A. Khan. 2017. *Observing Cable Laying and Particle Settlement During the Construction of the Block Island Wind Farm*. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2017-027. 225 pp. Available: https://tethys.pnnl.gov/sites/default/files/publications/Elliot-et-al-2017.pdf. Accessed: August 28, 2020.

Elliott, J., A. A. Khan, L. Ying-Tsong, T. Mason, J. H. Miller, A. E. Newhall, G. R. Potty, and K. J. Vigness-Raposa. 2019. *Field Observations during Wind Turbine Operations at the Block Island Wind Farm, Rhode Island*. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2019-028. Available: https://espis.boem.gov/final%20reports/BOEM_2019-028.pdf.

Empire Offshore Wind, LLC (Empire). 2022. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. May. Available: https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan.

Erbe, C. 2013. International Regulation of Underwater Noise. Acoustics Australia 41(1):12–19. Available: https://search.ebscohost.com/login.aspx?direct=true&db=asx&AN=90475142&site=eds-live.

Erbe, C., A. MacGillivray, and R. Williams. 2012. Mapping cumulative noise from shipping to inform marine spatial planning. *The Journal of the Acoustical Society of America* 132:EL423–EL428.

Erbe, C., C. Reichmuth, K. Cunningham, K. Lucke, and R. Dooling. 2016. Communication masking in marine mammals: A review and research strategy. *Marine Pollution Bulletin* 103:15–38.

Erbe, C., S. A. Marley, R. P. Schoeman, J. N. Smith, L. E. Trigg, and C. B. Embling. 2019. The Effects of Ship Noise on Marine Mammals—A Review. *Frontiers in Marine Science* 6:606. DOI: 10.3389/fmars.2019.00606.

Evans, P. G., and A. Bjørge. 2013. Impacts of climate change on marine mammals. *Marine Climate Change Impacts Partnership Science Review 2013*:134–148.

Evans, P., and J. Waggitt. 2020. Impacts of climate change on marine mammals, relevant to the coastal and marine environment around the UK. *Marine Climate Change Impacts Partnership Science Review* 2020:421–455. DOI: 10.14465/2020.arc19.mmm.

Exponent Engineering, P.C. 2018. *Deepwater Wind South Fork Wind Farm Onshore Electric and Magnetic Field Assessment*. Appendix K2 in Construction and Operations Plan South Fork Wind Farm. New York, New York: Exponent Engineering, P.C.

Fernández, A., J. F. Edwards, F. Rodríguez, A. Espinosa de los Monteros, P. Herráez, P. Castro, J. R. Jaber, V. Martín, and M. Arbelo. 2005. ‘Gas and fat embolic syndrome’ involving a mass stranding of beaked whales (family Ziphiidae) exposed to anthropogenic sonar signals. *Vet. Pathol.* 42:446–457.

Finley, K. J. 1990. *The Impacts of Vessel Traffic on the Behavior of Belugas.* International Forum for the Future of the Beluga. pgs. 113–140.

Finneran, J. J. 2015. Noise-induced hearing loss in marine mammals: A review of temporary threshold shift studies from 1996–2015. *The Journal of the Acoustical Society of America* 138(3):1702–1726.

Gerstein, E., J. Blue, and S. Forsythe. 2006. Ship strike acoustics: A paradox and parametric solution. *Journal of the Acoustical Society of America* 119(5):3289–3289.

Gill, A. B., I. Gloyne-Phillips, K. J. Neal, and J. A. Kimber. 2005. *The Potential Effects of Electromagnetic Fields Generated by Sub-Sea Power Cables Associated with Offshore Wind Farm Developments on Electrically and Magnetically Sensitive Marine Organisms – A Review*. Report No. COWRIE-EM FIELD 2-06-2004. Final report. Prepared for Collaborative Offshore Wind Energy Research Into the Environment. Cranfield University and the Centre for Marine and Coastal Studies Ltd.

Graham, I. M., E. Pirotta, N. D. Merchant, A. Farcas, T. R. Barton, B. Cheney, G. D. Hastie, and P. M. Thompson. 2017. Responses of bottlenose dolphins and harbor porpoises to impact and vibration piling noise during harbor construction. *Ecosphere* 8(5):e01793. DOI: 10.1002/ecs2.1793.

Grashorn, S., and E. V. Stanev. 2016. Kármán vortex and turbulent wake generation by wind park piles. *Ocean Dyn*. 66:1543–1557. DOI: 10.1007/s10236-016-0995-2.

Gray, L., and D. Greeley. 1980. Source level model for propeller blade rate radiation for the world's merchant fleet. *Journal of the Acoustical Society of America* 67:516–522.

Guerra, M., S. M. Dawson, T. E. Brough, and W. J. Rayment. 2014. Effects of boats on the surface of an endangered population of bottlenose dolphins. *Endangered Species Research* 24:221–236. DOI: 10.3354/esr00598.

Hall, A. J., B. J. McConnell, L. H. Schwacke, G. M. Ylitalo, R. Williams, and T. K. Rowles. 2018. Predicting the effects of polychlorinated biphenyls on cetacean populations through impacts on immunity and calf survival. *Environmental Pollution* 233:407–418.

Hannay, D., and M. Zykov. 2022. *Underwater acoustic modeling of detonations of unexploded ordnance (UXO) for Ørsted wind farm construction, US East Coast*. Document 02604, Version 3.0. Report by JASCO Applied Sciences for Ørsted.

Harnois, V., H. C. Smith, S. Benjamins, and L. Johanning. 2015. Assessment of entanglement risk to marine megafauna due to offshore renewable energy mooring systems. *International Journal of Marine Energy* 11:27–49.

Hastie, G., B. Wilson, and L. Tufft. 2003. Bottlenose Dolphins Increase Breathing Synchrony in Response to Boat Traffic. *Marine Mammal Science* 19(1):74–84.

Hayes, S. A., E. Josephson, K. Maze-Foley, and P. E. Rosel. 2020. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2019*. NOAA Tech Memo NMFS-NE 264.

Hayes, S. A., E. Josephson, K. Maze-Foley, P. E. Rosel, and J. Turek. 2021. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2020*. NOAA Tech Memo NMFS-NE 271.

Hayes, S. A., E. Josephson, K. Maze-Foley, P. E. Rosel, and J. Wallace. 2022a. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2021*. NOAA Tech Memo NMFS-NE 288. May 2022.

Hayes, S. A., E. Josephson, K. Maze-Foley, P. E. Rosel, and J. Wallace. 2022b. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2022. Draft*. June 2022.

Heinis, F., C. de Jong, M. Ainslie, W. Borst, and T. Vellinga. 2013. Monitoring programme for the Maasvlakte 2, Part III - The effects of underwater sound. *Terra et Aqua* 132:2132.

Hoffman, Christopher A. 2012. Mitigating Impacts of Underwater Noise From Dredging on Beluga Whales in Cook Inlet, Alaska. *Adv Exp Med Biol.* 2012;730:617–619. DOI: 10.1007/978-1-4419-7311-5_140. PMID: 22278577.

Holt, M. M., D. P. Noren, V. Veirs, C. K. Emmons, and S. Veirs. 2009. Speaking up: Killer whales (Orcinus orca) increase their call amplitude in response to vessel noise. *The Journal of the Acoustical Society of America* 125(1):EL27–EL32. Available: https://doi.org/10.1121/1.3040028.

Holt, M. M., J. B. Tennessen, M. Bradley Hanson, C. K. Emmons, D. A. Giles, J. T. Hogan, and M. J. Ford. 2021. Vessels and their sounds reduce prey capture effort by endangered killer whales (Orcinus orca). *Marine Environmental Research* 170 (2021):105429. Available: https://doi.org/10.1016/j.marenvres.2021.105429.

Houser D. S., R. Howard, and S. Ridgway. 2001. Can diving-induced tissue nitrogen supersaturation increase the chance of acoustically driven bubble growth in marine mammals? *Journal of Theoretical Biology* 213:183–195.

Inspire Environmental (Inspire). 2019. *Sediment Profile and Plan View Imaging Benthic Assessment Survey in Support of the South Fork Wind Farm Site Assessment*. Appendix N in Construction and Operations Plan South Fork Wind Farm. Newport, Rhode Island: Inspire Environmental.

Jansen, E., and C. de Jong. 2016. Underwater noise measurements in the North Sea in and near the Princess Amalia Wind Farm in operation. 45th International Congress and Exposition on Noise Control Engineering: Towards a Quieter Future, INTER-NOISE 2016. 21 August 2016 through 24 August 2016, 7846–7857.

JASCO Applied Sciences (JASCO). 2011. *Underwater Acoustics: Noise and the Effects on Marine Mammals*. A Pocket Handbook, 3rd Ed. Available: http://oalib.hlsresearch.com/PocketBook%203rd%20ed.pdf.

JASCO Applied Sciences Inc. (JASCO). 2022a. *Distance to behavioral threshold for vibratory pile driving of sheet piles*. Technical Memorandum by JASCO Applied Sciences for Ocean Wind LLC. March 21.

JASCO Applied Sciences Inc. (JASCO). 2022b. New England Wind Offshore Wind Farm Application for Marine Mammal Protection Act (MMPA) Rulemaking and Letter of Authorization. July. Available: https://media.fisheries.noaa.gov/2022-08/NewEnglandWind_2023LOA_App_OPR1_508.pdf.

Jensen, A. S., G. K. Silber, and J. Calambokidis. 2003. Large whale ship strike database. U.S. Department of Commerce (p. 37). NOAA Technical Memorandum. NMFS-ORP. Available: https://repository.library.noaa.gov/view/noaa/23127/noaa_23127_DS1.pdf.

Jepson, P. D., M. Arbelo, R. Deaville, I. A. P. Patterson, P. Castro, J. R. Baker, E. Degollada, H. M. Ross, P. Herraez, A. M. Pocknell, F. Rodriguez, F. E. Howie, A. Espinosa, R. J. Reid, J. R. Jaber, V. Martin, A. A. Cunningham, and A. Fernández. 2003. Gas-bubble lesions in stranded cetaceans. *Nature* 425:575–576.

Jepson, P. D., R. Deaville, L. J. Barber, A. Aguilar, A. Borrell, S. Murphy, J. Barry, A. Brownlow, J. Barnett, S. Berrow, and A. A. Cunningham. 2016. PCB pollution continues to impact populations of orcas and other dolphins in European waters. *Scientific reports* 6(1):1–17.

Johansson T., and M. Andersson. 2012. *FOI Ambient Underwater Noise Levels at Norra Midsjöbanken during Construction of the Nord Stream Pipeline*. FOI Report.

Johnson, A., G. Salvador, J. Kenney, J. Robbins, S. Kraus, S. Landry, and P. Clapham. 2005. “Fishing Gear Involved in Entanglement of Right and Humpback Whales.” *Marine Mammal Science* 21(4):635–645.

Johnson, S. R., W. J. Richardson, S. B. Yazvenko, S. A. Blokhin, G. Gailey, M. R. Jenkerson, S. K. Meier, H. R. Melton, M. W. Newcomer, A. S. Perlov, S. A. Rutenko, B. Wursig, C. R. Martin, and D. E. Egging. 2007. A western gray whale mitigation and monitoring program for a 3-D seismic survey, Sakhalin Island, Russia. *Environ Monit Assess* 134:1–19. DOI 10.1007/s10661-007-9813-0.

Josephson, E., F. Wenzel, and M. C. Lyssikatos. 2021. *Serious injury determinations for small cetaceans and pinnipeds caught in commercial fisheries off the Northeast US coast, 2014–2018*. US Department of Commerce, Northeast Fisheries Science Center Reference Document 21-04. Washington, DC: US Department of Commerce.

Kastelein, R. A., L. A. E. Huijser, S. Cornelisse, L. Helder-Hoek, N. Jennings, and C. A. F. de Jong. 2019. Effect of Pile-Driving Playback Sound Level on Fish-Catching Efficiency in Harbor Porpoises (Phocoena phocoena). *Aquatic Mammals* 45(4):398–410. DOI 10.1578/AM.45.4.2019.398.

Kates Varghese, H., J. Miksis-Olds, N. DiMarzio, K. Lowell, E. Linder, L. Mayer, and D. Moretti. 2020. "The Effect of Two 12 Khz Multibeam Mapping Surveys on the Foraging Behavior of Cuvier's Beaked Whales Off of Southern California." *J Acoust Soc Am* 147(6):3849. DOI: https://doi.org/10.1121/10.0001385. Available: https://www.ncbi.nlm.nih.gov/pubmed/32611139.

Kates Varghese, Hilary, Kim Lowell, Jennifer Miksis-Olds, Nancy DiMarzio, David Moretti, and Larry Mayer. 2021. "Spatial Analysis of Beaked Whale Foraging During Two 12 Khz Multibeam Echosounder Surveys." *Frontiers in Marine Science* 8. DOI: https://doi.org/10.3389/fmars.2021.654184.

Kellar, N. M., T. R. Speakman, C. R. Smith, S. M. Lane, B. C. Balmer, M. L. Trego, K. N. Catelani, M. N. Robbins, C. D. Allen, R. S. Wells, E. S. Zolman, T. K. Rowles, and L. H. Schwacke. 2017. "Low Reproductive Success Rates of Common Bottlenose Dolphins Tursiops truncatus in the Northern Gulf of Mexico Following the Deepwater Horizon Disaster (2010–2015)." *Endangered Species Research* 33:143–158.

Ketten, D. R. 1991. The marine mammal ear: specializations for aquatic audition and echolocation. Pp. 717–750 in: Webster. D., R. Fay, and A. Popper (Eds), *The Biology of Hearing*. Berlin: Springer-Verlag.

Ketten, D. R. 1998. *Marine Mammal Auditory Systems: A Summary of Audiometric and Anatomical Data and its Implications for Underwater Acoustic Impacts*. NOAA Tech Memo NMFS: NOAA-TM-NMFS-SWFSC-256.

Ketten, D. R. and D. C. Mountain. 2011. *Final Report: Hearing in Minke Whales*. Joint Industry Program. 26 pp.

Ketten, D. R., and D. C. Mountain. 2014. Inner ear frequency maps: First stage audiograms of low to infrasonic hearing in mysticetes. Presentation at ESOMM 2014, Amsterdam, Netherlands in Southall, B. L., J. J. Finneran, C. Reichmuth, P. E. Nachtigall, D. R. Ketten, A. E. Bowles, W. T. Ellison, D. P. Nowacek, and P. L. Tyack. 2019. Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. *Aquatic Mammals* 2019, 45(2):125–232. DOI 10.1578/AM.45.2.2019.125.

Kilfoyle, A. K., R. F. Jermain, M. R. Dhanak, J. P. Huston, and R. E. Speiler. 2018. Effects of EMF emissions from undersea electric cables on coral reef fish. *Bioelectromagnetics* 39:35–52.

Knowlton, A. R., P. K. Hamilton, M. K. Marx, H. P. Pettis, and S. D. Kraus. 2012. Monitoring North Atlantic right whale Eubalaena glacialis entanglement rates: A 30 year retrospective. *Marine Ecology Progress Series* 466:293–302.

Küsel, E. T., M. J. Weirathmueller, K. E. Zammit, S. J. Welch, K. E. Limpert, and D. G. Zeddies. 2022. *Underwater Acoustic and Exposure Modeling*. Document 02109, Version 1.0 DRAFT. Technical report by JASCO Applied Sciences for Ocean Wind LLC.

Laist D. W., A. R. Knowlton, and D. Pendleton. 2014. Effectiveness of mandatory vessel speed limits for protecting North Atlantic Right whales. *Endangered Species Research* 23:133–147.

Laist, D. W., A. R. Knowlton, J. G. Mead, A. S. Collet, and M. Podesta. 2001. Collisions between ships and whales. *Marine Mammal Science* 17(1):35–75.

Learmonth, J. A., C. D. MacLeod, M. B. Santos, G. J. Pierce, H. Q. P. Crick, and R. A. Robinson. 2006. Potential effects of climate change on marine mammals. *Oceanography and Marine Biology: An Annual Review* 44:431–464.

Lefcheck, J. S., B. B. Hughes, A. J. Johnson, B. W. Pfirrmann, D. B. Rasher, A. R. Smyth, B. L. Williams, M. W. Beck, and R. J. Orth. 2019. Are coastal habitats important nurseries? A meta-analysis. *Conservation Letters* 12(4):e12645.

Lesage, V., C. Barrette, M. C. S. Kingsley, and B. Sjare. 1999. The effect of vessel noise on the vocal behavior of belugas in the St. Lawrence River estuary, Canada. *Marine Mammal Science* 15(1):65–84. DOI:10.1111/j.1748-7692.1999.tb00782.x.

Lewiston, R. L., L. B. Crowder, B. P. Wallace, J. E. Moore, T. Cox, R. Zydelis, S. McDonald, A. DiMatteo, D. C. Dunn, C. Y. Kot, R. Bjorkland, S. Kelez, C. Soykan, K. R. Stewart, M. Sims, A. Boustany, A. J. Read, P. Halpin, W. J. Nichols, and C. Safina. 2014. “Global Patterns of Marine Mammal, Seabird, and Marine Mammal Bycatch Reveal Taxa-Specific and Cumulative Megafauna Hotspots.” *Proceeding of the National Academy of Sciences of the United States of America* 111(14):5271–8276. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3986184/pdf/pnas.201318960.pdf.

Ljungblad, D. K., B. Wursig, S. L. Swartz, and J. M. Keene. 1988. Observations on the Behavioral Responses of Bowhead Whales (Balaena mysticetus) to Active Geophysical Vessels in the Alaskan Beaufort Sea. *Arctic* 41(3):183–194.

Long, C. 2017. *Analysis of the Possible Displacement of Bird and Marine Mammal Species Related to the Installation and Operation of Marine Energy Conversion Systems*. Scottish Natural Heritage Commissioned Report No. 947.

Love, M., A. Baldera, C. Young, and C. Robbins. 2013. *The GoM Ecosystem: A Coastal and Marine Atlas*. New Orleans, LA: Ocean Conservancy, Gulf Restoration Center.

Lucke, K., P. A. Lepper, B. Hoeve, E. Everaarts, N. van Elk, and U. Siebert. 2007. Perception of Low-Frequency Acoustic Signals by a Harbour porpoise (*Phocoena phocoena*) in the Presence of Simulated Offshore Wind Turbine Noise. *Aquatic Mammals* 33 (1):55–68.

Ludewig, E. 2015. *On the Effect of Offshore Wind Farms on the Atmosphere and Ocean Dynamics*. Cham: Springer International Publishing.

Lyssikatos, M. C. 2015. *Estimates of cetacean and pinniped bycatch in Northeast and Mid-Atlantic bottom Trawl Fisheries, 2008–2013*. Woods Hole, Massachusetts, U.S. Department of Commerce. Northeast Fisheries Science Center Reference Document 15-19.

Madsen, P. T., M. Wahlberg, J. Tougaard, K. Lucke, and P. Tyack. 2006. "Wind Turbine Underwater Noise and Marine Mammals: Implications of Current Knowledge and Data Needs." *Marine Ecology Progress Series*, Vol. 309:279–295. Available: https://www.researchgate.net/publication/236156710_Wind_turbine_underwater_noise_and_marine_mammals_Implications_of_current_knowledge_and_data_needs.

Malme, C. I., B. Würsig, J. E. Bird, and P. Tyack. 1986. *Behavioral responses of gray whales to industrial noise: feeding observations and predictive modeling*. BBN Rep. 6265. OCS Study MMS 88-0048. Outer Contin. Shelf Environ. Assess. Progr., Final Rep. Princ. Invest., NOAA, Anchorage 56(1988):393–600. NTIS PB88-249008.

Martin, J., Q. Sabatier, T. A. Gowan, C. Giraud, E. Gurarie, C. S. Calleson, J. G. Ortega-Ortiz, C. J. Deutsch, A. Rycyk, and S. M. Koslovsky. 2016. A quantitative framework for investigating risk of deadly collisions between marine wildlife and boats. *Methods in Ecology and Evolution* 7(1):42–50.

Martins, M. C. I., L. Sette, E. Josephson, A. Bogomolni, K. Rose, S. M. Sharp, M. Niemeyer, and M. Moore. 2019. Unoccupied aerial system assessment of entanglement in Northwest Atlantic gray seals (*Halichoerus grypus*). *Marine Mammal Science* 35(4):1613–1624.

Mazet, J. A. K., I. A. Gardner, D. A. Jessup, and L. J. Lowenstine. 2001. "Effects of Petroleum on Mink Applied as a Model for Reproductive Success in Sea Otters." *Journal of Wildlife Diseases* 37(4):686–692.

McCauley, R. 1998. *Radiated Underwater Noise Measured from the Drilling Rig Ocean General, Rig Tenders Pacific Ariki and Pacific Frontier, Fishing Vessel Reef Venture and Natural Sources in the Timor Sea, Northern Australia*. Prepared for Shell Australia. Project Centre for Marine Science and Technology Report C98-20.

McIntosh, R. R., R. Kirkwood, D. R. Sutherland, and P. Dann. 2015. Drivers and annual estimates of marine wildlife entanglement rates: a long-term case study with Australian fur seals. *Marine Pollution Bulletin* 101(2):716–725.

McMahon, K., P. Lavery, and M. Mulligan. 2011. Recovery from the impact of light reduction on the seagrass *Amphibolis griffithii*, insights for dredging management. *Marine Pollution Bulletin* 62(2):270–283.

Methratta, E. T., and W. R. Dardick. 2019. Meta-Analysis of Finfish Abundance at Offshore Wind Farms. *Reviews in Fisheries Science & Aquaculture* 27:2:242–260.

Mid-Atlantic Fishery Management Council (MAFMC). 2023. *Mid-Atlantic Artificial Reefs*. Available: https://www.mafmc.org/artificial-reefs. Accessed: March 3, 2023.

Mikkelsen, L., M. Johnson, D. M. Wisniewska, A. van Neer, U. Siebert, P. T. Madsen, and J. Teilmann. 2019. Long-term sound and movement recording tags to study natural behavior and reaction to ship noise of seals. *Ecology and Evolution* 9:2588–2601. DOI: 10.1002/ece3.4923

Miller, J. H., and G. R. Potty. 2017. "Overview of Underwater Acoustic and Seismic Measurements of the Construction and Operation of the Block Island Wind Farm." *Journal of the Acoustical Society of America* 141(5):3993. DOI:10.1121/1.4989144. Available: https://asa.scitation.org/doi/10.1121/1.4989144.

Mitson, R. B. 1995. *Underwater noise of research vessels – review and recommendations*. Cooperative Research Report. 209. ACOUSTEC, prepared for the International Council for the Exploration of the Sea. Copenhagen, Denmark.

Mohr, F. C., B. Lasely, and S. Bursian. 2008. "Chronic Oral Exposure to Bunker C Fuel Oil Causes Adrenal Insufficiency in Ranch Mink." *Archive of Environmental Contamination and Toxicology* 54:337–347.

Moore, M. J., and J. M. van der Hoop. 2012. "The Painful Side of Trap and Fixed Net Fisheries: Chronic Entanglement of Large Whales." *Journal of Marine Biology* 2012. Article 230653, 4 pp.

Moore, M. J., J. van de Hoop, S. G. Barco, et al. 2013. Criteria and case definitions for serious injury and death of pinnipeds and cetaceans caused by anthropogenic trauma. *Diseases of Aquatic Organisms* 103:229–264.

Moulton, V. D., W. J. Richardson, M. T. Williams, and S. B. Blackwell. 2003. Ringed seal densities and noise near an icebound artificial island with construction and drilling. *Acoustics Research Letters Online* 4:112–117. DOI: 10.1121/1.1605091.

Muir, D. C. G., R. Wagemann, N. P. Grift, R. J. Norstrom, M. A. Simon, and J. Lien. 1988. Organochlorine chemical and heavy metal contaminants in white-beaked dolphins (*Lagenorhynchus albirostris*) and pilot whales (*Globicephala melaena*) from the coast of Newfoundland, Canada. *Archives of Environmental Contamination and Toxicology* 17(5):613–629.

Murphy, S., R. J. Law, R. Deaville, J. Barnett, M. W. Perkins, A. Brownlow, R. Penrose, N. J. Davison, J. L. Barber, and P. D. Jepson. 2018. Organochlorine contaminants and reproductive implication in cetaceans: a case study of the common dolphin. *Marine Mammal Ecotoxicology* 3-38.

Nabe-Nielsen, J., J. Tougaard, J. Teilmann, and S. Sveegaard. 2011. *Effects of Wind Farms on Harbour Porpoise Behavior and Population Dynamics*. Report commissioned by the Environmental Group under the Danish Environmental Monitoring Programme. Scientific Report from Danish Centre for Environment and Energy No. 1. Denmark: Aarhus University. September.

National Aeronautics and Space Administration (NASA). 2019. *The Effects of Climate Change*. Available: https://climate.nasa.gov/effects/. Accessed: November 2021.

National Marine Fisheries Service (NMFS). 2016. Endangered Species Act Section 7 Consultation on the Continued Prosecution of Fisheries and Ecosystem Research Conducted and Funded by the Northeast Fisheries Science Center and the Issuance of a Letter of Authorization under the Marine Mammal Protection Act for the Incidental Take of Marine Mammals Pursuant to those Research Activities PCTS ID: NER-2015-12532. Available: https://media.fisheries.noaa.gov/dam-migration/nefsc_rule2016_biop.pdf.

National Marine Fisheries Service (NMFS). 2018a. *2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts*. National Oceanic and Atmospheric Administration Technical Memorandum NMFS-OPR-59. U.S. Department of Commerce, National Oceanographic and Atmospheric Administration.

National Marine Fisheries Service (NMFS). 2018b. Greater Atlantic Regional Fisheries Office: Section 7 Pile Driving Acoustics Tool. Updated 09/14/2020. Available: http://www.greateratlantic.fisheries.noaa.gov/protected/section7/guidance/consultation/index.html. Accessed: February 2021.

National Marine Fisheries Service (NMFS). 2018c. NOAA Fisheries' User Spreadsheet tool. Available: https://www.fisheries.noaa.gov/action/user-manual-optional-spreadsheet-tool-2018-acoustic-technical-guidance. Accessed: September 2019.

National Marine Fisheries Service (NMFS). 2020. North Atlantic Right Whale *(Eubalaena glacialis)* Vessel Speed Rule Assessment. June 2002. Available: https://media.fisheries.noaa.gov/2021-01/FINAL_NARW_Vessel_Speed_Rule_Report_Jun_2020.pdf?null. Accessed: April 2023.

National Marine Fisheries Service (NMFS). 2021a. *Endangered Species Act Section 7 Consultation Biological Opinion for the Construction, Operation, Maintenance, and Decommissioning of the South Fork Offshore Energy Project (Lease OCS-A 0517)* GARFO-2021-00353 – [Corrected]. Available: https://media.fisheries.noaa.gov/2021-12/SFW_BiOp_OPR1.pdf.

National Marine Fisheries Service (NMFS). 2021b. *Endangered Species Act Section 7 Consultation Biological Opinion for the Construction, Operation, Maintenance, and Decommissioning of the Vineyard Wind Offshore Energy Project (Lease OCS-A 0501)* GARFO-2021-01265 – [Corrected]. Available: https://www.boem.gov/sites/default/files/documents/renewable-energy/2021-Vineyard-Wind-1-BiOp-Final_0.pdf.

National Oceanic and Atmospheric Administration (NOAA). 2013. *Draft guidance for assessing the effects of anthropogenic sound on marine mammals: Acoustic threshold levels for onset of permanent and temporary threshold shifts*. December 2013, 76 pp. Silver Spring, Maryland: NMFS Office of Protected Resources. Available: http://www.nmfs.noaa.gov/pr/acoustics/draft_acoustic_guidance_2013.pdf.

National Oceanic and Atmospheric Administration (NOAA). 2020a. *North Atlantic Right Whale (Eubalaena glacialis) Vessel Speed Rule Assessment*. June. NOAA Fisheries, Office of Protected Resources. Available: https://media.fisheries.noaa.gov/2021-01/FINAL_NARW_Vessel_Speed_Rule_Report_Jun_2020.pdf?null.

National Oceanic and Atmospheric Administration (NOAA). 2020b. *Draft Environmental Impact Statement, Regulatory Impact Review, and Initial Regulatory Flexibility Analysis for Amending the Atlantic Large Whale Take Reduction Plan: Risk Reduction Rule*. Vol. 1. Available at: https://www.greateratlantic.fisheries.noaa.gov/public/nema/PRD/DEIS_RIR_ALWTRP_RiskReductionRule_VolumeI.pdf.

National Oceanic and Atmospheric Administration (NOAA). 2022. 2017–2022 North Atlantic Right Whale Unusual Mortality Event. Available: https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2022-north-atlantic-right-whale-unusual-mortality-event.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2020. *2018–2020 Pinniped Unusual Mortality Event along the Northeast Coast*. National Oceanic and Atmospheric Administration. Available: https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-lifedistress/2018-2020-pinniped-unusual-mortality-event-along. Accessed: April 11, 2022.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2022a. *2016–2022 Humpback Whale Unusual Mortality Event along the Atlantic Coast*. National Oceanic and Atmospheric Administration. Available: https://www.fisheries.noaa.gov/national/marine-life-distress/2016-2022-humpback-whale-unusual-mortality-event-along-atlantic-coast. Accessed: April 11, 2021.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2022b. *2017–2022 Minke Whale Unusual Mortality Event along the Atlantic Coast*. National Oceanic and Atmospheric Administration. Available: https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2022-minke-whale-unusual-mortality-event-along-atlantic-coast. Accessed: April 11, 2022.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2022c. *Rule to Amend the North Atlantic Right Whale Vessel Speed Regulations Closed for Comment*. National Oceanic and Atmospheric Administration. Updated November 7, 2022. Available: https://www.fisheries.noaa.gov/feature-story/rule-amend-north-atlantic-right-whale-vessel-speed-regulations-closed-comment. Accessed: January 13, 2023.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2022d. Ecology of the Northeast Continental Shelf. Available: http://archive.nefmc.org/ecosystems/eco_northeast_shelf.pdf.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2023a. *2017–2023 North Atlantic Right Whale Unusual Mortality Event*. National Oceanic and Atmospheric Administration. Updated January 10, 2023. Available: https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2022-north-atlantic-right-whale-unusual-mortality-event. Accessed: January 11, 2023.

National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2023b. *2022 Pinniped Unusual Mortality Event along the Main Coast*. National Oceanic and Atmospheric Administration. Updated December 21, 2022. Available: https://www.fisheries.noaa.gov/2022-2023-pinniped-unusual-mortality-event-along-maine-coast. Accessed: January 12, 2023.

Nedwell J., J. Langworthy, and D. Howell. 2003. *Assessment of Sub-Sea Acoustic Noise and Vibration from Offshore Wind Turbines and its Impact on Marine Wildlife; Initial Measurements of Underwater Noise during Construction of Offshore Windfarms, and Comparison with Background Noise* (Report No. 544 R 0424). Report by Subacoustech Ltd. Report for The Crown Estate.

New England Wind. 2022. *New England Wind Offshore Wind Farm, Application for Marine Mammal Protection Act Rulemaking and Letter of Authorization.* July.

New Jersey Department of Environmental Protection (NJDEP). 2010. *Ocean/Wind Power Ecological Baseline Studies* January 2008–December 2009. Final Report. July 2010. Prepared for New Jersey Department of Environmental Protection Office of Science by Geo-Marine, Inc., Plano, Texas. Available: http://www.nj.gov/dep/dsr/ocean-wind/report.htm.

Nielsen, J. B., F. Nielsen, P. J. Jørgensen, and P. Grandjean. 2000. Toxic metals and selenium in blood from pilot whales (*Globicephala melas*) and sperm whales (*Physeter catodon*). *Marine Pollution Bulletin* 40(4):348–351.

Normandeau, Exponent, T. Tricas, and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species*. OCS Study BOEMRE 2011-09. Camarillo, California: U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region.

Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2011. *2010 Annual Report to the Inter-Agency Agreement M10PG00075/0001: A Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2012. *2011 Annual Report to the Inter-Agency Agreement M10PG00075/0001: A Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2013. *2012 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2014. *2013 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2015. *2014 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2016. *2016 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean - AMAPPS II*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2018. *2017 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean - AMAPPS II*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2020. *2019 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean - AMAPPS II*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2022. *2021 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean - AMAPPS III*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Nowacek, S. M., R. S. Wells, and A. R. Solow. 2001. Short-term Effects of Boat Traffic on Bottlenose Dolphins, Tursiops Truncatus, in Sarasota Bay, Florida. *Marine Mammal Science* 17(4):673–688.

Nowacek, D., M. P. Johnson, and P. L. Tyack. 2004. North Atlantic right whales (Eubalaena glacialis) ignore ships but respond to alerting stimuli. Proceedings of the Royal Society of London. *Series B, Biological Sciences* 271:227–231.

Ocean Wind LLC (Ocean Wind). 2019. *Aerial Seal Haul-Out Survey: Ocean Wind Offshore Windfarm.* Prepared by Normandeau Associates, Inc. and APEM Ltd. July 16, 2019.

Ocean Wind LLC (Ocean Wind). 2022. *Application for Marine Mammal Protection Act (MMPA) Rulemaking and Letter of Authorization*: DRAFT. Prepared by HDR. February.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Olson, J. K., D. M. Lambourn, J. L. Huggins, S. Raverty, A. A. Scott, and J. K. Gaydos. 2021. Trends in propeller strike-induced mortality in harbor seals (*Phoca vitulina*) of the Salish Sea. *Journal of Wildlife Diseases* 57(3):689–693.

Orphanides, C. D. 2020. *Estimates of Cetacean and Pinniped Bycatch in the 2017 New England Sink and Mid-Atlantic Gillnet Fisheries*. Northeast Fisheries Science Center Reference Document 20-03. Available: https://repository.library.noaa.gov/view/noaa/23650.

Orr, T., S. Herz, and D. Oakley. 2013. *Evaluation of Lighting Schemes for Offshore Wind Facilities and Impacts to Local Environments*. OCS Study BOEM 2013-0116. Herndon, Virginia: U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs.

Osiecka, A. N., O. Jones, and M. Wahlberg. 2020. The diel pattern in harbour porpoise clicking behavior is not a response to prey activity. *Nature Scientific Reports* 10:14876. Available: https://doi.org/10.1038/s41598-020-71957-0.

OSPAR Commission. 2009. *Overview of the impacts of anthropogenic underwater sound in the marine environment*. London, UK: OSPAR Commission.

Pace, R. M. 2021. *Revisions and Further Evaluations of the Right Whale Abundance Model: Improvements for Hypothesis Testing*. NOAA Technical Memorandum NMFS-NE 269. Available: https://apps-nefsc.fisheries.noaa.gov/rcb/publications/tm269.pdf.

Pace, R. M. III, R. Williams, S. D. Kraus, A. R. Knowlton, and H. M. Pettis. 2021. Cryptic mortality of North Atlantic right whales. *Conservation Science and Practice* 2021(3):e346. Available: https://doi.org/10.1111/csp2.346.

Pace, R. M., and G. K. Silber. 2005. Simple Analysis of Ship and Large Whale Collisions: Does Speed Kill? Presentation at the Sixteenth Biennial Conference on the Biology of Marine Mammals, San Diego, CA, December 2005.

Pacific Marine Environmental Laboratory (PMEL). 2020. Ocean Acidification: The Other Carbon Dioxide Problem. Available: https://www.pmel.noaa.gov/CO_2/story/Ocean+Acidification. Accessed: February 11, 2020.

Palka, D. L., S. Chavez-Rosales, E. Josephson, D. Cholewiak, H. L. Haas, L. Garrison, M. Jones, D. Sigourney, G. Waring, M. Jech, E. Broughton, M. Soldevilla, G. Davis, A. DeAngelis, C. R. Sasso, M. V. Winton, R. J. Smolowitz, G. Fay, E. LaBrecque, J. B. Leiness, K. Dettloff, M. Warden, K. Murray, and C. Orphanides. 2017. *Atlantic Marine Assessment Program for Protected Species: 2010–2014*. OCS Study BOEM 2017-071. Bureau of Ocean Energy Management, Washington, DC. Available: https://espis.boem.gov/final%20reports/5638.pdf.

Parks, S. E., C. W. Clark, and P. L. Tyack. 2007. Short- and long-term changes in right whale calling behavior: the potential effects of noise on acoustic communication. *Journal of the Acoustical Society of America* 122(6):3725–3731. DOI:10.1121/1.2799904.

Parsons, E. C. M., D. Dolman, A. J. Wright, N. A. Rose, and W. C. G. Burns. 2008. Navy sonar and cetaceans: just how much does the gun need to smoke before we act? *Mar. Pollut. Bull.* 56:1248–1257.

Paskyabi, M. B., I. and Fer. 2012. "Upper Ocean Response to Large Wind Farm Effect in the Presence of Surface Gravity Waves," in Selected papers from Deep Sea Offshore Wind R&D Conference, Vol. 24, (Trondheim):45–254. DOI: 10. 1016/j.egypro.2012.06.106.

Patenaude, N. J., W. J. Richardson, M. A. Smultea, W. R. Koski, G. W. Miller, B. Würsig, and C. R. Greene, Jr. 2002. Aircraft sound and disturbance to bowhead and beluga whales during spring migration in the alaskan Beaufort sea. *Marine Mammal Science* 18(2):309–335. Available: https://doi.org/10.1111/j.1748-7692.2002.tb01040.x.

Pfleger, M., P. Mustain, M. Valentine, E. Gee, W. Webber, and B. Fenty. 2021. Vessel Strikes Threaten North Atlantic Right Whales. *Oceana*. DOI: 10.5281/zenodo.5120727.

Pierce, G. J., M. B. Santos, S. Murphy, J. A. Learmonth, A. F. Zuur, E. Rogan, P. Bustamante, F. Caurant, V. Lahaye, V. Ridoux, and B. N. Zegers. 2008. Bioaccumulation of persistent organic pollutants in female common dolphins (*Delphinus delphis*) and harbour porpoises (*Phocoena phocoena*) from western European seas: Geographical trends, causal factors and effects on reproduction and mortality. *Environmental Pollution* 153(2):401–415.

Pirotta E., B. V. Laesser, A. Hardaker, N. Riddoch, and M. Marcoux. 2013. Dredging displaces bottlenose dolphins rom an urbanized foraging patch. *Marine Pollution Bulletin* 74(1):396–402. SSN 0025-326X. Available: https://doi.org/10.1016/j.marpolbul.2013.06.020.

Putland, R. L., N. D. Merchant, A. Farcas, and C. A. Radford. 2017. Vessel noise cuts down commercial space for vocalizing fish and marine mammals. *Glob Change Biol.* 2017:1–14. DOI: 10.1111/gcb.13996.

Quick, Nicola, Lindesay Scott-Hayward, Dina Sadykova, Doug Nowacek, and Andrew Read. 2017. "Effects of a Scientific Echo Sounder on the Behavior of Short-Finned Pilot Whales (Globicephala Macrorhynchus)." *Canadian Journal of Fisheries and Aquatic Sciences* 74(5):716–726. DOI: https://doi.org/10.1139/cjfas-2016-0293.

Raoux, A., S. Tecchio, J.-P. Pezy, G. Lassalle, S. Degraer, D. Wilhelmsson, M. Cachera, B. Ernande, C. Le Guen, M. Haraldsson, K. Grangeré, F. Le Loc'h, J.-C. Dauvin, and N. Niquil. 2017. Benthic and fish aggregation inside an offshore wind farm: Which effects on the trophic web functioning? *Ecological Indicators* 72:33–46.

Read A. J., P. Drinker, and S. Northridge. 2006. "Bycatch of Marine Mammals in U.S. and Global Fisheries." *Conservation Biology* 20(1):163–169. Available: https://conbio.onlinelibrary.wiley.com/doi/abs/10.1111/j.1523-1739.2006.00338.x?sid=nlm%3Apubmed.

Rees, D. R., D. V. Jones, and B. A. Bartlett. 2016. *Haul-out Counts and Photo-Identification of Pinnipeds in Chesapeake Bay, Virginia: 2015/16 Annual Progress Report*. Final Report. Prepared for U.S. Fleet Forces Command, Norfolk, Virginia. November 2016.

Reichmuth, C. 2007. Assessing the hearing capabilities of mysticete whales. A proposed research strategy for the Joint Industry Programme on Sound and Marine Life on 12 September. Available: http://www.soundandmarinelife.org/Site/Products/MysticeteHearingWhitePaper-Reichmuth.pdf.

Revolution Wind LLC (Revolution Wind). 2022a. *Petition for Incidental Take Regulations for the Construction and Operation of the Revolution Wind Offshore Wind Farm*. February.

Revolution Wind LLC (Revolution Wind). 2022b. *Construction and Operations Plan, Revolution Wind Farm Project.* July. Available: https://www.boem.gov/renewable-energy/state-activities/revolution-wind-farm-construction-and-operations-plan.

Richardson, W. J., B. Würsig, and C. R. Greene, Jr. 1990. Reactions of bowhead whales, Balaena mysticetus, to drilling and dredging noise in the Canadian Beaufort Sea. Marine Environmental Research 29(2):135–160. Available: https://doi.org/10.1016/0141-1136(90)90032-J.

Richardson, W. J., C. R. Greene, Jr., C. I. Malme, and D. H. Thomson. 1995. *Marine Mammals and Noise*. San Diego, CA: Academy Press. Available: https://www.elsevier.com/books/marine-mammals-and-noise/richardson/978-0-08-057303-8. Accessed: September 9, 2020.

Richardson, W. J., B. Wursig, and C. R. Greene. 1986. Reactions of bowhead whales, *Balaena mysticetus*, to seismic exploration in the Canadian Beaufort Sea. *J. Acoust. Soc. Am.* 79(4):1117–1128. DOI: 0001-4966 / 86 / 041117-12500.80.

Richardson, W. J., G. W. Miller, and C. R. Greene. 1999. Displacement of migrating bowhead whales by sounds from seismic surveys in shallow waters of the Beaufort Sea. *J. Acoust. Soc. Am.* 106:2281. Available: http://dx.doi.org/10.1121/1.427801.

Ridgway, S. H., and D. A. Carder. 2001. Assessing hearing and sound production in cetaceans not available for behavioural audiograms: Experiences with sperm, pygmy sperm, and gray whales. *Aquatic Mammals* 27:267–276.

Robbins, J. 2012. *Scar-based inference into Gulf of Maine Humpback whale entanglement*: 2010. Report to the Northeast Fisheries Science Center, National Marine Fisheries Service, Woods Hole, Massachusetts. Available: http://www.nefsc.noaa.gov/psb/docs/HUWHScarring%28Robbins2012%29.pdf.

Robbins, J., and D. K. Mattila. 2001. *Monitoring entanglements of humpback whales (Megaptera novaeangliae) in the Gulf of Maine on the basis of caudal peduncle scarring*. Scientific Committee meeting document SC/53/NAH25. International Whaling Commission, Cambridge, UK.

Roberts, J. J., and P. N. Halpin. 2022. *Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico*. Available: https://seamap.env.duke.edu/models/Duke/EC/ in HDR Inc. 2022. Ocean Wind 1 Offshore Wind Farm Updates to the Application for Marine Mammal Protection Act (MMPA) Rulemaking and Letter of Authorization – Provided in Provided in Attachment J-1 of Appendix J.

Roberts J. J., R. S. Schick, and P. N. Halpin. 2020. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2018–2020 (Option Year 3)*. Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.

Roberts, J. J., B. D. Best, L. Mannocci, E. Fujioka, P. N. Halpin, D. L. Palka, L. P. Garrison, K. D. Mullin, T. V. Cole, C. B. Khan, and W. A. McLellan. 2016a. Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico. *Scientific Reports* 6:22615.

Roberts, J. J., L. Mannocci, and P. N. Halpin. 2016b. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2015-2016 (Base Year)*. Version 1.0. Report by the Duke University Marine Geospatial Ecology Lab for Naval Facilities Engineering Command, Atlantic Durham, NC.

Roberts, J. J., L. Mannocci, and P. N. Halpin. 2017. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016–2017 (Opt. Year 1)*. Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.

Roberts, J. J., L. Mannocci, R. S. Schick, and P. N. Halpin. 2018. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017–2018 (Opt. Year 2)*. Document version 1.2 - 2018-09-21. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.

Roberts, J. J., R. S. Schick, and P. N. Halpin. 2021a. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2020 (Option Year 4)*. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.

Roberts, J. J., B. McKenna, L. Ganley, and C. Mayo. 2021b. *Right Whale Abundance Estimates for Cape Cod Bay in December*. Document version 3. Duke University Marine Geospatial Ecology Lab, Durham, NC.

Rolland, R. M., S. E. Parks, K. E. Hunt, M. Castellote, P. J. Corkeron, D. P. Nowacek, S. K. Wasser, and S. D. Kraus. 2012. Evidence that ship noise increases stress in right whales. *Proc. R. Soc. B.* DOI: 10.1098/rspb.2011.2429.

Ruppel, C. D., T. C. Weber, E. R. Staaterman, S. J. Labak, and P. E. Hart. 2022. Categorizing Active Marine Acoustic Sources Based on Their Potential to Affect Marine Animals. *J. Mar. Sci. Eng.* 10:1278. Available: https://doi.org/10.3390/jmse10091278.

Russel, D. J. F., S. M. J. M. Brasseur, D. Thompson, G. D. Hastie, V. M. Janik, G. Aarts, B. T. McClintock, J. Matthiopoulos, S. E. W. Moss, and B. McConnel. 2014. Marine mammals trace anthropogenic structures at sea. *Current Biology* 24(14):R638–R639.

Russell, D. J. F., G. D. Hastie, D. Thompson, V. M. Janik, P. S. Hammond, L. A. S. Scott-Hayward, J. Matthiopoulos, E. L. Jones, and B. J. McConnell. 2016. Avoidance of wind farms by harbour seals is limited to pile driving activities. *Journal of Applied Ecology* DOI:10.1111/1365-2664.12678.

Schakner, Z. A., and D. T. Blumstein. 2013. Behavior biology of marine mammal deterrents: A review and prospectus. *Biological Conservation* 167: 380–389. Available: http://dx.doi.org/10.1016/j.biocon.2013.08.024.

Scheifele, P. M., S. Andrew, R. A. Cooper, M. Darre, F. E. Musiek, and L. Max. 2004. Indication of a Lombard vocal response in the St. Lawrence River beluga. *Journal of the Acoustical Society of America* 17:1486–1492. DOI:10.1121/1.1835508.

Schofield, O., R. Chant, B. Cahill, R. Castelo, D. Gong, A. Kahl, J. Kohut, M. Montes-Hugo, R. Ramadurai, P. Ramey, X. Yi, and S. Glenn. 2008. The Decadal View of the Mid-Atlantic Bight from the COOLroom: Is Our Coastal System Changing? *Oceanography* 21(4):108–117.

Schultze, L. K. P., L. M. Merckelbach, J. Horstmann, S. Raasch, and J. R. Carpenter. 2020. Increased Mixing and Turbulence in the Wake of Offshore Wind Farm Foundations. J. *Geophys. Res. Oceans* 125:e2019JC015858. DOI: 10.1029/ 2019JC015858.

Slocum, C. J., A. Ferland, N. Furina, and S. Evert. 2005. What do harbor seals eat in New Jersey? A first report from the Mid-Atlantic region (USA). Page 262 in Abstracts, 16th Biennial Conference on the Biology of Marine Mammals. San Diego, CA, 12–16 December 2005.

Smith, C. R., T. K. Rowles, L. B. Hart, F. I. Townsend, R. S. Wells, E. S. Zolman, B. C. Balmer, B. Quigley, M. Ivnacic, W. McKercher, M. C. Tumlin, K. D. Mullin, J. D. Adams, Q. Wu, W. McFee, T. K. Collier, and L. H. Schwacke. 2017. "Slow Recovery of Barataria Bay Dolphin Health Following the Deepwater Horizon Oil Spill (2013–2014) with Evidence of Persistent Lung Disease and Impaired Stress Response." *Endangered Species Research* 33:127–142.

Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene, Jr., D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. *Aquatic Mammals* 33(4):411–521.

Southall, B. L., D. P. Nowacek, A. E. Bowles, V. Senigaglia, L. Bejder, and P. L. Tyack. 2021. Marine Mammal Noise Exposure Criteria: Assessing the Severity of Marine Mammal Behavioral Responses to Human Noise. *Aquatic Mammals* 47(5):421–464.

Southall, B. L., J. J. Finneran, C. Reichmuth, P. E. Nachtigall, D. R. Ketten, A. E. Bowles, W. T. Ellison, D. P. Nowacek, and P. L. Tyack. 2019. Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. *Aquatic Mammals* 45(2):125–232.

Sprogis, K. R., S. Videsen, and P. T. Madsen. 2020. Vessel noise levels drive behavioural response of humpack whales with implications for whale-watching. *eLife.* Available: https://doi.org/10.7554/eLife.5676.

Stöber, U. and F. Thomsen. 2021. How could operational underwater sound from future offshore wind turbines impact marine life? *Journal of the Acoustical Society of America* 149(3):1791–1795.

Sullivan, L., T. Brosnan, T. K. Rowles, L. Schwacke, C. Simeone, and T. K. Collier. 2019. *Guidelines for Assessing Exposure and Impacts of Oil Spills on Marine Mammals*. NOAA Tech. Memo. NMFS-OPR62, 82 pp.

Sunrise Wind LLC (Sunrise Wind). 2022a. *Petition for Incidental Take Regulations for the Construction and Operation of the Sunrise Wind Offshore Wind Farm.* May.

Sunrise Wind LLC (Sunrise Wind). 2022b. *Construction and Operations Plan, Sunrise Wind Farm Project.* August. Available: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/SRW01_COP_Rev3_2022-08-19_508_0.pdf.

Takeshita, R., L. Sullivan, C. Smith, T. Collier, A. Hall, T. Brosnan, T. Rowles, and L. Schwacke. 2017. "The Deepwater Horizon Oil Spill Marine Mammal Injury Assessment." *Endangered Species Research* 33:96–106.

Taormina, B., J. Bald, A. Want, G. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. A review of potential impacts of submarine power cables on the marine environment: Knowledge gaps, recommendations and future directions. Renewable and Sustainable Energy Reviews, Elsevier, 2018, 96, pp. 380–391. 10.1016/j.rser.2018.07.026. hal-02405630.

Taruski, A. G., C. E. Olney, and H. E. Winn. 1975. Chlorinated hydrocarbons in cetaceans. *Journal of the Fisheries Board of Canada* 32(11):2205–2209. In Hayes, S. A., E. Josephson, K. Maze-Foley, and P. E. Rosel. 2020. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2019*. NOAA Tech Memo NMFS-NE 264.

Teilmann, J., and J. Cartensen. 2012. "Negative Long-term Effects on Harbour Porpoises from a Large Scale Offshore Wind Farm in the Baltic—Evidence of Slow Recovery." *Environmental Resource Letters* 7(4):045101.

Todd, V. L. G., I. B. Todd, J. C. Gardiner, E. C. N. Morrin, N. A. MacPherson, N. A. DiMarzio, and F. Thomsen. 2015. A review of direct and indirect impacts of marine dredging activities on marine mammals. *ICES Journal of Marine Science* 72(2):328–340. Available: https://doi.org/10.1093/icesjms/fsu187.

Todd, V. L. G., L. D. Williamson, J. Jiang, S. E. Cox, I. B. Todd, and M. Ruffert. 2020. Proximate underwater soundscape of a North Sea offshore petroleum exploration jack-up drilling rig in the Dogger Bank. *Journal of the Acoustical Society of America* 148:3971. DOI: 10.1121/10.0002958.

Todd, V. L. G., W. D. Pearse, N. C. Tregenza, P. A. Lepper, and I. B. Todd. 2009. Diel echolocation activity of harbour porpoises (*Phocoena phocoena*) around North Sea offshore gas installations. *ICES Journal of Marine Science* 66:734–745.

Tougaard, J., J. Carstensen, J. Teilmann, H. Skov, and P. Rasmussen. 2009b. Pile driving zone of responsiveness extends beyond 20 km for harbour porpoises (Phocoena phocoena). *Journal of the Acoustical Society of America* 126:11–14.

Tougaard, J., L. Hermannsen, and P. T. Madsen. 2020. How loud is the underwater noise from operating offshore wind turbines? *Journal of the Acoustical Society of America* 148(5):2885–2893.

Tougaard, J., O. D. Henriksen, and Lee A. Miller. 2009a. Underwater noise from three types of offshore wind turbines: Estimation of impact zones for harbor porpoises and harbor seals. *Journal of the Acoustical Society of America* 125(6):3766–3773. DOI:10.1121/1.3117444.

Tricas, T., and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species*. Normandeau Associates, Inc. and Exponent Inc., Final Report submitted to the U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09. 426 pp.

Tsujii, K., T. Akamatsu, R. Okamoto, K. Mori, Y. Mitani, N. Umeda. 2018. Change in singing behavior of humpback whales cause by shipping noise. *PLOS ONE* 13(10): e0204112. Available: https://doi.org/10.1371/journal.pone.0204112.

Urick, R. J. 1983. *Principles of underwater sound* (3rd ed.). Los Altos Hills (CA): Peninsula Publishing.

U.S. Army Corps of Engineers (USACE). 2020. *Final Environmental Assessment National Regional Sediment Management (RSM) Program, WRDA 2016 Section 1122 Beneficial Use Pilot Project: Oyster Creek Channel Barnegat Inlet Federal Navigation Project Ocean County, New Jersey*. November. Available: https://www.nap.usace.army.mil/Portals/39/docs/Civil/Reports/Final-EA-Barn-Inlet-Section-1122-Oyster-Creek-November-2020.pdf?ver=SrZ2PrKeCtXGydSRoGZKzw%3d%3d. Accessed November 10, 2022.

U.S. Army Corps of Engineers (USACE). 2021. *Newark Bay, New Jersey Federal Navigation Project Maintenance Dredging*. Public Notice No. Newark Bay, NJ FY21. May.

U.S. Department of the Navy (Navy). 2017. *Technical Report: Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*. San Diego, California: SSC Pacific. Available: https://www.nwtteis.com/portals/nwtteis/files/technical_reports/Criteria_and_Thresholds_for_U.S._Navy_Acoustic_and_Explosive_Effects_Analysis_June2017.pdf.

U.S. Environmental Protection Agency (USEPA). 2016. *Climate Change Indicators: Oceans*. Available online: https://www.epa.gov/climate-indicators/oceans. Accessed: November 2021.

Vallejo, G. C., K. Grellier, E. J. Nelson, R. M. McGregor, S. J. Canning, F. M. Caryl, and N. McLean. 2017. Responses of two marine top predators to an offshore wind farm. *Ecology and Evolution* 7(21):8698–8708. doi.org/10.1002/ece3.3389.

van Berkel, J., H. Burchard, A. Christensen, L. O. Mortensen, O. S. Petersen, and F. Thomsen. 2020. The effects of offshore wind farms on hydrodynamics and implications for fishes. *Oceanography* 33(4):108–117.

van der Hoop, J., A. Vanderlaan, and C. Taggart. 2012. Absolute probability estimates of lethal vessel strikes to North Atlantic right whales in Roseway Basin, Scotian Shelf. *Ecological applications: a publication of the Ecological Society of America* 22:2021–2033. 10.2307/41723112.

Van Parjis, S. M., C. Curtice, and M. C. Ferguson. 2015. Biologically Important Areas for Cetaceans within U.S. Waters. *Aquatic Mammals* (Special Issue), 41(1).

Van Waerebeek, K., A. Baker, F. Felix, J. Gedamke, M. Iniguez, G. P. Sanino, E. D. Secchi, D. Sutaria, A. N. van Helden, and Y. Wang. 2007. Vessel Collisions with Small Cetaceans Worldwide and with Large Whales in the Southern Hemisphere, an Initial Assessment. *LAJAM* 6(1):43–49.

Vanderlaan, A. S. M., and C. T. Taggart. 2007. Vessel Collisions with Whales: The Probability of Lethal Injury Based on Vessel Speed. *Marine Mammal Science* 23(1):144–156. Available: https://www.phys.ocean.dal.ca/~taggart/Publications/Vanderlaan_Taggart_MarMamSci23_2007.pdf.

Veirs, S., V. Veirs, and J. D. Wood. 2016. Ship noise extends to frequencies used for echolocation by endangered killer whales. PeerJ 4:e1657; DOI 10.7717/peerj.1657.

Vires, G. 2011. *Echosounder Effects on Beaked Whales in the Tongue of the Ocean, Bahamas*. Masters of Environmental Management, Duke University.

Wang, J. W., and S. C. Yang. 2006. Unusual stranding events of Taiwan in 2004 and 2005. *J. Cetacean Res. Manage.* 8(3):283–292.

Waring, G. T., E. Josephson, K. Maze-Foley, and P. E. Rosel (eds.). 2011. *US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2010*. NOAA Technical Memorandum NMFS-NE-219. National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA.

Waring, G. T., E. Josephson, K. Maze-Foley, and P. E. Rosel (Editors). 2015. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments-2014*. NOAA Technical Memorandum NMFS-NE-231, Northeast Fisheries Science Center, Woods Hole, MA.

Wartzok, D., and D. R. Ketten. 1999. "Marine mammal sensory systems," in *Biology of Marine Mammals*, J, Reynolds and S. Rommel (Eds). Washington, DC: Smithsonian Institution Press. Pp. 117–175.

Weilgart, L. S. 2007. "The Impacts of Anthropogenic Ocean Noise on Cetaceans and Implications for Management." *Canadian Journal of Zoology* 85:1091–1116. Available: http://whitelab.biology.dal.ca/lw/publications/Weilgart%202007%20CJZ%20noise%20review.pdf.

Weisbrod, A. V., D. Shea, M. J. Moore, and J. J. Stegeman. 2000. Bioaccumulation patterns of polychlorinated biphenyls and chlorinated pesticides in northwest Atlantic pilot whales. *Environmental Toxicology and Chemistry: An International Journal* 19(3):667–677.

Wells, R. S., and M. D. Scott. 1997. Seasonal Incidence of Boat Strikes on Bottlenose Dolphins Near Sarasota, Florida. *Marine Mammal Science* 3:475–480.

Werner, S., A. Budziak, J. van Franeker, F. Galgani, G. Hanke, T. Maes, M. Matiddi, P. Nilsson, L. Oosterbaan, E. Priestland, R. Thompson, J. Veiga, and T. Vlachogianni. 2016. *Harm Caused by Marine Litter*. MSFD GES TG Marine Litter - Thematic Report; JRC Technical report; EUR 28317 EN. DOI:10.2788/690366.

Wilber, D. H., and D. G. Clarke. 2001. Biological effects of suspended sediments: A review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. *North American Journal of Fisheries Management* 21:855–875.

Williams, T. M., S. B. Blackwell, O. Tervo, E. Garde, M. S. Sinding, B. Richter, and M. P. Heide-Jorgensen. 2022. Physiological responses of narwhals to anthropogenic noise: A case study with seismic airguns and vessel traffic in the Arctic. *Functional Ecology* 2022;00:1–16. DOI: 10.1111/1365-2435.14119.

Wisehart, L. A., B. R. Dumbauld, J. L. Reusink, and S. D. Hacker. 2007. Importance of eelgrass early life history stages in response to aquaculture disturbance. *Marine Ecology Progress Series* 344:71–80. August 23, 2007.

Wisniewska, D. M., M. Johnson, J. Teilmann, U. Siebert, A. Galatius, R. Dietz, and P. T. Madsen. 2018. High rates of vessel noise disrupt foraging in wild harbour porpoises (Phocoena phocoena). *Proc. R. Soc. B* 285:20172314. Available: http://dx.doi.org/10.1098/rspb.2017.2314.

Würsig, B., C. R. Greene Jr., and T. A. Jefferson. 2000. Development of an air bubble curtain to reduce underwater noise of percussive piling. *Marine Environmental Research* 49(1):79–93.

Wynne, K., and M. Schwartz. 1999. *Guide to Marine Mammals & Turtles of the U.S. Atlantic & Gulf of Mexico*. Fairbanks: University of Alaska Press.

B.2.3.16. Section 3.16, Navigation and Vessel Traffic

Atlantic Shores Offshore Wind (Atlantic Shores). 2021. *Construction and Operations Plan, Atlantic Shores Offshore Wind*. Volume I. September. Available: https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-construction-and-operations-plan.

Bureau of Ocean Energy Management (BOEM). 2022. Ocean Wind Memo to File: Calculation for New Jersey Inter-array Buffer Distance. April 18.

Mid-Atlantic Regional Council of the Ocean (MARCO). 2020. Mid-Atlantic Ocean Data Portal [MARCO]. Available: http://portal.midatlanticocean.org/visualize/#x=-73.24&y=38.93&z=7&logo=true&controls=true&basemap=Ocean&tab=data&legends=false&layers=true. Accessed: January 17, 2019.

National Academies of Sciences, Engineering, and Medicine 2022. *Wind Turbine Generator Impacts to Marine Vessel Radar*. Washington, DC: The National Academies Press. https://doi.org/10.17226/26430.

National Oceanic and Atmospheric Administration (NOAA). 2023. *Coast Pilot Volume 2, Chapter 11, New York Harbor and Approaches – 52nd Edition.* January 15.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Ocean Wind LLC (Ocean Wind). 2023. citing MarineTraffic. 2020. Automatic Identification System data acquired from MarineTraffic, Historical AIS-T data (vessel positions) for TIMESTAMP between '2019-03-01 00:00' and '2020-02-29 23:59' UTC, LAT between 38.0 and 40.0 and LON between -75.2 and -73.0.

Sharples, Malcolm. 2011. *Offshore Electrical Cable Burial for Offshore Wind Farms on the OCS*. Prepared for Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) by Risk & Technology Consulting, Inc. November. Available: https://www.bsee.gov/sites/bsee.gov/files/tap-technical-assessment-program/final-report-offshore-electrical-cable-burial-for-wind-farms.pdf.

U.S. Coast Guard (USCG). 2016. *Atlantic Coast Port Access Route Study*. USCG-2011-0351. February 2016. Available: https://www.navcen.uscg.gov/?pageName=PARSReports. Accessed: October 12, 2021.

U.S. Coast Guard (USCG). 2019. *Navigation and Vessel Inspection Circular 01-19*. Available: https://www.mafmc.org/s/190801-Nav-Vess-Insp-Circ-01-19.pdf. Accessed: August 1, 2019.

U.S. Coast Guard (USCG). 2020a. Proposed Rule: "Shipping Safety Fairways Along the Atlantic Coast" 85 Federal Register 37034-37040 published Friday, June 19. Available: https://www.regulations.gov/document/USCG-2019-0279-0001. Accessed: October 11, 2022.

U.S. Coast Guard (USCG). 2020b. *The Areas Offshore of Massachusetts and Rhode Island Port Access Route Study. USCG 2019-0131*. May 14. Available: https://www.navcen.uscg.gov/pdf/PARS/FINAL_REPORT_PARS_May_14_2020.pdf. Accessed: October 13, 2021.

U.S. Coast Guard (USCG). 2021a. Draft *Port Access Route Study: Seacoast of New Jersey Including Offshore Approaches to the Delaware Bay, Delaware*. USCG-2020-0172. Available: https://downloads.regulations.gov/USCG-2020-0172-0044/content.pdf. Accessed: October 12, 2021.

U.S. Coast Guard (USCG). 2021b. U.S. Coast Guard Scoping Comments for the Ocean Wind Notice of Intent to Prepare an Environmental Impact Statement. Docket No. BOEM-2021-0024. May 6.

U.S. Coast Guard (USCG). 2021c. Search and Rescue Operations Near Offshore Wind Energy Projects. Fiscal Year 2020 Report to Congress. June 16.

U.S. Coast Guard (USCG). 2022a. Final *Port Access Route Study: Seacoast of New Jersey Including Offshore Approaches to the Delaware Bay, Delaware*. USCG-2020-0172. Available: https://www.federalregister.gov/documents/2022/03/24/2022-06228/port-access-route-study-seacoast-of-new-jersey-including-offshore-approaches-to-the-delaware-bay. Accessed: April 29, 2022.

U.S. Coast Guard (USCG). 2022b. *Consolidated Port Approaches and International Entry and Departure Transit Areas Port Access Route Studies (PARS) Integral to Efficiency of Possible Atlantic Coast Fairways*. USCG-2022-19546. Available: https://www.regulations.gov/document/USCG-2011-0351-0173. Accessed: November 13, 2022.

West, Stephen. 2022. Commander, USCG. Marine Transportation Specialist, Navigation Standards Division (CG-NAV-2), Office of Navigation Systems (CG-NAV). Emailed communication to Arianna Baker, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Environment Branch for Renewable Energy. March 29.

B.2.3.17. Section 3.17, Other Uses (Marine Minerals, Military Use, Aviation)

Bureau of Ocean Energy Management (BOEM). 2020. *Radar Inference Analysis for Renewable Energy Facilities on the Atlantic Outer Continental Shelf*. OCS Study BOEM 2020-039. Available: https://www.boem.gov/sites/default/files/documents/environment/Radar-Interferance-Atlantic-Offshore-Wind_0.pdf.

Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: https://www.boem.gov/vineyard-wind. Accessed: August 2021.

Cresitello, Donald E. 2020. Senior Coastal Planner, Planning and Policy Division, U.S. Army Corps of Engineers – North Atlantic Division. Emailed transmittal of unpublished NAD Sediment Needs Analysis to Jeffrey Waldner, P.G., Physical Scientist/Oceanographer, Bureau of Ocean Energy Management, Marine Minerals Division on September 1, 2020.

Hare, J. A., J. B. Blythe, K. H. Ford, S. Godfrey-McKee, B. R. Hooker, B. M. Jensen, A. Lipsky, C. Nachman, L. Pfeiffer, M. Rasser, and K. Renshaw. 2022. *NOAA Fisheries and BOEM Federal Survey Mitigation Strategy – Northeast U.S. Region.* NOAA Technical Memorandum NMFS-NE-292. Available: https://www.fisheries.noaa.gov/resource/document/federal-survey-mitigation-strategy-northeast-us-region. Accessed: December 13, 2022.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Ocean Wind LLC (Ocean Wind). 2023. Citing Westslope Consulting, LLC. 2019. Ocean Wind Project Basic Radar Line-of-Sight Study. Norman. November 6.

Patch. 2022. “County to Pay for Part of Berkeley Beach Replenishment.” Reporting by Veronica Flesher. Available: https://patch.com/new-jersey/berkeley-nj/county-pay-part-berkeley-beach-replenishment. Accessed: September 19, 2022.

Press of Atlantic City. 2022. “Dune erosion causes beach access closure in Strathmere.” Reporting by Bill Barlow. Available: https://pressofatlanticcity.com/news/local/dune-erosion-causes-beach-access-closure-in-strathmere/article_b8b4f8ec-0216-11ed-9734-937540d59342.html. Accessed: September 19, 2022.

Sample, Steven J. 2021. Executive Director, Military Aviation and Installation Assurance Siting Clearinghouse. Letter regarding results of Department of Defense review of the Ocean Wind COP sent to David MacDuffee, Chief, Projects and Coordination Branch, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. October 20, 2021.

B.2.3.18. Section 3.18, Recreation and Tourism

Atlantic Shores Offshore Wind (Atlantic Shores). 2021. *Construction and Operations Plan, Atlantic Shores Offshore Wind*. Volume I. September. Available: https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-construction-and-operations-plan.

Bureau of Ocean Energy Management (BOEM). 2012a. *Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development Impacts of Offshore Wind on Tourism and Recreation Economies*. BOEM 2012-085. Available: https://espis.boem.gov/final%20reports/5228.pdf.

Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012.

Bureau of Ocean Energy Management (BOEM). 2021b. *South Fork Wind Farm and South Fork Export Cable Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Page 3-189.

Burlington County. No date. Parks Interactive Map. Available: https://www.co.burlington.nj.us/552/Parks-Interactive-Map.

Cape May County. No date. Department of Tourism. Tourism Impacts in Cape May County. Available: https://capemaycountynj.gov/DocumentCenter/View/79/Tourism-Impacts-in-Cape-May-County-PDF.

Carr-Harris, A. and C. Lang. 2019. Sustainability and Tourism: The Effect of the United States' First Offshore Wind Farm on the Vacation Rental Market. *Resource and Energy Economics* 57:51–67. Available: https://www.sciencedirect.com/science/article/abs/pii/S0928765518302902 #sec0060%20study.

CSA Ocean Sciences, Inc. and Exponent. 2019. *Evaluation of Potential EMF Effects on Fish Species of Commercial or Recreational Fishing Importance in Southern New England*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Headquarters, Sterling, VA. OCS Study BOEM 2019-049.

Cumberland County. 2021. Tourism and Recreation. Available: http://www.co.cumberland.nj.us/Tourism.

Haughton, J., D. Giuffre, and J. Barrett. 2003. *Blowing in the Wind: Offshore Wind and the Cape Cod Economy*. The Beacon Hill Institute. Available: https://www.beaconhill.org/BHIStudies/BHIWindFarmStudy102803a.pdf. Accessed: October 7, 2022.

Kirkpatrick, A. J., S. Benjamin, G. S. DePiper, T. Murphy, S. Steinback, and C. Demarest. 2017. *Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic*. Volume I—Report Narrative. U.S Dept. of the Interior, Bureau of Ocean Energy Management, Atlantic OCS Region, Washington, D.C. OCS Study BOEM 2017-012. 150 pp. Available: https://espis.boem.gov/final%20reports/5580.pdf. Accessed October 22, 2021.

Lutzeyer, S., D. J. Phaneuf, and L. O. Taylor. 2017. *The Amenity Costs of Offshore Windfarms: Evidence from a Choice Experiment*. (CEnREP Working Paper No. 17-017). Raleigh, NC: Center for Environmental and Resource Economic Policy. August 2017.

Mid-Atlantic Regional Council on the Ocean (MARCO). 2018. Data Portal. Recreational Boating Survey. Available: http://midatlanticocean.org/data-portal/.

National Oceanic and Atmospheric Administration (NOAA). No date. Fisheries One Stop Shop (FOSS). Available: https://www.fisheries.noaa.gov/foss/f?p=215:200:13647185114733:Mail:NO. Accessed March 23, 2022.

National Oceanic and Atmospheric Administration (NOAA). 2022a. Marine Recreational Information Program (MRIP) Survey Directories. Available: https://www.st.nmfs.noaa.gov/msd/html/siteRegister.jsp. Accessed: April 13, 2022.

National Oceanic and Atmospheric Administration (NOAA). 2022b. *Social Indicators for Coastal Communities.* Available: https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-coastal-communities. Accessed: April 1, 2022.

National Oceanic and Atmospheric Administration (NOAA). 2022c. *Fisheries Economics of the United States 2019*. Economics and Sociocultural Status and Trends Series. NOAA Technical Memorandum NMFS-F/SPO-229A. Available: https://media.fisheries.noaa.gov/2022-07/FEUS-2019-final-v3_0.pdf. Accessed: September 19, 2022.

National Park Service (NPS). 2021. *Land and Water Conservation Fund State Assistance Program*. Federal Financial Assistance Manual Volume 71. Available: https://www.nps.gov/subjects/lwcf/upload/LWCF-FA-Manual-Vol-71-3-11-2021-final.pdf.

New Jersey Casino Reinvestment Development Authority (NJCRDA). 2012. *Atlantic City: Tourism District Master Plan*. Volume 1. Available: https://njcrda.com/wp-content/uploads/documents/2021/06/Tourism-District-Master-Plan-Vol.1.pdf.

New Jersey Department of Environmental Protection (NJDEP). 2018a. *2018–2022 New Jersey Statewide Comprehensive Outdoor Recreation Plan*. Green Acres Program. September. Available: https://www.state.nj.us/gspt/pdf/Reports/DEPComprehensiveOutdoorRecreationPlan.pdf.

New Jersey Department of Environmental Protection (NJDEP). 2018b. Blue Claws: Crabbing in New Jersey. Available: https://www.state.nj.us/dep/fgw/blueclaw.htm.

New Jersey Department of Environmental Protection (NJDEP). 2018c. Division of Fish and Wildlife. Tuckahoe WMA Impoundment Management. Available: https://www.state.nj.us/dep/fgw/news/2018/tuckahoe_improvements18-2.htm.

New Jersey Department of Environmental Protection (NJDEP). 2021a. Division of Fish and Wildlife. Wildlife Management Areas. Available: https://www.state.nj.us/dep/fgw/wmaland.htm.

New Jersey Department of Environmental Protection (NJDEP). 2021b. Parks by Location. Available: https://www.njparksandforests.org/map.html.

New Jersey Department of State. 2021a. Division of Travel and Tourism. Surfing New Jersey. Available: https://www.visitnj.org/article/surfing-new-jersey.

New Jersey Department of State. 2021b. Division of Travel and Tourism. New Jersey Sailing Center. Available: https://www.visitnj.org/nj-charter-boats/new-jersey-sailing-center.

New Jersey Department of State. 2021c. Division of Travel and Tourism. Edwin B. Forsythe National Wildlife Refuge. Available: https://visitnj.org/nj-hiking/edwin-b-forsythe-national-wildlife-refuge.

New Jersey Department of State. 2021d. Division of Travel and Tourism. Barnegat Lighthouse State Park. Available: https://www.visitnj.org/nj-lighthouses/barnegat-lighthouse-state-park.

Ocean County. 2021. Department of Parks and Recreation. Ocean County Parks. Available: http://www.oceancountyparks.org/.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Orr, Terry L., Susan M. Herz, and Darrell L. Oakley. 2013. *Evaluation of Lighting Schemes for Offshore Wind Facilities and Impacts to Local Environments*. Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-0116. Available: https://espis.boem.gov/final%20reports/5298.pdf.

Parsons, George, and Jeremy Firestone. 2018. *Atlantic Offshore Wind Energy Development: Values and Implications for Recreation and Tourism*. U.S. Department of the Interior, Bureau of Ocean Energy Management. Available: https://www.semanticscholar.org/paper/Atlantic-Offshore-Wind-Energy-Development%3A-Values-Parsons-Firestone/91b0ede146b8701cb44d72c58f09b29533df3cdf.

Parsons, G., J. Firestone, L. Yan, J. Toussaint. 2020. The Effect of Offshore Wind Power Projects on Recreational Beach Use on the East Coast of the United States: Evidence from Contingent-Behavior Data. *Energy Policy* 144:111659. Available: https://www.sciencedirect.com/science/article/abs/pii/S030142152030389X.

Smythe, T., H. Smith, A. Moore, D. Bidwell, and J. McCann. 2018. *Analysis of the Effects of Block Island Wind Farm (BIWF) on Rhode Island Recreation and Tourism Activities*. U.S. Department of the Interior, Bureau of Ocean Energy Management. Sterling, Virginia. OCS Study BOEM 2018-068. Available: https://espis.boem.gov/final%20reports/BOEM_2018-068.pdf.

Tourism Economics. 2021. Economic Impact of Tourism in New Jersey, 2021. Available: https://visitnj.org/sites/default/files/Economic_Impact_of_Tourism_in_New_Jersey_2021_Final.pdf?tag=itinerary.

U.S. Census Bureau. 2021a. ACS Business and Economy Estimates. 2015–2019 American Community Survey 5-Year Estimates. Available: https://data.census.gov/cedsci/all?q=&text=at-place%20employment&t=Business%20and%20Economy. Accessed: September 15, 2021.

U.S. Census Bureau. 2021b. ACS Employment and Payroll Estimates. 2015–2019 American Community Survey 5-Year Estimates. Available: https://data.census.gov/cedsci/all?q=&text=at-place%20employment&t=Payroll. Accessed: September 15, 2021.

B.2.3.19. Section 3.19, Sea Turtles

Alpine Ocean Seismic Survey, Inc. (Alpine). 2017. *Ocean Wind High Resolution Geophysical and Geotechnical Survey, Protected Species Observer Report*. Survey Report for Alpine Ocean Seismic Survey Inc. on behalf of Ocean Wind LLC.

Bailey, H., S. R. Benson, G. L. Shillinger, S. J. Bograd, P. H. Dutton, S. A. Eckert, S. J. Morreale, F. V. Paladino, T. Eguchi, D. G. Foley, B. A. Block, R. Piedra, C. Hitipeuw, R. F. Tapilatu, and J. R. Spotila. 2012. Identification of distinct movement patterns in Pacific leatherback turtle populations influenced by ocean conditions. *Ecological Applications* 22(3):735–747.

Barkaszi, M. J., M. Fonseca, T. Foster, A. Malhotra, and K. Olsen. 2021. *Risk Assessment to Model Encounter Rates between Large Whales and Sea Turtles and Vessel Traffic from Offshore Wind Energy on the Atlantic OCS*. OCS Study BOEM 2021-034. April 2021. Available: https://espis.boem.gov/final%20reports/BOEM_2021-034.pdf. Accessed: November 7, 2022.

Barnette, M. C. 2017. *Potential impacts of artificial reef development on sea turtle conservation in Florida*. NNMFS Southeast Regional Office, St. Petersburg, FL. January 2017. NOAA Technical Memorandum. NMFS-SER5. Available: https://tethys.pnnl.gov/sites/default/files/publications/NOAA-2017-SeaTurtle.pdf. Accessed: November 16, 2021.

Bartol, S. M., and D. R. Ketten. 2006. "Turtle and Tuna Hearing." In *Sea Turtle and Pelagic Fish Sensory Biology: Developing Techniques to Reduce Sea Turtle Bycatch in Longline Fisheries*, edited by Y. Swimmer and R. Brill, 98-105. NOAA Technical Memorandum. NMFS-PIFSC-7.

Bartol, S. M., and I. K. Bartol. 2011. Hearing Capabilities of Loggerhead Sea Turtles (*Caretta caretta*) Throughout Ontogeny: an Integrative Approach Involving Behavioral and Electrophysical Techniques. Final Report submitted to the Joint Industries Programme. 35 pp.

Bartol, S. M., J. A. Musick, and M. L. Lenhardt. 1999. Auditory evoked potentials of the loggerhead sea turtle (*Caretta caretta*). *Copeia* 1999(3):836–840.

Bejarano, A. C., J. Michel, J. Rowe, Z. Li, D. French McCay, L. McStay and D. S. Etkin. 2013. *Environmental Risks, Fate and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf*. US Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2013-213.

Berreiros J. P., and V. S. Raykov. 2014. Lethal lesions and amputation caused by plastic debris and fishing gear on the loggerhead turtle Caretta (Linnaeus, 1758). Three case reports from Terceira Island, Azores (NE Atlantic). *Marine Pollution Bulletin* 86:518–522.

Bolten, A. B., L. B. Crowder, M. G. Dodd, A. M. Lauritsen, J. A. Musick, B. A. Schroeder, and B. E. Witherington. 2019. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*) Second Revision (2008): Assessment of progress for recovery. December 2019. 21 pp. Available: https://media.fisheries.noaa.gov/dam-migration/final_nw_atl_cc_recovery_team_progress_review_report_508.pdf. Accessed November 7, 2022.

Borcuk, J. R., G. H. Mitchell, S. L. Watwood, T. E. Moll, E. M. Oliveira, and E. R. Robinson. 2017. *Dive distribution and group size parameters for marine species occurring in the U.S. Navy's Atlantic and Hawaii-Southern California training and testing study areas*. Naval Undersea Warfare Center Division. Newport, Rhode Island. NUWC-NPT Technical Report 12,243. June 2017. Available: https://apps.dtic.mil/sti/pdfs/AD1046608.pdf. Accessed: June 28, 2022.

Brazner, J. C., and J. McMillan. 2008. Loggerhead turtle (Caretta caretta) bycatch in Canadian pelagic longline fisheries: relative importance in the western North Atlantic and opportunities for mitigation. *Fisheries Research* 91(2–3):310–324.

Bugoni, L., L. Krause, and M. V. Petry. 2001. Marine debris and human impacts on sea turtles in southern Brazil. *Marine Pollution Bulletin* 42(12):1330–1334.

Bureau of Ocean Energy Management (BOEM). 2012. *Atlantic OCS Proposed Geological and Geophysical Activities: Final Programmatic Environmental Impact Statement*. Mid-Atlantic and South Atlantic Planning Areas. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2014-001. March 2012. Available: https://www.boem.gov/oil-gas-energy/atlantic-geological-and-geophysical-gg-activities-programmatic-environmental-impact. Accessed: August 20, 2021.

Bureau of Ocean Energy Management (BOEM). 2018. *Biological Assessment: Data Collection and Site Survey Activities for Renewable Energy of the Atlantic Outer Continental Shelf*. U.S. Department of the Interior Bureau of Ocean Energy Management, Office of Renewable Energy Programs.

Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: https://www.boem.gov/vineyard-wind.

Bureau of Ocean Energy Management (BOEM). 2021b. *South Fork Wind Farm and South Fork Export Cable Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2020-057. Available: https://www.boem.gov/renewable-energy/state-activities/sfwf-feis.

Bureau of Ocean Energy Management (BOEM). 2022. *Ocean Wind Offshore Wind Farm Biological Assessment for National Marine Fisheries Service.* [Month].

Burke, V. J., E. A. Standora, and S. J. Morreale. 1993. Diet of juvenile Kemp's ridley and loggerhead sea turtles from Long Island, New York. *Copeia* 1993(4):1176–1180.

Burke V., S. Morreale, and E. Standora. 1994. Diet of the Kemp's ridley sea turtle, Lepidochelys kempii, in New York waters. *Fishery Bulletin* 92:26–32.

Byles, R. A. 1988. *The Behavior and Ecology of Sea Turtles in Virginia*. Unpublished Ph.D. dissertation, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA.

Carr, A., and D. Caldwell. 1956. The ecology and migrations of Sea Turtles, I. Results of field work in Florida, 1955. *American Museum Novitates* 1793:1–23.

Ceriani, S. A., J. D. Roth, C. R. Sasso, C. M. McClellan, M. C. James, H. L. Haas, R. J. Smolowitz, D. R. Evans, D. S. Addison, D. A. Bagley, and L. M. Ehrhart. 2014. Modeling and mapping isotopic patterns in the Northwest Atlantic derived from loggerhead sea turtles. *Ecosphere* 5(9)1–24.

Conserve Wildlife Foundation of New Jersey. 2021. *New Jersey Endangered and Threatened Species Field Guide*. Available: http://www.conservewildlifenj.org/species/fieldguide/. Accessed: August 20, 2021.

Degraer, S., D. Carey, J. Coolen, Z. Hutchison, F. Kerckhof, B. Rumes, and J. Vanaverbeke. 2020. Offshore Wind Farm Artificial Reefs Affect Ecosystem Structure and Functioning: A Synthesis. *Oceanography* 33(4):48–57.

Denes, S. L., D. G. Zeddies, and M. M. Weirathmueller. 2021. *Turbine Foundation and Cable Installation at South Fork Wind Farm: Underwater Acoustic Modeling of Construction Noise*. Appendix J1 in *Construction and Operations Plan South Fork Wind Farm*. Silver Spring, Maryland: JASCO Applied Sciences.

DeRuiter, S. L., and K. L. Doukara. 2012. Loggerhead turtles dive in response to airgun sound exposure. Loggerhead turtles dive in response to airgun sound exposure. *Endangered Species Research* 16: 55–63. Available: https://www.seaturtles911.org/research/publications/DeRuiter_2012_Loggerhead_turtles_dive_in_response_to_airgun_sound_exposure.pdf. Accessed: April 1, 2022.

Dickerson, D., M. S. Wolters, C. Theriot, and C. Slay. 2004. September. Dredging impacts on sea turtles in the Southeastern USA: a historical review of protection. In *Proceedings of World Dredging Congress XVII*, Dredging in a Sensitive Environment (Vol. 27).

Eastman, C. B., J. A. Farrell, L. Whitmore, D. R. Rollinson Ramia, R. S. Thomas, J. Prine, S. F. Eastman, T. Z. Osborne, M. Q. Martindale, and D. J. Duffy. 2020. Plastic ingestion in post-hatchling sea turtles: Assessing a major threat in Florida near shore waters. *Frontiers in Marine Science* 25, August 2020.

Eckert, K. L., B. P. Wallace, J. G. Frazier, S. A. Eckert, and P. C. H. Pritchard. 2012. *Synopsis of the Biological Data on Leatherback Sea Turtles (Dermochelys coriacea)*. US. Department of the Interior, Fish and Wildlife Service, Biological Technical Publication BTP-R4015-2012, Washington D.C. Available: http://seaturtle.org/library/EckertKL_2012_USFWSTechReport.pdf. Accessed: April 1, 2022.

Edmonds, N. J., C. J. Firmin, D. Goldsmith, R. C. Faulkner, and D. T. Wood. 2016. A review of crustacean sensitivity to high amplitude underwater noise: Data needs for effective risk assessment in relation to UK commercial species. *Marine Pollution Bulletin* 108(1):5–11.

Epperly, S., L. Avens, L. Garrison, T. Henwood, W. Hoggard, J. Mitchell, J. Nance, J. Poffenberger, C. Sasso, E. Scott-Denton, and C. Yeung. 2002. *Analysis of Sea Turtle Bycatch in the Commercial Shrimp Fisheries of Southeast U.S. Waters and the Gulf of Mexico*. NOAA Technical Memorandum NMFS-SEFSC-490:1–88.

Excelon Generation. 2012. *Annual sea turtle incidental take report – 2012*. Oyster Creek Nuclear Generating Station report submitted to NMFS. Prepared by M. Browne, K. Voishnis, and J. Kerr. December 2012. Available: https://www.nrc.gov/docs/ML1236/ML12361A025.pdf. Accessed: November 16, 2021.

Finkbeiner, E. M., B. P. Wallace, J. E. Moore, R. L. Lewison, L. B. Crowder, and A. J. Read. 2011. Cumulative estimates of sea turtle bycatch and mortality in USA fisheries between 1990 and 2007. *Biological Conservation* 144(11):2719–2727.

Finneran, J., E. Henderson, D. Houser, K. Jenkins, S. Kotecki, and J. Mulsow. 2017. *Criteria and Thresholds for US Navy Acoustic and Explosive Effects Analysis (Phase III)*. Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 pp.

Foley, A. M., B. A. Stacy, R. F. Hardy, C. P. Shea, K. E. Minch, and B. A. Schroeder. 2019. Characterizing Watercraft-Related Mortality of Sea Turtles in Florida. *The Journal of Wildlife Management* 83(5):1057–1072. Available: https://wildlife.onlinelibrary.wiley.com/doi/pdf/10.1002/jwmg.21665. Accessed: April 1, 2022.

Foley, A. M., K. Singel, R. Hardy, R. Bailey, K. Sonderman, and S. Schaf. 2008. *Distributions, relative abundances, and mortality factors for sea turtles in Florida from 1980 through 2007 as determined from strandings*. Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Jacksonville Field Laboratory. Available: https://georgehbalazs.com/wp-content/uploads/2020/03/Stranding-Report-2007.pdf. Accessed: November 16, 2021.

Gitschlag, G. R., and B. A. Herczeg. 1994. Sea Turtle Observations at Explosive Removals of Energy Structures. *Marine Fisheries Review* 56(2):1–8.

Greater Atlantic Regional Fisheries Office (GARFO). 2021. Master ESA Species Table - Sea Turtles. Available: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-presence-table-sea-turtles-greater.

Gregory, M. R. 2009. Environmental implications of plastic debris in marine settings – Entanglement, ingestion, smothering, hangers-on, hitch-hiking, and alien invasion. *Philosophical Transactions of the Royal Society* B 364:2013–2025.

Hastings, R. W., L. H. Ogren, and M. T. Marbry. 1976. Observations of Fish Fauna Associated with Offshore Platforms in the Northeastern Gulf of Mexico. *Fisheries Bulletin* 74(2):387–402.

Hazel, J., I. Lawler, H. Marsh, and S. Robson. 2007. Vessel speed increases collision risk for the green turtle Chelonia mydas. *Endangered Species Research* 3:105–113.

Heithaus, M. R., J. J. McLash, A. Frid, L. W. Dill, and G. J. Marshall. 2002. Novel insights into green sea turtle behavior using animal-borne video cameras. Journal *of the Marine Biological Association of the UK* 82(06):1049–1050.

Henwood, T. A., and W. E. Stuntz. 1987. Analysis of sea turtle captures and mortalities during commercial shrimp trawling. *Fisheries Bulletin* 85(4):814–817.

Hoarau, L., L. Ainley, C. Jean, and S. Ciccione. 2014. Ingestion and defecation of marine debris by loggerhead sea turtles, from by-catches in the south-west Indian Ocean. *Marine Pollution Bulletin* 84:90–96.

Hochscheid, S. 2014. Why we mind sea turtles' underwater business: A review on the study of diving behavior. *Journal of Experimental Marine Biology and Ecology*, 450:118–136.

Hutchison, Z. L., M. L. Bartley, S. Degraer, P. English, A. Khan, J. Livermore, B. Rumes, and J. W. King. 2020. Offshore wind energy and benthic habitat changes: Lessons from Block Island Wind Farm. *Oceanography* 33(4):58–69.

James, M. C., S. A. Sherrill-Mix, K. Martin, and R. A. Myers. 2006. Canadian waters provide critical foraging habitat for leatherback sea turtles. *Biological Conservation* 133:347–357.

Janßen, H., C. B. Augustin, H. H. Hinrichsen, and S. Kube. 2013. Impact of secondary hard substrate on the distribution and abundance of *Aurelia aurita* in the western Baltic Sea. *Marine Pollution Bulletin* 75: 224–234.

Johnson, A. 2018. *The effects of turbidity and suspended sediments on ESA-listed species from projects occurring in the Greater Atlantic Region*. Greater Atlantic Region Policy Series 18-02. NOAA Fisheries Greater Atlantic Regional Fisheries Office. 106 pp. Available: https://www.greateratlantic.fisheries.noaa.gov/policyseries/index.php/GARPS/article/view/8/8. Accessed: April 1, 2022.

Ketten, D. R., and S. M. Bartol. 2006. *Functional measures of sea turtle hearing*. Woods Hole Oceanographic Institution, Woods Hole, Massachusetts. Available: www.ntis.gov.

Kraus, S. D., S. Leiter, K. Stone, B. Wikgren, C. Mayo, P. Hughes, R. D. Kenney, C. W. Clark, A. N. Rice, B. Estabrook and J. Tielens. 2016. *Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles.* OCS Study BOEM 2016-054. Sterling, Virginia: U.S. Department of the Interior, Bureau of Ocean Energy Management.

Lavender, A. L., S. M. Bartol, and I. K. Bartol. 2014. Ontogenetic investigation of underwater hearing capabilities in loggerhead sea turtles (*Caretta caretta*) using a dual testing approach. *Journal of Experimental Biology* 217:2580–2589.

Lazell, J. D., Jr. 1980. New England waters: Critical habitat for marine turtles. *Copeia* 1980(2):290–295.

Lohmann, K. J., N. F. Putman, and C. M. F. Lohmann. 2008. Geomagnetic Imprinting: a Unifying Hypothesis of Long-Distance Natal Homing in Salmon and Sea Turtles. *Proceedings of the National Academy of Sciences* 105(49):19096–190101.

Luschi, P., S. Benhamou, C. Girard, S. Ciccione, D. Roos, J. Sudre, and S. Benvenuti. 2007. Marine Turtles use Geomagnetic Cues during Open Sea Homing. *Current Biology* 17:126–133. Available: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.572.8884&rep=rep1&type=pdf. Accessed: April 1, 2022.

Lutcavage, M. E., and P. L. Lutz. 1997. Diving physiology. In: Lutz P. L, Musick J. A, editors. *The biology of sea turtles*. CRC Press; Boca Raton, FL: pp. 277–296.

Martin, K. J., S. C. Alessi, J. C. Gaspard, A. D. Tucker, G. B. Bauer, and D. A. Mann. 2012. Underwater hearing on the loggerhead turtle (*Caretta caretta*): A comparison of behavioral and auditory evoked potential audiograms. *Journal of Experimental Biology* 215(17):3001–3009.

Mavraki, N., S. Degraer, J. Vanaverbeke, and U. Braeckman. 2020. Organic matter assimilation by hard substrate fauna in an offshore wind farm area: a pulse-chase study. *ICES Journal of Marine Science* 77:2681–2693.

Mazor, T., N. Levin, H. P. Possingham, Y. Levy, D. Rocchini, A. J. Richardson, et al. 2013. Can satellite-based night lights be used for conservation? The case of nesting sea turtles in the Mediterranean. *Biological Conservation* 159:63–72. Available: https://karkgroup.org/wp-content/uploads/Mazor-et-al-2013-sea-turtles.pdf. Accessed: April 8, 2022.

McCauley, R. D., J. Fewtrell, A. J. Duncan, C. Jenner, M.-N. Jenner, J. D. Penrose, R. I. T. Prince, A. Adhitya, J. Murdoch, and K. McCabe. 2000. Marine seismic surveys: a study of environmental implications. *The APPEA Journal* 40:692–708.

McKenna, M. F., D. Ross, S. M. Wiggins, and J. A. Hildebrand. 2012. Underwater radiated noise from modern commercial ships. *Journal of the Acoustical Society of America* 131(1):92–103. Available: https://www.cetus.ucsd.edu/docs/publications/McKennaJASA2012.pdf. Accessed: April 6, 2022.

Methratta, E. T., and W. R. Dardick. 2019. Meta-Analysis of Finfish Abundance at Offshore Wind Farms. *Reviews in Fisheries Science & Aquaculture* 27(2):242–260.

Meylan, A. 1995. Sea turtle migration: Evidence from tag returns. In *Biology and Conservation of Sea Turtles* (revised), edited by K. A. Bjorndal, pp. 91–100. Washington, D.C.: Smithsonian Institution Press.

Michel, J. A., C. Bejarano, C. H. Peterson, and C. Voss. 2013. *Review of biological and biophysical impacts from dredging and handling of offshore sand*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Herndon, VA. OCS Study BOEM 2013-0119. 258 pp. Available: https://espis.boem.gov/final%20reports/5268.pdf. Accessed: November 16, 2021.

Miller, J. H., and G. R. Potty. 2017. Overview of underwater acoustic and seismic measurements of the construction and operation of the Block Island Wind Farm. *Journal of the Acoustical Society of America* 141(5):3993. DOI:10.1121/1.4989144. Available: https://asa.scitation.org/doi/10.1121/1.4989144. Accessed: April 1, 2022.

Minerals Management Service (MMS). 2007. *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf*. Available: https://www.boem.gov/Guide-To-EIS/. Accessed: January 1, 2019.

Moein, S. E., J. A. Musick, J. A. Keinath, D. E. Barnard, M. Lenhardt, and R. George. 1994. *Evaluation of seismic sources for repelling sea turtles from hopper dredges*. Final report submitted to the U.S. Army Corps of Engineers Waterways Experimental Station by the Virginia Institute of Marine Science, College of William and Mary. Gloucester Point, VA.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1991. Recovery Plan for U.S. Population of the Atlantic Green Turtle (*Chelonia mydas*). Washington, D.C.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1992. Recovery Plan for Leatherback Turtles (*Dermochelys coriacea*) in the U.S. Caribbean, Atlantic and Gulf of Mexico. Silver Spring, Maryland: National Marine Fisheries Service.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007a. Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) 5-Year Review: Summary and Evaluation. Silver Spring, Maryland: National Marine Fisheries Service, Office of Protected Resources; Albuquerque, New Mexico: U.S. Fish and Wildlife Service, Southwest Region.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007b. Green Sea Turtle (*Chelonia mydas*) 5-Year Review: Summary and Evaluation. August.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007c. Loggerhead Sea Turtle (Caretta caretta) 5-Year Review: Summary and Evaluation. National Fisheries Service, Washington, D.C.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2013. Leatherback Sea Turtle (*Dermochelys coriacea*) 5-Year Review: Summary and Evaluation. Silver Spring, Maryland, and Jacksonville, Florida. November.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2015a. Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) 5-Year Review: Summary and Evaluation. Silver Spring, Maryland, and Albuquerque, New Mexico. July.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2015b. Green Turtle (*Chelonia mydas*) Status Review under the U.S. Endangered Species Act. Report of the Green Turtle Status Review Team.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2020. Endangered Species Act Status Review of the Leatherback Turtle (*Dermochelys coriacea*). Report to the National Marine Fisheries Service Office of Protected Resources and U.S. Fish and Wildlife Service.

National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and Secretariat of Environment and Natural Resources. 2011. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). Second revision. Silver Spring, Maryland: National Marine Fisheries Service, U.S. Fish and Wildlife Service, and Secretariat of Environment and Natural Resources.

National Marine Fisheries Service (NMFS). 2016. Endangered Species Act Section 7 Consultation on the Continued Prosecution of Fisheries and Ecosystem Research Conducted and Funded by the Northeast Fisheries Science Center and the Issuance of a Letter of Authorization under the Marine Mammal Protection Act for the Incidental Take of Marine Mammals Pursuant to those Research Activities PCTS ID: NER-2015-12532. Available: https://media.fisheries.noaa.gov/dam-migration/nefsc_rule2016_biop.pdf. Accessed: April 1, 2022.

National Marine Fisheries Service (NMFS). 2019. Kemp's Ridley Turtle *Lepidochelys kempii*. Species Directory. Available: https://www.fisheries.noaa.gov/species/kemps-ridley-turtle. Accessed: December 7, 2020.

National Marine Fisheries Service (NMFS). 2020. *Section 7 Effect Analysis: Turbidity in the Greater Atlantic Region: Guidance for action agencies to address turbidity in their Effects Analysis*. NOAA Greater Atlantic Regional Fisheries Office. Available: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effect-analysis-turbidity-greater-atlantic-region. Accessed: November 16, 2021.

National Marine Fisheries Service (NMFS). 2021a. Sea Turtle Stranding and Salvage Network Public. Annual data reports for Zone 39, in New Jersey. Available: https://grunt.sefsc.noaa.gov/stssnrep/SeaTurtleReportI.do?action=reportquery. Accessed: September 21, 2021.

National Marine Fisheries Service (NMFS). 2021b. Section 7 Consultation with GARFO - Effects of certain site assessment and site characterization activities to be carried out to support the siting of offshore wind energy development projects off the U.S. Atlantic coast.

National Oceanic and Atmospheric Administration (NOAA). 2013. *Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals: Acoustic threshold levels for onset of permanent and temporary threshold shifts*. December 2013, 76 pp. Silver Spring, Maryland: NMFS Office of Protected Resources. Available: http://www.nmfs.noaa.gov/pr/acoustics/draft_acoustic_guidance_2013.pdf.

National Park Service (NPS). 2021. Review of the Sea Turtle Science and Recovery Program at Padre Island National Seashore. Approved June 8, 2020; Amended May 7, 2021. Available: https://www.nps.gov/pais/learn/management/upload/PAIS-STSR-Review-Report_20210507_FINALamended_508.pdf.

National Research Council. 1990. *Decline of the Sea Turtles: Causes and Prevention*. Washington, D.C.: National Academy Press. 280 pp. Available: https://nap.nationalacademies.org/catalog/1536/decline-of-the-sea-turtles-causes-and-prevention. Accessed: March 28, 2002.

National Science Foundation (NSF) and U.S. Geological Survey (USGS). 2011. *Final Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research*. Available: https://www.nsf.gov/geo/oce/envcomp/usgs-nsf-marine-seismic-research/nsf-usgs-final-eis-oeis_3june2011.pdf. Accessed: August 20, 2021.

Nelms, S. E., E. M. Duncan, A. C. Broderick, T. S. Galloway, M. H. Godfrey, M. Hamann, P. K. Lindeque, and B. J. Godley. 2016. Plastic and marine turtles: A review and call for research. *ICES Journal of Marine Science* 73(2):165–181.

New Jersey Department of Environmental Protection (NJDEP). 2006. New Jersey Marine Mammal and Sea Turtle Conservation Workshop Proceedings. Endangered and Nongame Species Program Division of Fish and Wildlife. April 17-19, 2006. Available: https://www.state.nj.us/dep/fgw/ensp/pdf/marinemammal_seaturtle_workshop06.pdf. Accessed: September 21, 2021.

New Jersey Department of Environmental Protection (NJDEP). 2010. *Ocean/Wind Power Ecological Baseline Studies January 2008–December 2009*. Final Report. Prepared for New Jersey Department of Environmental Protection Office of Science by Geo-Marine, Inc., Plano, Texas. Available: https://dspace.njstatelib.org/xmlui/handle/10929/68435. Accessed: July 2010.

New Jersey Department of Environmental Protection (NJDEP). 2010. Citing Mrosovsky, N. 1980. Thermal biology of sea turtles. *American Zoologist* 20(3):531–547.

Normandeau Associates, Inc. (Normandeau), Exponent, Inc., T. Tricas, and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species*. Final Report. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09. Available: https://espis.boem.gov/final%20reports/5115.pdf.

Normandeau Associates, Inc. and APEM Inc. 2018a. *Digital aerial baseline survey of marine wildlife in support of offshore wind energy: Summer 2018 taxonomic analysis summary report*. Prepared for New York State Energy Research and Development Authority. Available: https://remote.normandeau.com/docs/NYSERDA_Summer_2018_Taxonomic_Analysis_Summary_Report.pdf.

Normandeau Associates, Inc. and APEM Inc. 2018b. *Digital aerial baseline survey of marine wildlife in support of Offshore Wind Energy: Spring 2018 taxonomic analysis summary report*. Prepared for New York State Energy Research and Development Authority. Available: https://remote.normandeau.com/docs/NYSERDA_Spring_2018_Taxonomic_Analysis_Summary_Report.pdf.

Normandeau Associates, Inc. and APEM Inc. 2019a. *Digital aerial baseline survey of marine wildlife in support of offshore wind energy: Spring 2019 taxonomic analysis summary report*. Prepared for New York State Energy Research and Development Authority. Available: https://remote.normandeau.com/docs/NYSERDA_Spring_2019_Taxonomic_Analysis_Summary_Report.pdf.

Normandeau Associates, Inc. and APEM Inc. 2019b. *Digital aerial baseline survey of marine wildlife in support of offshore wind energy: Fall 2018 taxonomic analysis summary report*. Prepared for New York State Energy Research and Development Authority. Available: https://remote.normandeau.com/docs/NYSERDA_Fall_2018_Taxonomic_Analysis_Summary_Report.pdf.

Normandeau Associates, Inc. and APEM Inc. 2020. *Digital aerial baseline survey of marine wildlife in support of offshore wind energy: Winter 2018-2019 taxonomic analysis summary report*. Prepared for New York State Energy Research and Development Authority. Available: https://remote.normandeau.com/docs/NYSERDA_Winter_2018_19_Taxonomic_Analysis_Summary_Report.pdf.

Northeast Fisheries Science Center and Southeast Fisheries Science Center (NEFSC and SEFSC). 2011. *Preliminary Summer 2010 Regional Abundance Estimate of Loggerhead Turtles (Caretta caretta) in Northwestern Atlantic Ocean Continental Shelf Waters*. Northeast Fisheries Science Center Reference Document 11-03. On file, National Marine Fisheries Service, Woods Hole, Massachusetts. April.

Northeast Regional Ocean Council (NROC). 2023. Northeast Ocean Data Portal. Log density of tagged loggerhead sea turtles – annual percent predicted density in each grid cell. Available: https://www.northeastoceandata.org/data-explorer/. Accessed: January 23, 2023.

O'Hara, J., and J. R. Wilcox. 1990. Responses of loggerhead sea turtles, *Caretta caretta*, to low frequency sound. *Copeia* 199:564–567.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Orr, T. L., S. M. Herz, and D. L. Oakley. 2013. *Evaluation of Lighting Schemes for Offshore Wind Facilities and Impacts to Local Environments.* Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-0116. 429 pp. Available: https://espis.boem.gov/final%20reports/5298.pdf. Accessed November 18, 2021.

Palka, D. L., S. Chavez-Rosales, E. Josephson, D. Cholewiak, H. L. Haas, L. Garrison, M. Jones, D. Sigourney, G. Waring (retired), M. Jech, E. Broughton, M. Soldevilla, G. Davis, A. DeAngelis, C. R. Sasso, M. V. Winton, R. J. Smolowitz, G. Fay, E. LaBrecque, J. B. Leiness, K. Dettloff, M. Warden, K. Murray, and C. Orphanides. 2017. *Atlantic Marine Assessment Program for Protected Species: 2010–2014*. OCS Study BOEM 2017-071. Washington, D.C.: U.S. Department of the Interior, Bureau of Ocean Energy Management, Atlantic OCS Region. Available: https://espis.boem.gov/final%20reports/5638.pdf.

Palka, D., L. Aichinger Dias, E. Broughton, E. Chavez-Rosales, D. Cholewiak, G. Davis, A. DeAngelis, L. Garrison, H. Haas, J. Hatch, K. Hyde, M. Jech, E. Josephson, L. Mueller-Brennan, C. Orphanides, N. Pegg, C. Sasso, D. Sigourney, M. Soldevilla, and H. Walsh. 2021. *Atlantic Marine Assessment Program for Protected Species: FY15 – FY19*. OCS Study BOEM 2021-051. Washington DC: US Department of the Interior, Bureau of Ocean Energy Management. Available: https://espis.boem.gov/Final%20reports/BOEM_2021-051.pdf.

Patel, S. H., M. V. Winton, J. M. Hatch, H. L. Haas, V. S. Saba, G. Fay, and R. J. Smolowitz. 2021. Projected shifts in loggerhead sea turtle thermal habitat in the Northwest Atlantic Ocean due to climate change. *Scientific Reports* 11:8850.

Pezy, J. P., A. Raoux, and J. C. Dauvin. 2018. An ecosystem approach for studying the impact of offshore wind farms: A French case study. *ICES Journal of Marine Science* 77(3):1238–1246.

Piniak, W. E. D., D. A. Mann, C. A. Harms, T. T. Jones, and S. A. Eckert. 2016. *Hearing in the juvenile green sea turtle (*Chelonia mydas*): A comparison of underwater and aerial hearing using auditory evoked potentials*. *PLOS ONE* 11(10):e0159711.

Piniak, W. E. D., D. A. Mann, S. A. Eckert, and C. A. Harms. 2012a. Amphibious hearing in sea turtles. p. 83–88. In: A.N. Popper and A. Hawkins (eds.) *The Effects of Noise on Aquatic Life*. Springer, New York. 695 p.

Piniak, W. E. D., S. A. Eckert, C. A. Harms, and E. M. Stringer. 2012b. *Underwater Hearing Sensitivity of the Leatherback Sea Turtle (*Dermochelys coriacea*): Assessing the Potential Effect of Anthropogenic Noise*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. OCS Study BOEM 2012-01156. 35 p.

Plotkin, P. T., M. K. Wicksten, and A. F. Amos. 1993. Feeding ecology of the loggerhead sea turtle, Caretta, in the northwestern Gulf of Mexico. *Marine Biology* 115(1):1–15.

Poloczanska, E. S., C. J. Limpus, and G. C. Hays. 2009. “Vulnerability of Marine Turtles to Climate Change.” Chapter 2 in D. W. Sims (editor) *Advances in Marine Biology* 56:151–211. Available: http://seaturtle.org/PDF/PoloczanskaES_2009_InAdvancesinMarineBiology_p151-211.pdf.

Popper, A. N., A. D. Hawkins, R. R. Fay, D. A. Mann, S. Bartol, T. J. Carlson, S. Coombs, W. T. Ellison, R. L. Gentry, M. B. Halvorsen, S. Løkkeborg, P. H. Rogers, B. L. Southall, D. G. Zeddies, and W. N. Tavolga. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report* prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. ASA S3/SC1.4 TR-2014. Technical report.

Ramirez, A, C. Y. Kot, and D. Piatkowski. 2017. *Review of sea turtle entrainment risk by trailing suction hopper dredges in the US Atlantic and Gulf of Mexico and the development of the ASTER decision support tool*. Sterling (VA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-084. 275 pp.

Raoux, A., S. Tecchio, J. P. Pezy, G. Lassalle, S. Degraer, S. Wilhelmsson, M. Cachera, B. Ernande, C. Le Guen, M. Haraldsson, K. Grangere, F. Le Loc’h, J. C. Dauvin, and N. Niquil. 2017. Benthic and fish aggregation inside an offshore wind farm: Which effects on the trophic web functioning? *Ecological Indicators* 72:33–46.

Reine, K. J., and D. G. Clarke. 1998. E*ntrainment by hydraulic dredges – A review of potential impacts, Technical Note DOER-E1* (pp. 1–14). U.S. Army Corps of Engineers, Engineer Research and Development Center, Vicksburg, MS.

Ridgway S. H., E. G. Wever, J. G. McCormick, J. Palin, and J. H. Anderson. 1969. Hearing in the giant sea turtle, *Chelonia mydas*. *Proceedings of the National Academy of Science US* 64(2):884–890.

Ruckdeschel, C. A., and C. R. Shoop. 1988. Gut contents of loggerheads: Findings, problems and new questions. In *Proceedings of the Eighth Annual Workshop on Sea Turtle Biology and Conservation*, 97-98, 146 pp. Edited by B. A. Schroeder. NOAA Technical Memorandum NMFS-SEFC-214.

Salmon, M., and J. Wyneken. 1990. Do swimming loggerhead sea turtles (*Caretta caretta* L.) use light cues for offshore orientation? *Marine Behaviour and Physiology* 17(4):233–246.

Samuel, Y., S. J. Morreale, C. W. Clark, C. H. Greene, and M. E. Richmond. 2005. Underwater, Low-frequency Noise in a Coastal Sea Turtle Habitat. *Journal of the Acoustical Society of America* 117(3):1465–1472.

Sasso, C. R. and S. P. Epperly. 2006. Seasonal sea turtle mortality risk from forced submergence in bottom trawls. *Fisheries Research* 81:86–88.

Schmid, J. R. 1998. Marine turtle populations on the west-central coast of Florida: Results of tagging studies at the Cedar Keys, Florida, 1986–1995. *Fishery Bulletin* 96:589–602.

Schultze, L., L. Merckelbach, J. Horstmann, S. Raasch, and J. Carpenter: 2020. Increased mixing and turbulence in the wake of offshore wind farms. *Journal of Geophysical Research: Oceans* 125. *Journal of Geophysical Research*: Oceans, 125, e2019JC015858. https://doi.org/10.1029/2019JC015858. Accessed April 1, 2022.

Schuyler, Q. A., C. Wilcox, K. Townsend, B. D. Hardesty, and N. J. Marshall. 2014. Mistaken identity? Visual similarities of marine debris to natural prey items of sea turtles. *BMC Ecology* 14(14). DOI:10.1186/1472-6785-14-14.

Seminoff, J. A., C. D. Allen, G. H. Balazs, P. H. Dutton, T. Eguchi, H. L. Haas, S. A. Hargrove, M. P. Jensen, D. L. Klemm, A. M. Lauritsen, S. L. MacPherson, P. Opay, E. E. Possardt, S. L. Pultz, E. E. Seney, K. S. Van Houtan, and R. S. Waples. 2015. Status Review of the Green Turtle (*Chelonia mydas*) Under the U.S. Endangered Species Act. NOAA Technical Memorandum, NOAANMFS-SWFSC-539.

Seney, E. E., and J. A. Musick. 2007. Historical diet analysis of loggerhead sea turtles (Caretta caretta) in Virginia. *Copeia* 2007(2):478–489.

Shaver D. J., B. A. Schroeder, R. A. Byles, P. M. Burchfield, J. Peña, and R. Márquez. 2005. Movements and home ranges of adult male Kemp's ridley sea turtles (*Lepidochelys kempii*) in the Gulf of Mexico investigated by satellite telemetry. *Chelonian Conservation and Biology* 4(4):817–827.

Shaver, D., and C. Rubio. 2008. Post-nesting movement of wild and head-started Kemp's ridley sea turtles *Lepidochelys kempii* in the Gulf of Mexico. *Endangered Species Research* 4:43–55.

Shigenaka, G., S. Milton, P. Lutz, R. Hoff, R. Yender, and A. Mearns. 2010. *Oil and Sea Turtles: Biology, Planning, and Response*. NOAA Office of Restoration and Response Publication. 116 pp. Available: https://www.widecast.org/Resources/Docs/Shigenaka_et_al_2021.pdf. Accessed: April 8, 2022.

Shoop, C. R., and R. D. Kenney. 1992. Seasonal distribution and abundances of loggerhead and leatherback sea turtles in waters of the northeastern United States. *Herpetological Monograph* 6:43–67.

Smultea Environmental Sciences. 2018. Protected Species Observer Technical Report OCW01 Geotechnical 1A Survey New Jersey (2017). Prepared for Fugro Marine GeoServices, Inc., Norfolk, Virginia, and DONG Energy Wind Power (US) LLC, Boston, Massachusetts, by Smultea Environmental Sciences, Preston, Washington.

Snoek, R., R. de Swart, K. Didderen, W. Lengkeek, and M. Teunis. 2016. *Potential effects of electromagnetic fields in the Dutch North Sea*. Final report submitted to Rijkswaterstaat Water, Verkeer en Leefmgeving. 95 pp. Available: https://www.buwa.nl/fileadmin/buwa_upload/Bureau_Waardenburg_rapporten/16-101_BuWareport_potential_effects_of_electromagnetic_fields_in_the_dutch_north_sea.pdf. Accessed: April 1, 2022.

Snyder, R. 2017. Monitoring nesting sea turtles using a thermal camera. *ECO Magazine* January/February 2017:36–41. Available: https://www.seiche.com/wp-content/uploads/2020/01/Eco-Magazine-JanFeb-2017new.pdf. Accessed: November 7, 2022.

Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene, Jr., D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. *Aquatic Mammals* 33(4):411–521.

Stöber, U., and F. Thomsen. 2021. How could operational underwater sound from future offshore wind turbines impact marine life? *Journal of the Acoustical Society of America* 149(3):1791–1795.

Thomás, J., R. Guitart, R. Mateo, and J. A. Raga. 2002. Marine debris ingestion in loggerhead turtles, *Caretta caretta*, from the Western Mediterranean. *Marine Pollution Bulletin* 44:211–216.

Tougaard, J., L. Hermannsen, and P. T. Madsen. 2020. How loud is the underwater noise from operating offshore wind turbines? *Journal of the Acoustical Society of America* 148(5):2885–2893.

Tougaard, J., O. D. Henriksen, and Lee A. Miller. 2009. Underwater noise from three types of offshore wind turbines: Estimation of impact zones for harbor porpoises and harbor seals. *Journal of the Acoustical Society of America* 125(6):3766–3773. DOI:10.1121/1.3117444.

Turtle Expert Working Group (TEWG). 2007. *An Assessment of the Leatherback Turtles Population in the Atlantic Ocean*. NOAA Technical Memorandum NMFS-SEFSC-555. A Report of the Turtle Expert Working Group. U.S. Department of Commerce. April 2007.

Turtle Expert Working Group (TEWG). 2009. *An Assessment of the Loggerhead Turtle Population in the Western North Atlantic Ocean*. NOAA Technical Memorandum NMFS-SEFSC-575. U.S. Department of Commerce.

U.S. Army Corps of Engineers (USACE). 2020. *South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States*. 646 pp. Available: https://media.fisheries.noaa.gov/dam-migration/sarbo_acoustic_revision_6-2020-opinion_final.pdf. Accessed: November 16, 2021.

U.S. Department of the Navy (Navy). 2007. Navy OPAREA Density Estimate (NODE) for the Northeast OPAREAs for the Northeast OPAREAS: Boston, Narragansett Bay, and Atlantic City. Prepared for the Department of the Navy, U.S. Fleet Forces Command, Norfolk, Virginia. Contract #N62470-02-D-9997, Task Order 045. Prepared by Geo-Marine, Inc., Hampton, Virginia. Available: https://seamap.env.duke.edu/downloads/resources/serdp/Northeast%20NODE%20Final%20Report.pdf.

U.S. Department of the Navy (Navy). 2017. *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*. Technical report. June 2017. Available: https://nwtteis.com/portals/nwtteis/files/technical_reports/Criteria_and_Thresholds_for_U.S._Navy_Acoustic_and_Explosive_Effects_Analysis_June2017.pdf. Accessed: March 31, 2022.

U.S. Department of the Navy (Navy). 2018. *Hawaii-Southern California Training and Testing EIS/OEIS*. Available: https://www.hstteis.com/portals/hstteis/files/hstteis_p3/feis/section/HSTT_FEIS_3.08_Reptiles_October_2018.pdf. Accessed: September 3, 2020.

Wang, J., X. Zou, W. Yu, D. Zhang, and T. Wang. 2019. Effects of established offshore wind farms on energy flow of coastal ecosystems: A case study of the Rudong offshore wind farms in China. *Ocean & Coastal Management* 171:111–118.

Watwood, S. L., and D. M. Buonantony. 2012. *Dive distribution and group size parameters for marine species occurring in Navy training and testing areas in the North Atlantic and North Pacific oceans*. Newport, Rhode Island. NUWC-NPT Technical Document 12,085. March 2012. Available: https://apps.dtic.mil/sti/pdfs/ADA560975.pdf. Accessed: June 28, 2022.

Weishampel, Z. A., W-H. Cheng, and J. F. Weishampel. 2016. Sea turtle nesting patterns in Florida vis-a-vis satellite-derived measures of artificial lighting. *Remote Sensing in Ecology and Conservation* 2(1):59–72.

Wibbels, T., and E. Bevan. 2019. Kemp's Ridley, Lepidochelys kempii. The IUCN Red List of Threatened Species in 2019: e.T11533A142050590. Available: https://www.iucnredlist.org/species/11533/142050590.

Winton, M. V, G. Fay, H. L. Haas, M. Arendt, S. Barco, M. C. James, C. Sasso, and R. Smolowitz. 2018. Estimating the distribution and relative density of satellite-tagged loggerhead sea turtles using geostatistical mixed effects models. *Marine Ecology Progress Series* 586:217–232.

Witzell, W. N., and J. R. Schmid. 2005. Diet of immature Kemp's ridley turtles (*Lepidochelys kempi*) from Gullivan Bay, Ten Thousand Islands, southwest Florida. *Bulletin of Marine Science* 77(2):191–199.

B.2.3.20. Section 3.20, Scenic and Visual Resources

Atlantic Shores Offshore Wind (Atlantic Shores). 2021. *Construction and Operations Plan, Atlantic Shores Offshore Wind*. Volume I. September. Available: https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-construction-and-operations-plan.

Bureau of Ocean Energy Management (BOEM). 2021c. *Assessment of Seascape, Landscape, and Visual Impacts of Offshore Wind Energy Developments on the Outer Continental Shelf of the United States*. OCS Study BOEM 2021-032. April.

Bureau of Ocean Energy Management (BOEM). 2022. *Ocean Wind Cumulative Historic Resources Visual Effects Analysis.* June.

Capitol Airspace Group. Ocean Wind Project Aircraft Detection Lighting System (ADLS) Efficacy Analysis. April 16.

Landscape Institute and Institute of Environmental Management and Assessment. 2016. *Guidelines for Landscape and Visual Assessment 3rd Edition*. Spon Press.

New Jersey Department of Environmental Protection (NJDEP). 2006. Public Access in New Jersey: The Public Trust Doctrine and Practical Steps to Enhance Public Access. Handbook prepared by the Coastal Management Office of New Jersey.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

B.2.3.21. Section 3.21, Water Quality

Bejarano, A. C., J. Michel, J. Rowe, Z. Li, D. French McCay, L. McStay, and D. S. Etkin. 2013. *Environmental Risks, Fate and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-213.

Bureau of Ocean Energy Management (BOEM). 2016. *Use of Finite-Volume Modeling and the Northeast Coastal Ocean Forecast System in Offshore Wind Energy Resource Planning*. BOEM 2016-050. July. Available: https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/NE-Ocean-Forecast-Model-Final-Report.pdf. Accessed: September 21, 2022.

Bureau of Ocean Energy Management (BOEM). 2019. *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Continental Shelf*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Sterling, VA. OCS Study BOEM 2019- 036. May 2019.

Bureau of Ocean and Energy Management (BOEM). 2021c. Hydrodynamic Modeling, Particle Tracking and Agent-Based Modeling of Larvae in the U.S. Mid-Atlantic Bight. OCE Study, BOEM 2021-049. Available: https://espis.boem.gov/final%20reports/BOEM_2021-049.pdf. Accessed: October 29, 2021.

Carpenter, J. R., L. Merckelbach, U. Callies, S. Clark, L. Gaslikova, and B. Baschek. 2016. "Potential Impacts of Offshore Wind Farms on North Sea Stratification." *PLOS ONE* 11(8): e0160830. Available: https://doi.org/10.1371/journal.pone.0160830.

Cazenave, Pierre William, Ricardo Torres, and J. Icarus Alen. 2016. "Unstructured Grid Modelling of Offshore Wind Farm Impacts on Seasonally Stratified Shelf Seas." *Progress in Oceanography* 145(2016) 25–41.

Center for Coastal Studies (CCS). 2017. *Water Quality Parameters*. Available: http://coastalstudies.org/cape-cod-bay-monitoring-program/monitoring-stations/. Accessed: June 18, 2018.

Connell, B. 2010. Nutrient Monitoring in NJ's Coastal Waters. Retrieved from NJDEP - Water Monitoring & Standards Marine Water Monitoring. Available: http://www.nj.gov/dep/wms/NJDEP%20MW%20Nutrients.pdf. Accessed: April 1, 2022

Department of Energy (DOE). 2014. *Assessment of Ports for Offshore Wind Development in the United States*. March 2014. 700694-USPO-R-03.

Harris, J., R. Whitehouse, and J. Sutherland. 2011. "Marine Scour and Offshore Wind: Lessons Learnt and Future Challenges. Proceedings of the International Conference on Offshore Mechanics and Arctic Engineering" OMAE. 5. 10.1115/OMAE2011-50117.

Kaplan, B., ed. 2011. *Literature Synthesis for the North and Central Atlantic Ocean*. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEMRE 2011-012. Available: https://www.boem.gov/ESPIS/5/5139.pdf. Accessed: October 30, 2018.

Kirchgeorg, T., I. Weingberg, M. Hornig, R. Baier, M. J. Schmid, and B. Brockmeyer. 2018. Emissions from Corrosion Protection Systems of Offshore Wind Farms: Evaluation of the Potential Impact on the Marine Environment. *Marine Pollution Bulletin* 136:257–268.

Latham, Pam, Whitney Fiore, Michael Bauman, and Jennifer Weaver. 2017. *Effects Matrix for Evaluating Potential Impacts of Offshore Wind Energy Development on U.S. Atlantic Coastal Habitats*. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2017-014. Available: https://www.boem.gov/Effects-Matrix-Evaluating-Potential-Impacts-of-Offshore-Wind-Energy-Development-on-US-Atlantic-Coastal-Habitats/. Accessed: October 30, 2018.

National Oceanic and Atmospheric Administration (NOAA). 2018. NOAA Deep Sea Coral Data Portal. Available: http://deepseacoraldata.noaa.gov. Accessed: August 2, 2018.

New Jersey Department of Environmental Protection (NJDEP). 2018. Digital Geodata Series – DGS02-1 Well Head Protection Areas for Public Community Water Supply Wells in New Jersey. April 4. Available: https://www.state.nj.us/dep/njgs/geodata/dgs02-2.htm#image. Accessed: September 8, 2021.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Ocean Wind LLC (Ocean Wind). 2023. Citing Normandeau Associates Inc. 2015. *Modeling sediment dispersion from cable burial for the Seacoast Reliability Project, Little Bay, New Hampshire*.

South Carolina Department of Health and Environmental Control. 2018. SC Watershed Atlas: Impaired Waters – 303(d) 2018. Available: https://gis.dhec.sc.gov/watersheds/. Accessed: November 22, 2021.

U.S. Environmental Protection Agency (USEPA). 2000. *Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras*. Office of Water. EPA-822-R-00-012. Available: https://nepis.epa.gov/Exe/ZyPDF.cgi/20003HYA.PDF?Dockey=20003HYA.PDF. Accessed: November 8, 2018.

U.S. Environmental Protection Agency (USEPA). 2012. *National Coastal Condition Report IV*. September. Available: https://www.epa.gov/sites/default/files/201410/documents/0_nccr_4_report_508_bookmarks.pdf. Accessed: September 8, 2021.

U.S. Environmental Protection Agency (USEPA). 2015. *National Coastal Condition Assessment 2010*. Office of Water and Office of Research and Development. EPA 841-R-15-006. Available: https://www.epa.gov/sites/production/files/2016-01/documents/ncca_2010_report.pdf. Accessed: October 30, 2018.

U.S. Environmental Protection Agency (USEPA). 2020. NEPAAssist Mapping Layer Descriptions – Impaired Water Points, Impaired Streams, Impaired Water Bodies. EPA Office of Water ATTAINS Geospatial Data.

B.2.3.22. Section 3.22, Wetlands

Atlantic Shores Offshore Wind (Atlantic Shores). 2021. *Construction and Operations Plan, Atlantic Shores Offshore Wind*. Volume I. September. Available: https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-construction-and-operations-plan.

New Jersey Department of Environmental Protection (NJDEP). 2015. Wetlands of New Jersey GIS. Available: https://gisdata-njdep.opendata.arcgis.com/datasets/wetlands-of-new-jersey-from-land-use-land-cover-2012-update/explore?location=40.143284%2C-74.755600%2C8.71. Accessed: October 7, 2021.

New Jersey Department of Environmental Protection (NJDEP). 2020. *Final Report: The Status and Future of Tidal Marshes in New Jersey Faced with Sea Level Rise*. NJDEP Science Advisory Board. Prepared by SAB Work Group. August. Available: https://www.nj.gov/dep/sab/sab-salt-marsh.pdf. Accessed: April 1, 2022.

New Jersey Department of Environmental Protection (NJDEP). 2021. Barnegat Bay. Phase Two: Moving Science into Action. Available: https://www.nj.gov/dep/barnegatbay/wetlands.html. Accessed: October 27, 2021.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

B.3. Glossary

Term	Definition
affected environment	Environment as it exists today that could be potentially affected by the proposed Project
algal blooms	Rapid growth of the population of algae, also known as algae bloom
allision	A moving ship running into a stationary ship
anthropogenic	Generated by human activity
archaeological resource	Historical place, site, building, shipwreck, or other archaeological site on the landscape
below grade	Below ground level
benthic	Related to the bottom of a body of water
benthic resources	The seafloor surface, the substrate itself, and the communities of bottom-dwelling organisms that live within these habitats
Cetacea	Order of aquatic mammals made up of whales, dolphins, porpoises, and related lifeforms
coastal habitat	Coastal areas where flora and fauna live, including salt marshes and aquatic habitats
coastal waters	Waters in nearshore areas where bottom depth is less than 98.4 feet (30 meters)
coastal zone	The lands and waters starting at 3 nm from the land and ending at the first major land transportation route
commercial fisheries	Areas or entities raising and catching fish for commercial profit
commercial-scale wind energy facility	Wind energy facility usually greater than 1 MW that sells the produced electricity
criteria pollutant	One of six common air pollutants for which USEPA sets NAAQS: CO, lead, NO_2, ozone, particulate matter, or SO_2
critical habitat	Geographic area containing features essential to the conservation of threatened or endangered species
cultural resource	Historical districts, objects, places, sites, buildings, shipwrecks, and archaeological sites on the American landscape, as well as sites of traditional, religious, or cultural significance to cultural groups, including Native American tribes
culvert	structure, usually a tunnel, allowing water to flow under an obstruction (e.g., road, trail)
cumulative impacts	Impacts that could result from the incremental impact of a specific action, such as the proposed Project, when combined with other past, present, or reasonably foreseeable future actions or other projects; can occur from individually minor, but collectively significant actions that take place over time
demersal	Living close to the ocean floor
design envelope	The range of proposed Project characteristics defined by the applicant and used by BOEM for purposes of environmental review and permitting
dredging	Removal of sediments and debris from the bottom of lakes, rivers, harbors, and other waterbodies
duct bank	Underground structure that houses the onshore export cables, which consists of polyvinyl chloride pipes encased in concrete

Term	Definition
ecosystem	Community of interacting living organisms and nonliving components (such as air, water, soil)
electromagnetic field	A field of force produced by electrically charged objects and containing both electric and magnetic components
embayment	Recessed part of a shoreline
endangered species	A species that is in danger of extinction in all or a significant portion of its range
Endangered Species Act-listed species	Species listed under the ESA of 1973 (as amended)
environmental protection measure	Measure proposed to avoid or minimize potential impacts
ensonification	The process of filling with sound
environmental consequences	The potential direct, indirect, and cumulative impacts that the construction, O&M, and decommissioning of the proposed Project would have on the environment
environmental justice communities	Minority and low-income populations affected by the proposed Project
epifauna	Fauna that lives on the surface of a seabed (or riverbed), or is attached to underwater objects or aquatic plants or animals
essential fish habitat	"Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (50 CFR 600)
export cables	Cables connecting the wind facility to the onshore electrical grid power
export cable corridor	Area identified for routing the entire length of the onshore and offshore export cables
federal aids to navigation	Visual references operated and maintained by USCG, including radar transponders, lights, sound signals, buoys, and lighthouses, that support safe maritime navigation
finfish	Vertebrate and cartilaginous fishery species, not including crustaceans, cephalopods, or other mollusks
for-hire commercial fishing	Commercial fishing on a for-hire vessel (i.e., a vessel on which the passengers make a contribution to a person having an interest in the vessel in exchange for carriage)
for-hire recreational fishing	Fishing from a vessel carrying a passenger for hire who is engaged in recreational fishing
foundation	The bases to which the WTGs and OSS are installed on the seabed. Three types of foundations have been considered and reviewed for the Project: jacket, monopile, or gravity-based structure.
geomagnetic	Relating to the magnetism of the Earth
hard-bottom habitat	Benthic habitats composed of hard-bottom (e.g., cobble, rock, and ledge) substrates
historic property	Prehistoric or historic district, site, building, structure, or object that is eligible for or already listed in the NRHP; also includes any artifacts, records, and remains (surface or subsurface) related to and located within such a resource
historical resource	Prehistoric or historic district, site, building, structure, or object that is eligible for or already listed in the NRHP; also includes any artifacts, records, and remains (surface or subsurface) related to and located within such a resource

Term	Definition
horizontal directional drilling	Trenchless technique for installing underground cables, pipes, and conduits using a surface-launched drilling rig
hull	Watertight frame or body of a ship
infauna	Fauna living in the sediments of the ocean floor (or river or lake beds)
inter-array cables	Cables connecting the wind turbine generators to the electrical service platforms
interconnection facility	Substation connecting the proposed Project to the existing bulk power grid system
inter-link cables	Cables connecting the electrical service platforms to one another
invertebrate	Animal with no backbone
jacket foundation	Latticed steel frame with three or four supporting piles driven into the seabed
jack-up vessel	Mobile and self-elevating platform with buoyant hull
jet excavation	Process of moving or removing soil with a jet
jet plowing	Plowing in which the jet plow, with an adjustable blade, or plow rests on the seafloor and is towed by a surface vessel; the jet plow creates a narrow trench at the designated depth, while water jets fluidize the sediment within the trench; in the case of the proposed Project, the cables would then be feed through the plow and laid into the trench as it moves forward; the fluidized sediments then settle back down into the trench and bury the cable
knot	Unit of speed equaling 1 nm per hour
landfall site	The shoreline landing site at which the offshore cable transitions to onshore
marine mammal	Aquatic vertebrate distinguished by the presence of mammary glands, hair, three middle ear bones, and a neocortex (a region of the brain)
marine waters	Waters in offshore areas where bottom depth is more than 98.4 feet (30 meters)
mechanical cutter	Method of submarine cable installation equipment that involves a cutting wheel or excavation chain to cut a narrow trench into the seabed allowing the cable to sink under its own weight or be pushed to the bottom of the trench via a cable depressor
mechanical plow	Method of submarine cable installation equipment that involves pulling a plow along the cable route to lay and bury the cable. The plow’s share cuts into the soil, opening a temporary trench, which is held open by the side walls of the share, while the cable is lowered to the base of the trench via a depressor. Some plows may use additional jets to fluidize the soil in front of the share.
monopile or monopile foundation	A long steel tube driven into the seabed that supports a tower
nautical mile	A unit used to measure sea distances and equivalent to approximately 1.15 miles (1.85 kilometers)
offshore substation	The interconnection point between the WTGs and the export cable; the necessary electrical equipment needed to connect the inter-array cables to the offshore export cables
onshore substation	Substation connecting the proposed Project to the existing bulk power grid system

Term	Definition
operations and maintenance facilities	Would include offices, control rooms, warehouses, shop space, and pier space
Outer Continental Shelf	All submerged land, subsoil, and seabed belonging to the United States but outside of states’ jurisdiction
pile	A type a foundation akin to a pole
pile driving	Installing foundation piles by driving them into the seafloor
pinnipeds	Carnivorous, semiaquatic marine mammals with fins, also known as seals
pin pile	Small-diameter pipe driven into the ground as foundation support
plume	Column of fluid moving through another fluid
private aids to navigation	Visual references on structures positioned in or near navigable WOTUS, including radar transponders, lights, sound signals, buoys, and lighthouses, that support safe maritime navigation; permits for the aids are administered by USCG
Project area	The combined onshore and offshore area where proposed Project components would be located
protected species	Endangered or threatened species that receive federal protection under the ESA of 1973 (as amended)
scour protection	Protection consisting of rock and stone that would be placed around all foundations to stabilize the seabed near the foundations as well as the foundations themselves
scrublands	Plant community dominated by shrubs and often also including grasses and herbs
sessile	Attached directly by the base
silt substrate	Substrate made of a granular material originating from quartz and feldspar, and whose size is between sand and clay
soft-bottom habitat	Benthic habitats include soft-bottom (i.e., unconsolidated sediments) and hard-bottom (e.g., cobble, rock, ledge) substrates, as well as biogenic habitat (e.g., eelgrass, mussel beds, worm tubes) created by structure-forming species
substrate	Earthy material at the bottom of a marine habitat; the natural environment that an organism lives in
suspended sediments	Very fine soil particles that remain in suspension in water for a considerable period of time without contact with the bottom; such material remains in suspension due to the upward components of turbulence and currents, or by suspension
threatened species	A species that is likely to become endangered within the foreseeable future
tidal energy project	Project related to the conversion of the energy of tides into usable energy, usually electricity
tidal flushing	Replacement of water in an estuary or bay because of tidal flow
trawl	A large fishing net dragged by a vessel at the bottom or in the middle of sea or lake water
turbidity	A measure of water clarity
utility right-of-way	Registered easement on private land that allows utility companies to access the utilities or services located there
vibracore	Technology/technique for collecting core samples of underwater sediments and wetland soils

Term	Definition
viewshed	Area visible from a specific location
visual resource	The visible physical features on a landscape, including natural elements such as topography, landforms, water, vegetation, and manmade structures
wetland	Land saturated with water; marshes; swamps
wind energy	Electricity from naturally occurring wind
wind energy area	Areas with significant wind energy potential and defined by BOEM
wind turbine generator	Component that puts out electricity in a structure that converts kinetic energy from wind into electricity

NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide

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Appendix C. Additional Analysis for Alternatives Dismissed

BOEM considered alternatives to the Proposed Action that were identified through coordination with cooperating and participating agencies and through public comments received during the public scoping period for the EIS. BOEM evaluated the alternatives and excluded from further consideration alternatives that did not meet the purpose and need, did not meet the screening criteria, or both. The screening criteria are presented below in Section C.1, *Alternatives Screening Criteria*. Alternatives that were considered and carried forward for detailed analysis are presented in Section 2.1, *Alternatives Analyzed in Detail*, of this Final EIS, and alternatives excluded from further consideration are presented in Section 2.1.7, *Alternatives Considered but not Analyzed in Detail*.

For several alternatives considered but not analyzed in detail, additional analysis was necessary to identify economic and technical feasibility concerns and resource impacts and determine whether those concerns and impacts were unacceptable. Section C.2, *Supplemental Information*, provides the analysis conducted to support the rationale for dismissal for the associated alternative.

C.1. Alternatives Screening Criteria

An alternative was considered but not analyzed in detail if it met any of the following criteria:

- It is outside the jurisdiction of the Lead Agency,[1] including resulting in activities that are not allowed under the lease (e.g., requiring locating part or all of the wind energy facility outside of the Lease Area, or constructing and operating a facility for another form of energy).
- It would not respond to the purpose and need of BOEM's action, including not furthering the United States' policy to make OCS energy resources available for expeditious and orderly development, subject to environmental safeguards.[2]
- It would require a major change to an existing law, regulation, or policy.
- It would not be responsive to the Applicant's goals, lease constraints, and obligations, such as alternatives that would:
    - Partially or completely relocate the Project outside of the defined geographic area where it was proposed; or
    - Result in the development of a Project that would not allow the developer to satisfy contractual obligations (e.g., resulting in a Project with a nameplate capacity that is less than what is required under a Power Purchase Agreement; result in significant implementation delays that would prevent the Project from initiating commercial operations by the contractually required date in the Power Purchase Agreement).
- It is technically infeasible, meaning implementation of the alternative is unlikely given past and current practice, technology (e.g., experimental turbine design or foundation type), or site conditions (e.g., presence of boulders) as determined by BOEM's technical experts.
- It is economically infeasible, meaning implementation of the alternative is unlikely due to unreasonable costs as determined by BOEM's technical experts; while this does not require cost-benefit analysis or speculation about an applicant's costs and profits, there must be a reasonable basis.

[1] "Include reasonable alternatives not within the jurisdiction of the lead agency" was removed with CEQ's updated NEPA-implementing regulations. See 43304 *Federal Register* 85, July 16, 2020.
[2] 43 USC 1332(3)

- It cannot be analyzed because its implementation is remote or speculative, or it is too conceptual in that it lacks sufficient detail to meaningfully analyze impacts.
- It is substantially similar in design to an alternative that is or will be analyzed in detail.
- It is environmentally infeasible, meaning implementation of the alternative would not be allowed by another agency from which a permit or approval is required, or implementation results in an obvious and substantial increase in impacts on the human environment.[3]
- It does not address a specific environmental or socioeconomic concern or issue.

C.2. Supplemental Information

C.2.1 Wind Turbine Array Layout Spacing

Commenters suggested that BOEM should analyze an alternative wind turbine layout using a 2-nm by 2-nm wind turbine layout to provide safe access for fishing vessels. BOEM evaluated the number of turbine positions that could be within the Lease Area using this spacing and found that a 2-nm by 2-nm wind turbine layout would only provide for 30 wind turbine positions in the Lease Area. Figure C-1 illustrates the wind turbine layout on a 2-nm grid. A 2-nm by 2-nm layout would significantly reduce annual energy production, resulting in failure to meet the required 1,100 MW of wind energy. Use of a 12-MW or 14-MW WTG for the 30 WTGs would result in a Project nameplate capacity of 360 and 420 MW, respectively. The reduced nameplate capacity and annual energy production would fail to fulfill BPU's solicitation award for 1,100 MW of offshore wind and would not meet the purpose of and need for action. Therefore, this alternative was dismissed from further consideration.

[3] "Human environment means comprehensively the natural and physical environment and the relationship of present and future generations of Americans with that environment" (40 CFR 1508.1(m)).

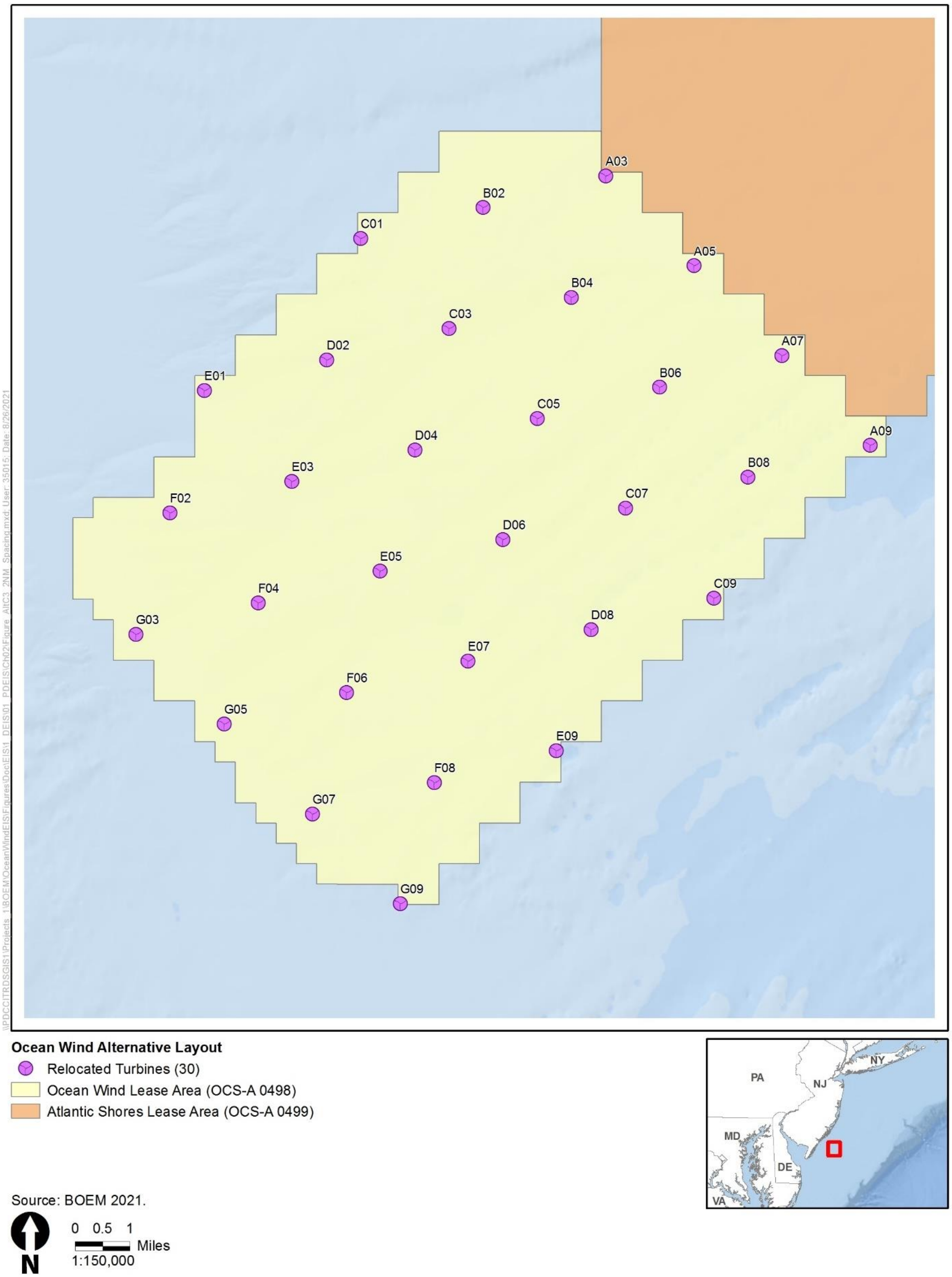

Figure C-1 Wind Turbine Layout on 2-Nautical Mile Grid

C.2.2 SAV Avoidance Alternative E-2

Under Alternative E-2, the construction, O&M, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the Ocean Wind 1 COP, subject to applicable mitigation measures. However, modifications would be made to the Oyster Creek export cable route to minimize impacts on SAV in Barnegat Bay. Figure C-2 illustrates Alternative E-2 as well as Alternative E-1, which was also dismissed from further consideration as described in Section 2.1.7, *Alternatives Considered but not Analyzed in Detail*. The export cable route would make landfall on Island State Beach Park within an auxiliary parking lot of Swimming Area #2 and then follow Central Avenue/Shore Road north approximately 2.7 miles before entering Barnegat Bay at an existing tidal pond. Alternative E-2 would increase the export cable route by approximately 4.3 miles, which would likely require installation of a reactive compensation station approximately 3 to 5 miles offshore of Island Beach State Park due to energy dissipation and consequent limits in the distance that active power can be carried.

Table C-1 presents impacts of Alternative E-2 on SAV in comparison to the Proposed Action and Alternative E. The Proposed Action and Alternative E are carried forward for detailed analysis in the Final EIS.

Table C-1 SAV Impacts of Alternative E-2 Compared to the Proposed Action and Alternative E

Data	Proposed Action (Acres)	Alternative E (Acres)	Alternative E-2 (Acres)
1979 Data	16.78	0.07	0.71
1985–1987 Data	14.66	1.18	--
2009 Data	13.01	0.03	--
Ocean Wind Survey Data	15.38	0.69	N/A

A reactive compensation station would be similar in appearance to the OSS that would be installed within the Lease Area, and it would include structural components similar to that of an OSS. Installation methodology would also be similar to that for the OSS. First, foundation (monopile or jacket) would be piled into the seabed, and then the topside would be installed with the help of a heavy-lift vessel. An example of a reactive compensation station installed at a previous Ørsted project is shown on Figure C-3.

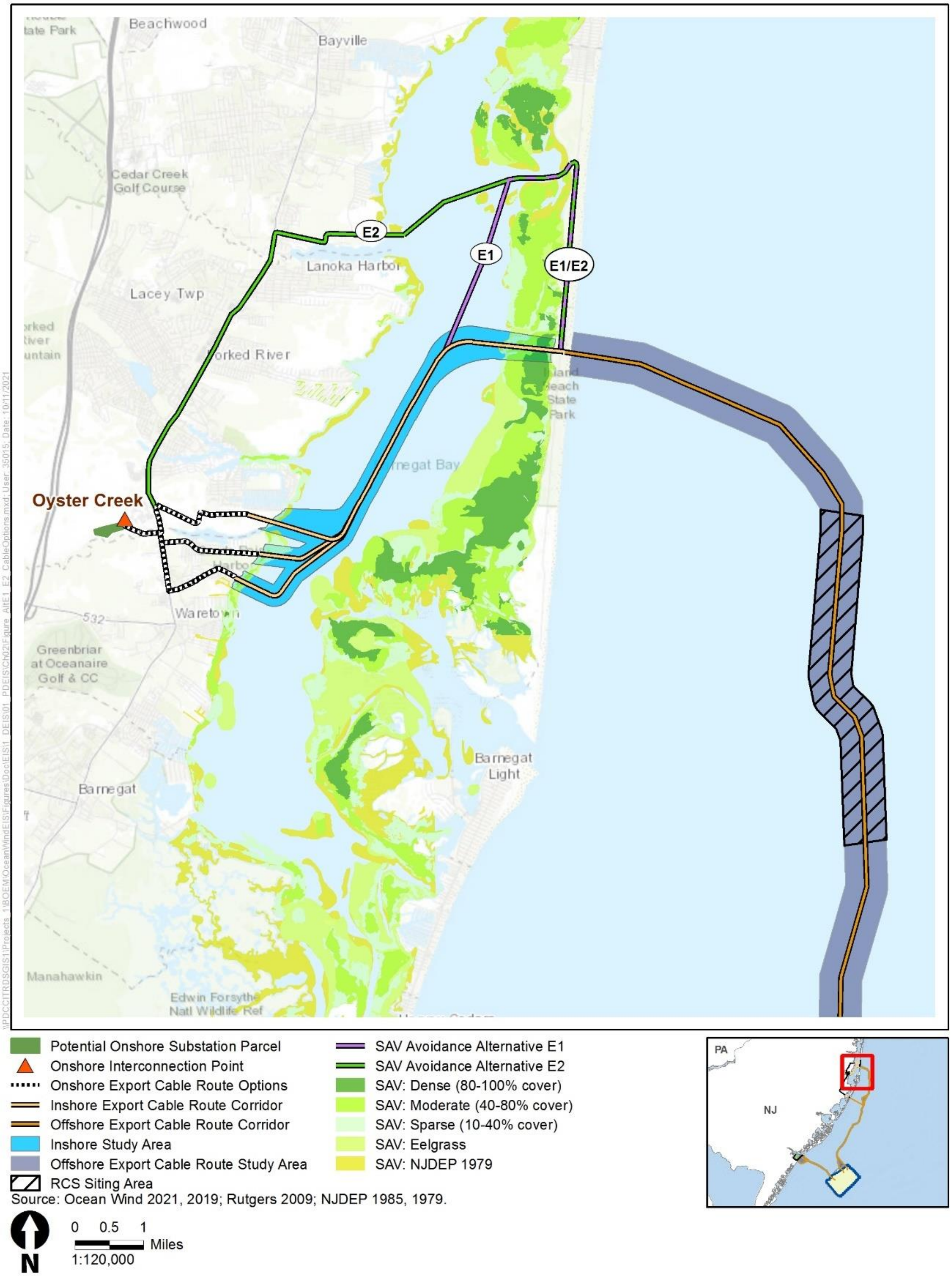

Figure C-2 Alternatives E-1 and E-2: Submerged Aquatic Vegetation Avoidance Alternative (Northern Route)

Figure C-3 Example of a Reactive Compensation Station (Hornsea I)

C.2.2.1. Feasibility Analysis and Environmental Consequences

Alternative E-2 would result in 0.71 acre of SAV impacts, substantially less than the Proposed Action. However, the increased export cable length and associated installation of a reactive compensation station would result in substantial adverse impacts on other resources, most notably through the presence of an above-water physical structure much closer to shore within the navigation approaches to New York Harbor, in an area of higher vessel transit than the Lease Area (navigation and vessel traffic, scenic and visual resources); additional foundation installations (benthic resources, marine mammals, sea turtles); and approximately 4.5 kilometers of new offshore and 4.4 kilometers of new onshore export cable route on Island Beach State Park and 10.6 kilometers of new onshore export cable route in Berkeley Township (land use and coastal infrastructure).

A portion of new offshore cable route would be in an unmapped area, so the potential presence of MEC and UXO, marine archaeological resources, and other unmapped obstacles in this portion of the route is unknown. Obtaining the required G&G, benthic, socioeconomic, and biological survey data to determine the technical feasibility of Alternative E-2 could take up to 2 years, which would result in delays to the anticipated commencement of commercial operations.

Benthic Resources: Under Alternative E-2, the export cable route would be aligned to avoid impacts on mapped SAV. Because export cables need to be spaced at 50 meters apart, the HDD would exit within the mapped SAV, which could result in up to 2 acres of SAV impacts. The reactive compensation station foundation would result in additional permanent conversion of up to 1 acre of sand and muddy sand-mobile or coarse sediment-mobile benthic habitat.

Marine Mammals, Sea Turtles: The decreased impact on SAV would potentially affect marine mammal prey species. The reduced acreage of SAV affected by cable emplacement within Barnegat Bay would reduce potential impacts on adult green sea turtles, as they are the only sea turtles that forage exclusively on aquatic vegetation such as eelgrass. While the number of green sea turtles that would potentially benefit is not quantifiable, the species regularly occurs in Barnegat Bay (Excelon Generation 2012); therefore, minimizing impacts on SAV in Barnegat Bay would avoid the destruction of important foraging habitat. The reactive compensation station would in essence be another OSS, causing additional temporary and permanent impacts on marine mammals and sea turtles.

Commercial Fishing: Alternative E-2 may result in slightly greater impacts on commercial fisheries and for-hire recreational fishing during construction due to avoidance of the area for nearshore fisheries due to the extended length of the export cable in Barnegat Bay. The acreage of SAV affected by cable emplacement and maintenance would be reduced and would slightly benefit the fisheries because SAV provides nursery habitat for targeted fishery species, thus possibly enhancing potential recruitment to the fishery, although any enhancement would be minimal. Alternative E-2 would likely require a reactive compensation station, which would require additional pre-construction surveys and installation of additional foundations; however, the incremental contribution of these activities would be minor in relation to the overall impacts of Alternative E-2.

Cultural Resources: Alternative E-2 would expand the APE to locations that have not been surveyed for the presence of onshore archaeological sites or ancient submerged landforms; therefore, there would be an increased potential for adverse impacts on cultural resources. Ground-disturbing construction activities could disturb or destroy undiscovered archaeological sites and TCPs, if present. However, state and federal requirements to identify cultural resources, assess Project impacts, and develop treatment plans to avoid, minimize, or mitigate adverse impacts would limit the extent, scale, and magnitude of impacts on individual cultural resources. The reactive compensation station approximately 3 to 5 miles offshore of Island Beach State Park would expand the visual study area. The reactive compensation station would likely be visible from historic properties and result in impacts on the historic properties.

Land Use and Coastal Infrastructure: Under Alternative E-2, the presence of a reactive compensation station would affect recreation and tourism as well as property values if visitors decide to visit different coastal locations and potential residents choose to select different residences. Construction of the Oyster Creek cable corridor under Alternative E-2 would result in up to 50 acres of temporary disturbance, an increase of 38 acres compared to the Proposed Action. Alternative E-2 would have a longer cable and would cause land disturbance in both Island Beach State Park and Lacey Township. Alternative E-2 would increase the onshore portion of the Oyster Creek export cable route by approximately 2.7 miles on Island Beach State Park. An additional approximately 3 acres of workspace and associated clearing would be needed to accommodate the turning radius for the cable from the road to the HDD workspace. The workspace would affect the undeveloped shrub/scrub and dune habitat adjacent to Tidal Pond Bird Blind Observation Trail. An additional approximately 6 acres of clearing would be needed adjacent to Central Avenue/Shore Road to accommodate the vaults for the cables once installed in the road (allowing for a 15-foot spacing between the two).

Trenching and installation activities to bury the cable would temporarily disturb beaches, wetlands, and vegetation on the barrier island and potentially interfere with recreational activities in the state park. The additional alignment, running the export cable north along Central Avenue/Shore Road before exiting west into Barnegat Bay, would likely require full road closure, partial road closure with specific construction sequencing, and traffic attenuation. Should full closure of the road be necessary, the park would likely require closing all public recreational access south of the ongoing construction. After construction, the right-of-way would be restored to pre-disturbance conditions. Future maintenance or emergency repairs may occur during times of heavy park visitation, and may result in intermittent impacts on Island Beach State Park and park users.

Navigation and Vessel Traffic: The reactive compensation station installed under Alternative E-2 would create a potential navigational hazard in an area of high fishing and recreational vessel activity, as there is substantial vessel movement along the coast and at the mouth of Barnegat Inlet (Figure C-4). Deep-draft vessel traffic would be 4 to 6 miles to the east of the potential substation location, resulting in no impacts on deep-draft vessel traffic. Tug traffic is likely to follow the informal fairway route that currently delineates the typical tug routes. Alternative E-2 would slightly increase risk of an allision by a fishing or pleasure vessel due to the presence of an additional fixed structure within near-shore waters.

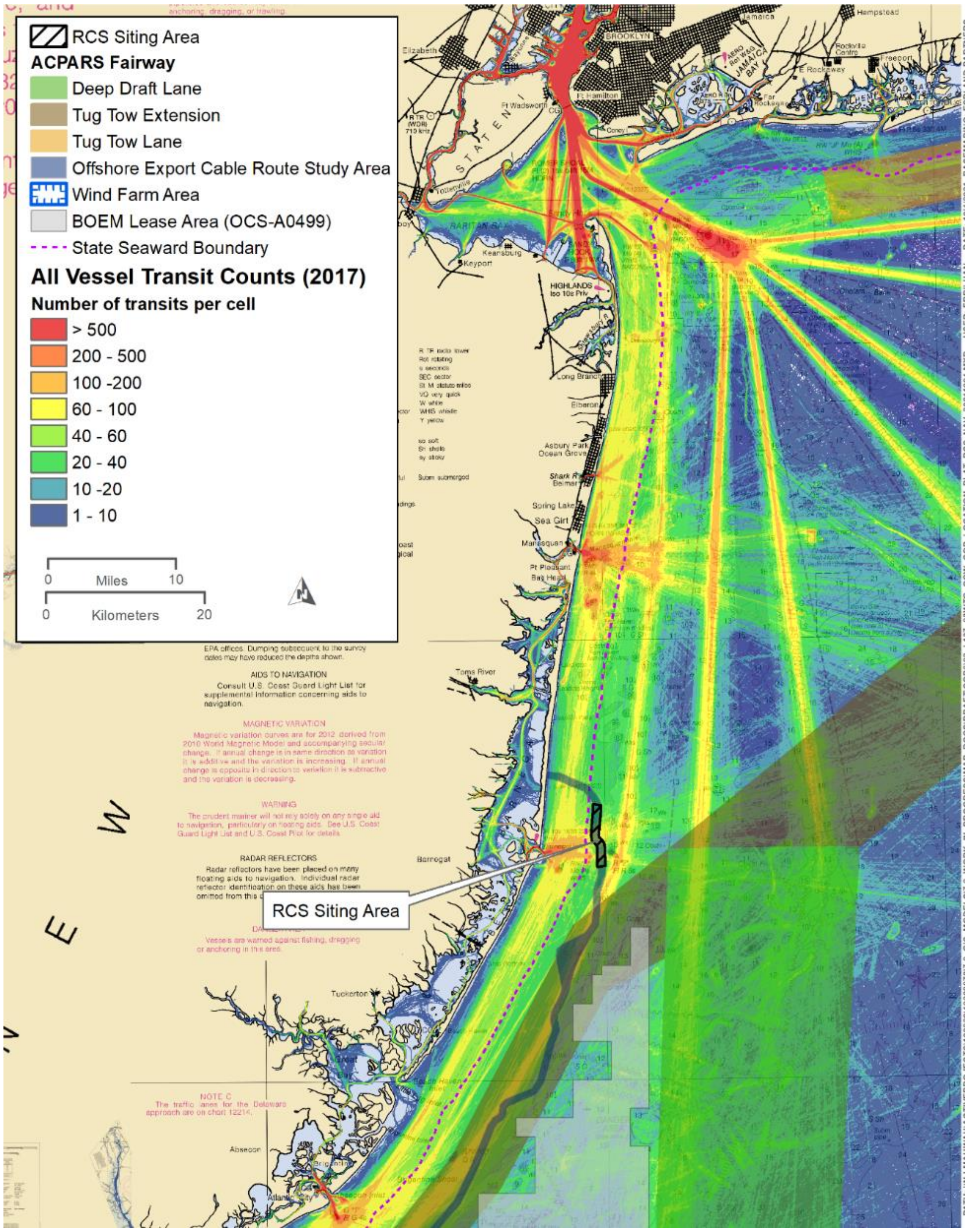

Figure C-4 Navigation and Vessel Traffic in the Vicinity of a Reactive Compensation Station

Scenic and Visual Resources: Alternative E-2 would increase the export cable route and would likely require installation of a reactive compensation station offshore of Island Beach State Park. As shown on Figure C-3, a reactive compensation station would be similar in appearance to the OSS that would be installed within the Lease Area. The reactive compensation station would be visually prominent from viewpoints on Long Beach given its proximity (see Figure C-5 for a visual simulation of the reactive compensation station as viewed from Long Beach). As shown on Figure C-6, the reactive compensation station would also expand the geographic extent of noticeable elements associated with the Proposed Action, with visual impacts extending farther north compared to the Proposed Action.

Due to distance, extensive FOVs, strong contrasts, large scale of change, level 6 prominence, and heretofore undeveloped ocean views, Alternative E-2 would have major effects on the open ocean character unit and viewer boating and cruise ship experiences. Effects of Alternative E-2 on high- and moderate-sensitivity seascape character units and landscape character units would also be major due to view distances, moderate FOVs, moderate and weak visual contrasts, clear-day conditions, and nighttime ADLS activation. The daytime presence of offshore WTGs, OSS, and the reactive compensation station as well as their nighttime lighting would change viewers' perception of ocean scenes from natural and undeveloped to a developed energy environment characterized by WTGs and OSS. In clear weather, the WTGs, OSS, and reactive compensation station would be unavoidable presences in views from the coastline, with moderate effects on landscape character.

Figure C-5 Visual Prominence of the Reactive Compensation Station, Given Its Size and Location Offshore

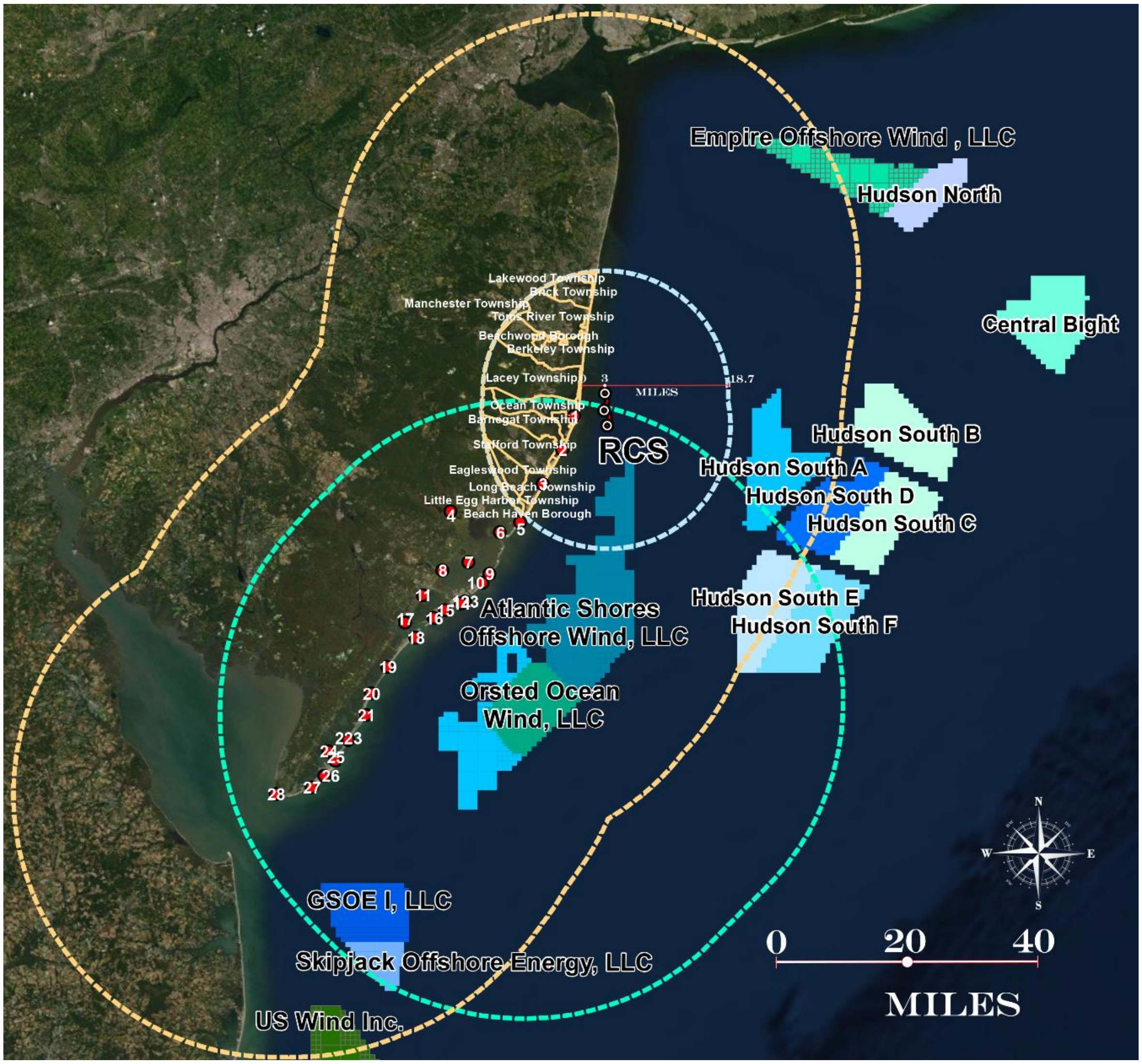

Figure C-6 Reactive Compensation Station Siting Location and Associated Visual Resource Impacts: Extension of the Visual Study Area

Wetlands: Alternative E-2 would result in increased temporary impacts compared to the Proposed Action. The onshore cable route to Oyster Creek would be longer than under the Proposed Action and would traverse more wetland areas. Table C-2 provides a comparison of the wetland impacts of Alternative E-2 in comparison to the Proposed Action and Alternative E. The Proposed Action and Alternative E are carried forward for detailed analysis in the Final EIS.

Table C-2 Temporary Wetland Impacts Along Oyster Creek Onshore Export Cable Route

Wetland Community	Proposed Action (Acres)	Alternative E (Acres)	Alternative E-2 (Acres)
Atlantic White Cedar Wetlands	--	--	0.50
Coniferous Scrub/Shrub Wetlands	--	--	0.23
Deciduous Scrub/Shrub Wetlands	1.06	1.06	0.07
Deciduous Wooded Wetlands	0.96	0.96	--

Wetland Community	Proposed Action (Acres)	Alternative E (Acres)	Alternative E-2 (Acres)
Herbaceous Wetlands	0.06	0.06	--
Mixed Scrub/Shrub Wetlands (Coniferous Dominant)	0.81	0.81	0.08
Mixed Scrub/Shrub Wetlands (Deciduous Dominant)	0.99	1.32	2.63
Mixed Wooded Wetlands (Coniferous Dominant)	--	--	0.68
Mixed Wooded Wetlands (Deciduous Dominant)	--	--	0.01
Phragmites Dominate Coastal Wetlands	0.08	0.08	0.16
Saline Marsh (High Marsh)	1.14	1.14	0.20
Saline Marsh (Low Marsh)	--	--	--
Total: Oyster Creek	**5.10**	**5.43**	**4.55**

BOEM calculated temporary wetland impacts in geographic information systems for the Proposed Action and alternatives based on the longest Oyster Creek cable route option using a 50-foot corridor width.

C.2.3 SAV Avoidance Alternative E-3

Under Alternative E-3, the construction, O&M, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey would occur within the range of the design parameters outlined in the Ocean Wind 1 COP, subject to applicable mitigation measures. However, modifications would be made to the Oyster Creek export cable route to minimize impacts on SAV in Barnegat Bay and utilize existing corridors, as preferred by NJDEP (Figure C-7). The export cable route would make landfall in an existing parking lot in Ship Bottom, New Jersey, and then follow Route 72 and U.S. Highway 9 to the onshore substation (Figure 2-11). After making landfall the export cable would be constructed as a buried onshore cable route.

Initially, Alternative E-3 proposed attaching the export cables to the Route 72 Bridge; however, through coordination with the New Jersey Department of Transportation, BOEM found that the proposed export cables cannot be attached to the Route 72 Bridge due to issues with weight and integrity. Consequently, the export cables would need to be routed through Manahawkin Bay, along a corridor that was previously disturbed during the recent rehabilitation of the Route 72 Bridge.

Table C-3 presents impacts of Alternative E-3 on SAV in comparison to the Proposed Action and Alternative E. The Proposed Action and Alternative E are carried forward for detailed analysis in the DEIS.

Table C-3 SAV Impacts of Alternative E-3 Compared to the Proposed Action and Alternative E

Data	Proposed Action (Acres)	Alternative E (Acres)	Alternative E-3 (Acres)
1979 Data	16.78	0.07	10.38
1985–1987 Data	14.66	1.18	16.05
2009 Data	13.01	0.03	1.78
Ocean Wind Survey Data	15.38	0.69	N/A

N/A = not applicable

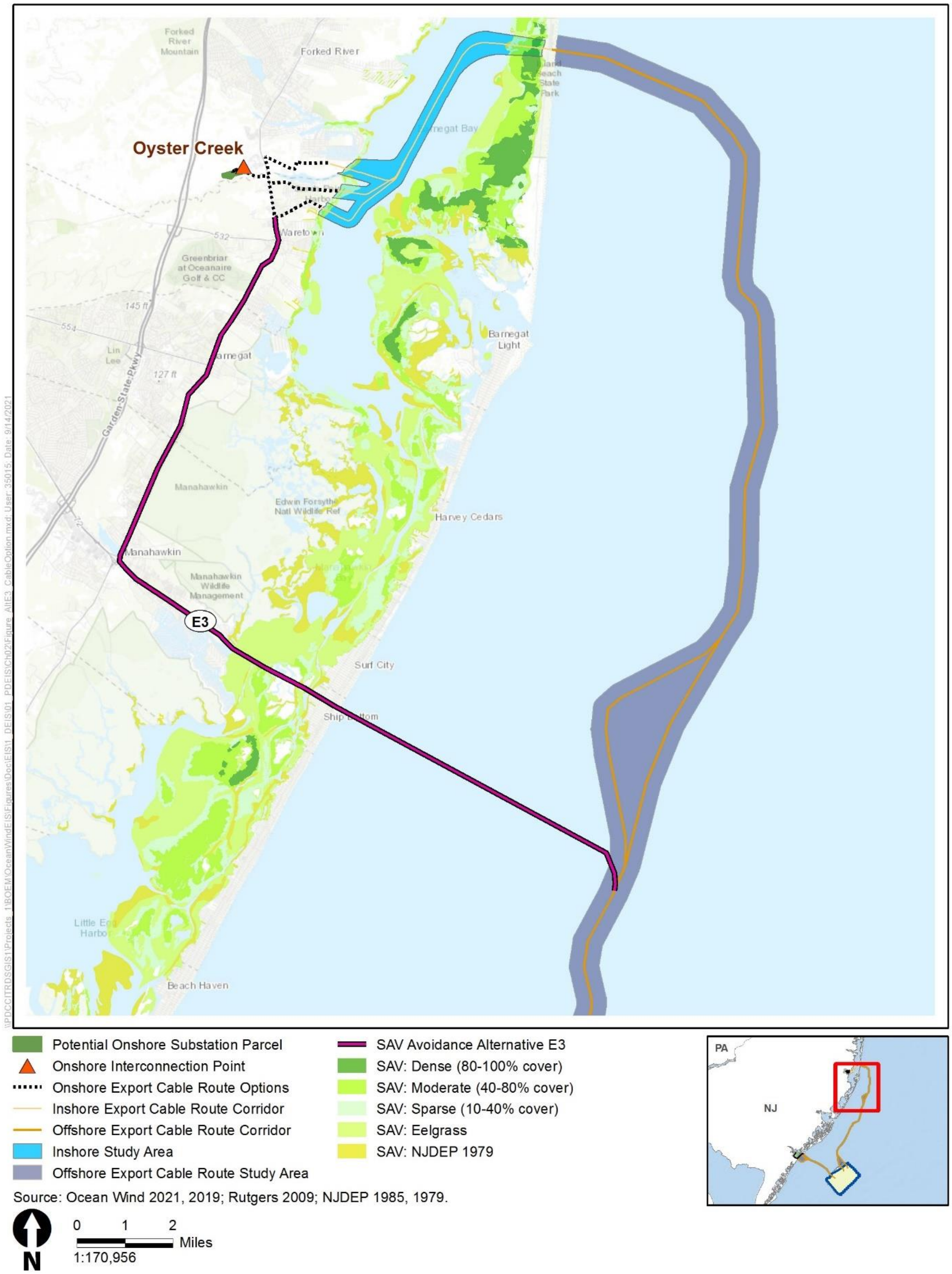

Figure C-7 Alternative E-3: Submerged Aquatic Vegetation Avoidance Alternative (Southern Route)

C.2.3.1. Feasibility Analysis and Environmental Consequences

Alternative E-3 was developed to minimize impacts on SAV. Alternative E-3 would result in substantially less SAV impacts than the Proposed Action according to the 2009 survey data. However, Alternative E-3 would result in substantial adverse impacts on other resources, as described below.

Alternative E-3 would include approximately 11.7 kilometers of new offshore and 22 kilometers of new onshore export cable route. Given the extent of new offshore cable route in an unmapped area, the potential presence of MEC and UXO, marine archaeological resources, and other unmapped obstacles in a substantial portion of the route is unknown. Obtaining the required G&G, benthic, socioeconomic, and biological survey data to determine the technical feasibility of Alternative E-3 could take up to 2 years, which would result in delays to the anticipated commencement of commercial operations and may result in a determination that Alternative E-2 is not feasible or results in unacceptable unavoidable impacts.

Benthic Resources: Alternative E-3 would minimize impacts on SAV associated with emplacement of the export cables. Although historic SAV mapping shows SAV throughout Manahawkin Bay, the recent Route 72 Bridge Rehabilitation Project affected SAV along the bridge, which is the same location proposed for the export cable route.

Marine Mammals, Sea Turtles: The decreased impact on SAV would potentially beneficial affect marine mammal prey species. The avoidance of impacts on SAV in Barnegat Bay and reduced acreage of SAV affected by cable emplacement within Manahawkin Bay would reduce potential impacts on adult green sea turtles, as they are the only sea turtles that forage exclusively on aquatic vegetation such as eelgrass. While the number of green sea turtles that would potentially benefit is not quantifiable, the species regularly occurs in Barnegat Bay (Excelon Generation 2012); therefore, minimizing impacts on SAV in Barnegat Bay would avoid the destruction of important foraging habitat.

Commercial Fishing: Alternative E-3 would lead to the same types of impacts on commercial fisheries and for-hire recreational fishing from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. The acreage of SAV affected by cable emplacement and maintenance would be reduced and would slightly benefit the fisheries because SAV provides nursery habitat for targeted fishery species, thus possibly enhancing potential recruitment to the fishery, although any enhancement would be minimal.

Cultural Resources: Alternative E-3 would expand the APE to locations that have not been surveyed for the presence of onshore archaeological sites or ancient submerged landforms; therefore, there is an increased potential for adverse impacts on cultural resources. Ground-disturbing construction activities could disturb or destroy undiscovered archaeological sites and TCPs, if present. However, state and federal requirements to identify cultural resources, assess Project impacts, and develop treatment plans to avoid, minimize, or mitigate adverse impacts would limit the extent, scale, and magnitude of impacts on individual cultural resources.

Land Use and Coastal Infrastructure: Alternative E-3 would increase the onshore export cable route by approximately 9 miles, and would result in up to 57 acres of temporary disturbance, an increase of 45 acres compared to the Proposed Action. Increased onshore cable routing would extend onshore construction duration and increase adverse impacts on local communities from increased noise and traffic. Under Alternative E-3, the export cable route would make landfall in an existing parking lot in Ship Bottom, New Jersey, and then follow Route 72 and U.S. Highway 9 to the onshore substation, constructed as a buried onshore cable route. Landfall siting in Surf City/Ship Bottom would be challenging given the roadway configurations, dense development in these locations, and need for 50 meters of separation between the two cables at landfall. There are only two north-south roads in Ship Bottom and three north-south roads in Surf City. The main roadway, Long Beach Boulevard, is approximately 120 to 130 meters from the beach, depending on which east-west street is selected. To meet depth requirements below dunes, it is anticipated that the HDD would need to be set back from the beach, which would locate portions of the drill site back to the second block on the barrier island affecting two of the north-south routes. Up to 2 acres is needed to support the drilling activities. However, due to the heavy development, even if this area is available, the orientation of the Project site (several connected two-lane roadways) is not optimal, as the narrowness of the roads would require heavy machinery to operate in very tight conditions. Road closures and temporary detours would affect the communities of Ship Bottom and Surf City.

Scenic and Visual Resources: Alternative E-3 would not add new aboveground infrastructure and visual impacts of Alternative E-3 would be the same as those of the Proposed Action for the primary IPFs related to the presence of structures, light, and vessel traffic.

Wetlands: Alternative E-3 would result in increased temporary impacts on wetlands compared to the Proposed Action because the longer onshore cable route would traverse more wetland areas. Table C-4 provides a comparison of the wetland impacts of Alternative E-3 in comparison to the Proposed Action and Alternative E. The Proposed Action and Alternative E are carried forward for detailed analysis in the Final EIS.

Table C-4 Temporary Wetland Impacts Along Onshore Export Cable Routes

Wetland Community	Proposed Action (Acres)	Alternative E (Acres)	Alternative E-3 (Acres)
Atlantic White Cedar Wetlands	--	--	0.76
Coniferous Scrub/Shrub Wetlands	--	--	--
Deciduous Scrub/Shrub Wetlands	1.06	1.06	0.58
Deciduous Wooded Wetlands	0.96	0.96	1.59
Herbaceous Wetlands	0.06	0.06	--
Mixed Scrub/Shrub Wetlands (Coniferous Dominant)	0.81	0.81	1.58
Mixed Scrub/Shrub Wetlands (Deciduous Dominant)	0.99	1.32	0.32
Mixed Wooded Wetlands (Coniferous Dominant)	--	--	1.44
Mixed Wooded Wetlands (Deciduous Dominant)	--	--	4.07
Phragmites Dominate Coastal Wetlands	0.08	0.08	--
Saline Marsh (High Marsh)	1.14	1.14	0.97
Saline Marsh (Low Marsh)	--	--	0.10
Total: Oyster Creek	**5.10**	**5.43**	**11.39**

BOEM calculated temporary wetland impacts in geographic information systems for the Proposed Action and alternatives based on the longest Oyster Creek cable route option using a 50-foot corridor width.

C.2.4 Great Egg Harbor Inlet Export Cable Route

Ocean Wind considered an export cable route through Great Egg Harbor inlet, the shipping channel, and Great Egg Harbor Bay, which would make landfall near the BL England Substation. Figure C-8 illustrates the Great Egg Harbor inlet export cable route, which was dismissed from further consideration as described in Section 2.1.7, *Alternatives Considered but not Analyzed in Detail*.

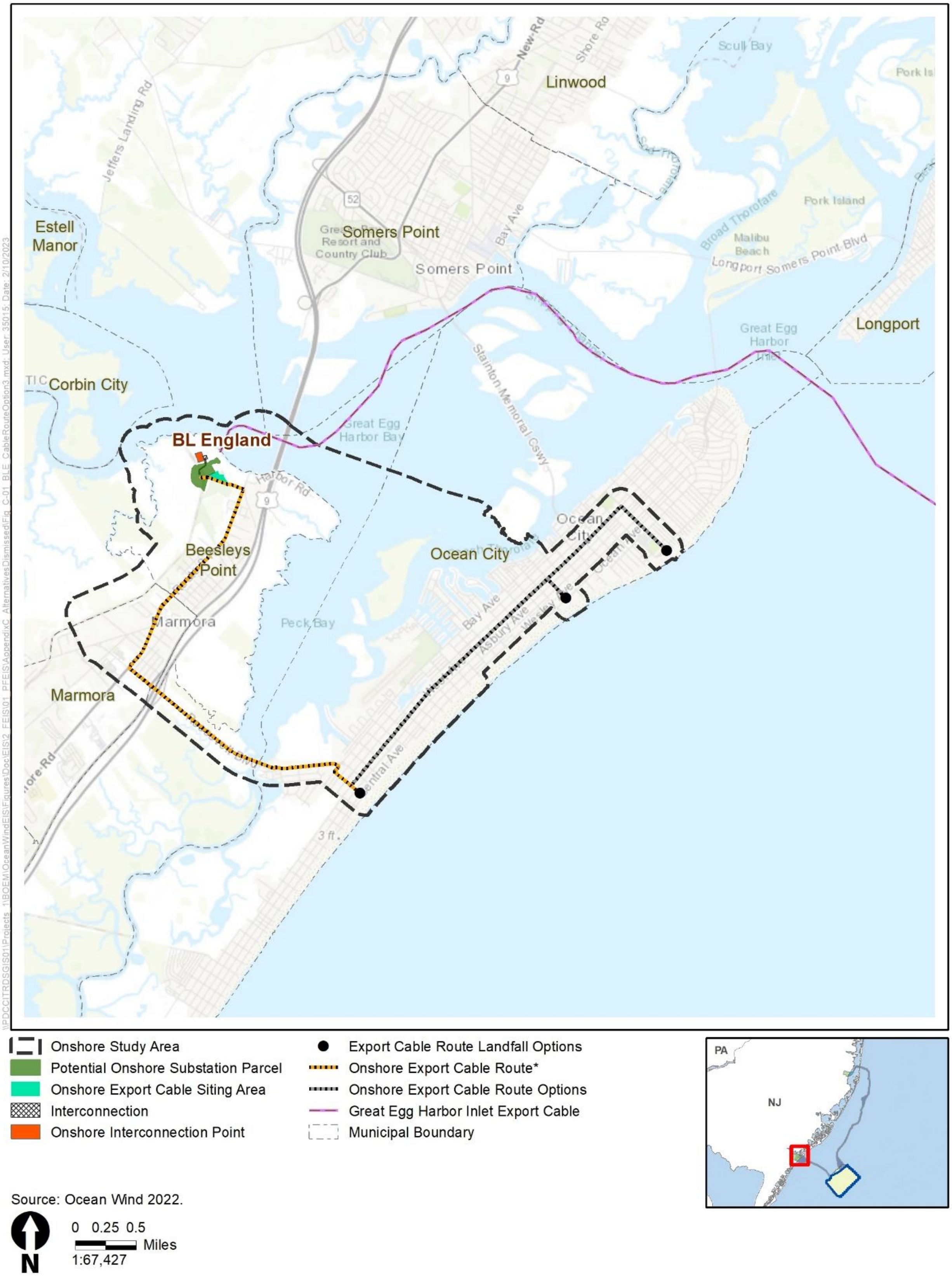

Figure C-8 Great Egg Harbor Inlet Export Cable Route

C.2.4.1. Feasibility Analysis

The Great Egg Harbor inlet export cable route was not carried forward into the Ocean Wind 1 COP as a BL England export cable route option because the route was deemed impracticable for the following reasons:

1. Sediments in the Great Egg Harbor inlet are dynamic and are maintained through maintenance dredging; therefore, placing the cable at a permitted depth below the authorized dredge depth for the entire length of the navigation channel places additional risk on the cable and may require additional cable protection such as cable mattresses, placement within an easement, or other mitigation for the export cable route within the inlet and navigation channel. Cable mattresses may also be required where the export cable crosses existing cable areas (i.e., Great Egg Harbor Inlet, from Anchorage Point to the Rainbow Islands, adjacent to the Stainton Memorial Causeway, and adjacent to the Garden State Parkway Bridge). Cable protection would result in additional impacts on natural resources and could cause permanent impacts on the navigation channel.

2. Access to the Great Egg Harbor inlet by other vessels would be restricted during construction, which would result in additional impacts on other marine uses and navigation. The Great Egg Harbor inlet export cable route would cross under three bridges with low clearance and in areas with shallow water depths, making construction challenging due to reduced draft for construction vessels, limited ability to maneuver, and modified cable burial methods.

   Due to the shallower water depths of Great Egg Harbor, the cable installation process (i.e., transporting, laying, and burying the cables) could not be completed by a cable burial vessel in a single operation. Instead, the cable would need to be converted from a single-three-phase cable to three single-core cables that would then be floated and retro-buried or individually buried. These steps are required to reduce vessel drafts to facilitate navigation within the harbor and avoid grounding cable installation vessels. These additional steps would require multiple vessels to operate in concert to store, feed, float, place, and bury the cables. Due to low water depth within Great Egg Harbor, the cables would need to be buried within the limits of the authorized federal and state channel for approximately 4 miles. The width of this channel is approximately 500 feet.

   If the cable were installed in the Great Egg Harbor inlet, a safety zone would be required around the cable-laying vessels while within the inlet and channel. Cable-laying vessels are functionally stationary within the inlet or channel (approximately 3 meters of cable per minute or less than 0.1 mile per hour) while placing submarine cable and disrupt typical vessel traffic. This may force vessels transiting into or out of Great Egg Harbor to transit more slowly, divert into auxiliary channels, or use alternative pathways while transiting the harbor. Due to the overhead clearance of the bridges within Great Egg Harbor, cable-laying procedures would be slower near the existing bridges and may require temporary closures of navigation channels to allow for cable burial and movement of construction equipment. As such, impacts on navigation resulting from the Great Egg Harbor inlet export cable route were anticipated to be significant.

3. There is an existing USACE borrow area at the mouth of the Great Egg Harbor inlet and USACE does not typically authorize crossing of borrow areas or would require mitigation that could not be implemented by the Project, including burial depths of up to 80 feet below the federal project limit.

In contrast, the proposed Oyster Creek export cable route within Barnegat Bay is in a portion of the bay where sediments are less dynamic and therefore largely avoids the need for cable mattress, minimizes co-location within a navigation channel, and does not cross a charted cable area. While the proposed export cable route within Barnegat Bay requires crossing the Intercoastal Waterway, the route minimizes the crossing length and is within a portion of Barnegat Bay that is over 1.5 miles wide. Adequate space would be available for recreational and commercial traffic to navigate safely during cable installation; therefore, impacts on navigation during construction are anticipated to be low. As the proposed export cable within

Barnegat Bay minimized environmental and navigational impacts and avoided the construction feasibility constraints that would affect the Great Egg Harbor inlet export cable route, the Great Egg Harbor inlet export cable route was dismissed from further consideration.

C.3. References Cited

Excelon Generation. 2012. *Annual sea turtle incidental take report – 2012*. Oyster Creek Nuclear Generating Station report submitted to NMFS. Prepared by M. Browne, K. Voishnis, and J. Kerr. December 2012. Available: https://www.nrc.gov/docs/ML1236/ML12361A025.pdf. Accessed: November 16, 2021.

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Appendix D. Analysis of Incomplete or Unavailable Information

In accordance with Section 1502.21 of the CEQ regulations implementing NEPA, when an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an EIS and when information is incomplete or unavailable, the agency shall make clear that such information is lacking. When incomplete or unavailable information was identified, BOEM considered whether the information was relevant to the assessment of impacts and essential to its analysis of alternatives based upon the resource analyzed. If essential to a reasoned choice among the alternatives, BOEM considered whether it was possible to obtain the information and if the cost of obtaining it was exorbitant. If it could not be obtained or if the cost of obtaining it was exorbitant, BOEM applied acceptable scientific methodologies to inform the analysis in light of this incomplete or unavailable information. For example, conclusive information on many impacts of the offshore wind industry may not be available for years, and certainly not within the contemplated timeframe of this NEPA process. However, if this information is essential for a reasoned decision, subject matter experts have used the scientifically credible information available and generally accepted scientific methodologies to evaluate impacts on the resources while this information is unavailable.

D.1. Incomplete or Unavailable Information Analysis for Resource Areas

D.1.1 Air Quality

Although a quantitative emissions inventory analysis of the region, or regional modeling of pollutant concentrations, over the next 35 years would more accurately assess the overall impacts of the changes in emissions from the Project, any action alternative would lead to reduced emissions regionally and can only lead to a net improvement in regional air quality. The differences among action alternatives with respect to direct emissions due to construction, O&M, and decommissioning of the Project are expected to be small. As such, the analysis provided in this EIS is sufficient to support sound scientific judgments and informed decision-making related to the use of the offshore portions of the Wind Farm Area and offshore export cable route corridor. Therefore, BOEM does not believe that there is incomplete or unavailable information on air quality that is essential to a reasoned choice among alternatives.

D.1.2 Bats

There will always be some level of incomplete information on the distribution and habitat use of bats in the offshore portions of the Wind Farm Area, as habitat use and distribution varies among seasons and species. Additionally, because U.S. offshore wind development is in its infancy, with only two offshore wind projects having been constructed at the time of this analysis, there is some level of uncertainty regarding the potential collision risk to individual bats that may be present within the offshore portions of the Wind Farm Area. However, sufficient information on collision risk to bats observed at land-based U.S. wind projects exists and was used to analyze and corroborate the potential for this impact as a result of the proposed Project. In addition, as described in Section 3.5, the likelihood of a bat encountering an operating WTG during migration is very low and, therefore, the differences among action alternatives with respect to bats for the Project are expected to be small. As such, the analysis provided in this EIS is sufficient to support sound scientific judgments and informed decision-making related distribution and use of the offshore portions of the Wind Farm Area as well as to the potential for collision risk of bats. Therefore, BOEM does not believe that there is incomplete or unavailable information on bat resources that is essential to a reasoned choice among alternatives.

D.1.3 Benthic Resources

Although there is uncertainty regarding the spatial and temporal distribution of benthic (faunal) resources and periods during which they might be especially vulnerable to disturbance, Ocean Wind's surveys of benthic resources and other broad-scale studies (Guida et al. 2017; Inspire 2021) provided a suitable basis for generally predicting the species, abundances, and distributions of benthic resources within the geographic analysis area. Uncertainty also exists regarding the impact of some IPFs on benthic resources. For example, specific stimulus-response related to acoustics and EMF is not well studied, although there is some emerging information from benthic monitoring at European wind facilities and the Block Island Wind Farm in the United States that allows for a broad understanding of the impacts. Similarly, specific secondary impacts, such as changes in diets throughout the food chain resulting from habitat modification and synergistic behavioral impacts from multiple IPFs, are not fully known. Again, results of benthic monitoring at European wind facilities and the Block Island Wind Farm in the United States provide general knowledge of the overall impacts of these IPFs combined, if not individually. Therefore, the analysis provided in this EIS is sufficient to support sound scientific judgments and informed decision-making related to the overall impacts. For these reasons, BOEM does not believe that there is incomplete or unavailable information on benthic resources that is essential to a reasoned choice among alternatives.

D.1.4 Birds

Habitat use and distribution of marine birds varies between seasons, species, and years and, as a result, there will always be some level of incomplete information on the distribution and habitat use of marine birds in the offshore portions of the geographic analysis area. However, avian survey findings by NJDEP that cover the Project (see COP Volume III, Appendix H, Section 3.2.4.1.1; Ocean Wind 2023) were used to inform the predictive models and analyze the potential adverse impacts on bird resources in the EIS. In addition, because U.S. offshore wind development is in its infancy, there will always be some level of uncertainty regarding the potential for collision risk and avoidance behaviors for some of the bird species that may be present within the offshore portions of the geographic analysis area. In place of this information, subject matter experts used the data and assumptions described below and in the EIS to create models to evaluate impacts, where it was determined that the information was essential for reasoned decision-making. Bird mortality data are available for onshore wind facilities and, based on a number of assumptions regarding their applicability to offshore environments, were used to inform the analysis of bird mortality associated with the offshore WTGs analyzed in the EIS. However, uncertainties exist regarding the use of the onshore bird mortality rate to estimate the offshore bird mortality rate due to differences in species groups present and life history and behavior of species as well as differences in the offshore marine environment compared to onshore habitats. Modeling is commonly used to predict the potential mortality rates for marine bird species in Europe and the United States (BOEM 2015, 2021b). Due to inherent data limitations, these models often represent only a subset of species potentially present. However, the datasets used by both Ocean Wind and BOEM to assess the potential for exposure of marine birds to the Wind Farm Area represent the best available data and provide context at both local and regional scales. Furthermore, sufficient information on collision risk and avoidance behaviors observed in related species at European offshore wind projects is available and was used to analyze and corroborate the potential for these impacts as a result of the proposed Project (e.g., Petersen et al. 2006; Skov et al. 2018). As such, the analysis provided in the EIS is sufficient to support sound scientific judgments and informed decision-making related to distribution and use of the offshore portions of the geographic analysis area as well as to the potential for collision risk and avoidance behaviors in bird resources. Furthermore, the similarity between the layouts analyzed for the different action alternatives does not render any of this incomplete and unavailable information essential to a reasoned choice among alternatives. Therefore, BOEM does not believe that there is incomplete or unavailable information on avian resources that is essential to a reasoned choice among alternatives.

D.1.5 Coastal Habitat and Fauna

Although the preferred habitats of terrestrial and coastal fauna are generally known, specific data on abundances and distributions within the geographic analysis area of various fauna within these habitats are likely to remain unknown without site-specific surveys. However, the species inventories and other general information about the area provide an adequate basis for evaluating the fauna likely to inhabit the onshore geographic analysis area. Additionally, the onshore activities proposed involve only common, industry-standard activities for which impacts are generally understood. Therefore, BOEM believes that the analysis provided in this EIS is sufficient to make a reasoned choice among the alternatives.

D.1.6 Commercial Fisheries and For-Hire Recreational Fishing

Fisheries are managed in the context of an incomplete understanding of fish stock dynamics and effects of environmental factors on fish populations. The commercial fisheries information used in this assessment has limitations. For example, vessel trip report data are only an approximation because this information is self-reported and may not account for all trips. The vessel trip report data also do not include all commercial fishing operations that may be affected by the Proposed Action and only represent vessel logbook data for species managed by the Greater Atlantic Regional Fisheries Office. While these data include incidental catch of Atlantic menhaden, highly migratory species, or species managed by the NMFS Southeast Regional Office (e.g., wahoo and mahi mahi) when targeting other species, they are not a subset of total catch of these species within the Lease Area. Additionally, available historical data lack consistency, making comparisons challenging.

VMS data are also limited, with a number of factors contributing to their limitations.

- VMS coverage is not universal for all fisheries, with some fisheries (summer flounder, scup, black sea bass, bluefish, American lobster, spiny dogfish, skate, whiting, and tilefish) not covered at all by VMS.
- There is limited historical coverage for most fisheries (e.g., monkfish is optional and elective on a yearly basis, 2005 or earlier for herring, 2006 for groundfish and scallops, 2008 for surfclams/ocean quahogs, 2014 for mackerel, and 2016 for longfin squid/butterfish).
- Trip declaration does not necessarily correspond to actual operation.
- Hourly position pings limit area resolution based on speed.
- Fishing time/location can be mis-estimated by operational assumptions (speed and direction) that are affected by externalities (weather, sea state, mechanical issues).
- Catch data are limited for there is no information on catch rates, retained catch composition is limited to target species and some bycatch species, and the data are not universal.
- Catch information is for the full trip, not sub-trips.
- Not all information is collected from all fisheries (gear type).

However, these data represent the best available data, and sufficient information exists to support the findings presented in this EIS.

A second limitation is that recent annual revenue exposed for for-hire recreational fishing in the Lease Area is not available. The economic analysis conducted by BOEM of recreational for-hire boats, as well as for-hire and private-boat angler trips that might be affected by the overall New Jersey WEA, including the Lease Area, was conducted for 2007–2012 (Kirkpatrick et al. 2017), and the New Jersey WEA is treated as one entity with no site-specific data for the individual offshore wind lease areas that compose the New Jersey WEA. Although these data are presented in Section 3.9 and used for findings, updated data for the period of 2013 to the present are not available. BOEM supplemented the data from the economic analysis with data compiled by NMFS (2021) regarding the annual revenue (2008–2018) for for-hire recreational fishing in the Lease Area and the percentage of each permit holder’s total trips coming from within the Lease Area during 2008–2018 to analyze differences in the importance of fishing grounds in the Lease Area for the for-hire recreational fishery. Using both sets of data, BOEM does not believe that there is incomplete or unavailable information on commercial fisheries and for-hire recreational fishing resources that is essential to a reasoned choice among alternatives.

D.1.7 Cultural Resources

Due to the size of the offshore remote-sensing survey areas in the marine APE, the full extent or size of individual ancient submerged landforms cannot be defined. As such, differences among alternatives with respect to cultural resources cannot be fully known. However, Ocean Wind has committed to avoiding ancient submerged landforms and, if they cannot be avoided, BOEM will specify mitigation in the ROD to resolve adverse effects on the ancient submerged landforms. Several potential submerged archaeological resources were identified within the remote-sensing survey area of the marine APE, but these resources were not definitively determined to be archaeological resources. However, these resources are assumed to be eligible, and Ocean Wind will avoid most of the resources as well as a 50-meter buffer around each resource. As a result, despite there being data gaps related to the specific nature of the potential submerged archaeological resources, there is sufficient information available to avoid these resources, or to minimize or mitigate impacts if they cannot be avoided.

Information pertaining to identification of historic properties within certain portions of the APE related to Alternatives C-1, C-2, and D will not be available until after the ROD is issued and the COP is approved. However, the differences among alternatives with respect to cultural, historic, and archaeological resources are not expected to be significant. If Alternative C-1, C-2, or D is selected, BOEM will use the ROD as an agreement document to establish commitments for deferred identification and evaluation of historic properties within the APE in accordance with BOEM’s existing *Guidelines for Providing Archaeological and Historic Property Information Pursuant to Title 30 Code of Federal Regulations Part 585*, ensuring potential historic properties are identified, effects assessed, and adverse effects resolved prior to construction. If Alternative C-1 is selected, previously un-surveyed areas associated with one WTG and potentially the inter-array cable routing may need to be surveyed for marine archaeology. If Alternative C-2 with a 1.1-nm setback and any distance other than the 750-meter setback is selected, previously un-surveyed areas associated with 22 WTG positions and potentially the inter-array cable routing may need to be surveyed for marine archaeology. If Alternative D is selected, previously un-surveyed areas associated with the inter-array cable may need to be surveyed for marine archaeology. Therefore, BOEM does not believe this incomplete or unavailable information on historic properties is essential to a reasoned choice among alternatives.

D.1.8 Demographics, Employment, and Economics

Ocean Wind’s economic analysis estimated the employment and outputs for the Proposed Action. This provided sufficient information for the evaluation of demographics, employment, and economics to support a reasoned choice among alternatives. There is some inherent uncertainty in forecasting how economic variables in various areas will evolve over time. However, the differences among action alternatives with respect to demographics, employment, and economics are not expected to be significant. Therefore, BOEM does not believe that there is specific incomplete or unavailable information on demographics, employment, and economics that is essential to a reasoned choice among alternatives.

D.1.9 Environmental Justice

Evaluations of impacts on environmental justice communities rely on the assessment of impacts on other resources. As a result, incomplete or unavailable information related to other resources, as described in this document, also affect the completeness of the analysis of impacts on environmental justice communities.

As discussed in other sections, BOEM has determined that incomplete and unavailable resource information for environmental justice or for other resources on which environmental justice communities rely was either not relevant to assess reasonably foreseeable significant adverse impacts, was not essential to a reasoned choice among alternatives, alternative data or methods could be used to predict potential impacts and provided the best available information, or the overall costs of obtaining the information were exorbitant or the means to do so were unknown. Therefore, the information provided in the EIS is sufficient to support sound scientific judgments and informed decision-making related to the proposed uses of the onshore and offshore portions of the geographic analysis area. Furthermore, the differences among action alternatives with respect to environmental justice are not expected to be significant.

D.1.10 Finfish, Invertebrates, and Essential Fish Habitat

Although there is some uncertainty regarding the spatial and temporal distribution of finfish and invertebrate resources and periods during which they might be especially vulnerable to disturbance, Ocean Wind’s aquatic resource surveys (e.g., Inspire 2021) and other broad-scale studies (e.g., Guida et al. 2017) provided a suitable basis for general predictions of finfish and invertebrate resources with respect to species, densities, and distributions within the geographic analysis area. Additional information related to ESA-listed species and EFH will be addressed in the forthcoming BA and EFH Assessment. While impacts on these specific finfish and invertebrate species are not anticipated to vary from the general impacts provided in the EIS, specific impact discussion for ESA-listed species and EFH will be provided in the BA and EFH Assessment.

Uncertainty also exists regarding the impact of some IPFs on invertebrate resources, such as the effects of EMFs and underwater noise (e.g., generated from pile driving). The available information on invertebrate sensitivity to EMF is equivocal (Hutchinson et al. 2020), and sensitivity to sound pressure and particle motion effects is not well understood for many species, nor are synergistic or antagonistic impacts from multiple IPFs. Similarly, specific secondary impacts such as changes in diets throughout the food chain resulting from habitat modification are not well known for finfish and invertebrates. Where applicable, the assessment drew upon information in the available literature and an increasing number of monitoring and research studies related to wind development, other undersea development, or artificial reefs in Europe and the United States, several of which were recently drafted or published. These monitoring studies help provide a broad understanding of the overall impacts of these IPFs combined, if not individually.

For these reasons, the information provided in this EIS is sufficient to support sound scientific judgments and informed decision-making related to the overall impacts. Therefore, BOEM does not believe that there is incomplete or unavailable information on finfish, invertebrate, and EFH resources that is essential to a reasoned choice among alternatives.

D.1.11 Land Use and Coastal Infrastructure

There is no incomplete or unavailable information related to the analysis of impacts on land use and coastal infrastructure.

D.1.12 Marine Mammals

NMFS has summarized the most current information about marine mammal population status, occurrence, and use of the region in its 2019 stock status report for the Atlantic OCS and Gulf of Mexico (Hayes et al. 2020, 2021). These studies provided a suitable basis for predicting the species, abundances, and distributions of marine mammals in the geographic analysis area. However, population trend data from NMFS are unavailable for 14 species, and annual human-caused mortality is unknown for five species (see Table I-8 in Appendix I). The majority of species lacking population trend data are offshore species, such as blue whale, fin whale, and non-porpoise odontocetes (e.g., beaked whales and dolphins). As a result, there is uncertainty regarding how Project activities and cumulative effects may affect these populations. In addition to species distribution information, effects of some IPFs on marine mammals are also uncertain or ambiguous, as described below.

Potential effects of EMF have not been scaled to consider impacts on marine mammal populations or their prey in the geographic analysis area (Taormina et al. 2018). The widespread ranges of marine mammals and difficulty obtaining permits make experimental studies challenging. As a result, no scientific studies have been conducted that examine the effects of altered EMF on marine mammals. However, although scientific studies summarized by Normandeau et al. (2011) demonstrate that marine mammals are sensitive to, and can detect, small changes in magnetic fields (Section 3.15), potential impacts would likely only occur within a few feet of cable segments. The current literature does not support a conclusion that EMF could lead to changes in behavior that would cause significant adverse effects on marine mammal populations.

The behavioral effects of anthropogenic noises on marine mammals are increasingly being studied; however, behavioral responses vary depending on a variety of factors such as life stage, previous experience, and current behavior (e.g., feeding, nursing) and are therefore difficult to predict. In addition, the current NMFS disturbance criteria apply a single threshold for all marine mammals for impulsive noise sources and do not consider the overall duration, exposure, or frequency distribution of the sound to account for species-dependent hearing acuity. While elevated underwater sound could startle or displace animals, behavioral responses are not necessarily predictable from source levels alone (Southall et al. 2007).

In addition, research regarding the potential behavioral effects of pile-driving noise has generally focused on harbor porpoises and seals; studies that examine the behavioral responses of baleen whales to pile driving are absent from the literature. Of the available research, most studies conclude that, although pile-driving activities could cause avoidance behaviors or disruption of feeding activities, individuals would likely return to normal behaviors once the activity had stopped. However, uncertainty remains regarding the long-term cumulative acoustic impacts associated with multiple pile-driving projects that may occur over a number of years. This also applies to other project activities such as vessel movements, HRG surveys, geotechnical drilling, and dredging activities that may elicit behavioral reactions in marine mammals. As a result, it is not possible to predict with certainty the potential long-term behavioral effects on marine mammals from Project-related pile driving or other activities, as well as ongoing concurrent and cumulative pile driving and other activities.

To address this uncertainty, the assessment used the best available information when considering behavioral effects related to underwater noise. To better characterize these impacts, the behavioral response severity scores developed by Southall et al. (2021) were used in conjunction with the NMFS disturbance threshold, as described in Section 3.15.3.1. For the assessment of large baleen whales, studies on other impulsive noises (e.g., seismic sources) were used to inform the potential behavioral reactions to pile-driving noise. Monitoring studies would provide insight into species-specific behavioral reactions to Project-generated underwater noise. Long-term monitoring of concurrent and multiple projects could inform the understanding of long-term effects and subsequent consequences from cumulative underwater noise activities on marine mammal populations.

Offshore WTGs produce continuous, non-impulsive underwater noise during operation, mostly in lower-frequency bands below 1,500 Hz (summarized in Section 3.15.3.2). Current and near-term commercially available WTGs likely used for the Project range from 12.4-MW to 14.7-MW WTGs using the direct-drive GE Haliade-X 12-MW WTG. SPLs measured from direct-drive WTGs within this size range do not currently exist in the literature and modeling scenarios are limited to two studies with a high degree of uncertainty. It is likely that source levels and frequencies emitted from the larger direct-drive WTGs to be used for the Project would fall somewhere between those recorded for smaller-gear driven WTGs (e.g., 109 to 128 dB re 1 μPa SPL_{RMS} [at varying distances]) (Tougaard et al. 2009; Lindeboom et al. 2011; Pangerc et al. 2016) and those modeled in Stöber and Thomsen (2021) (e.g., 170 to 177 dB re 1 μPa SPL_{RMS}). Using the least-squares fits from Tougaard et al. (2020), SPLs from 11.5-MW turbines (in 20-meter-per-second, gale-force wind) would be expected to fall below the 120 dB re 1 μPa behavioral threshold within 245 meters (about 800 feet). In lighter, 10-meter-per-second winds (approximately 20 knots), the predicted range to threshold would be only 140 meters (about 460 feet). Effects related to the large direct-drive WTGs to be used for the Project would include behavioral and masking effects. Masking of the low-frequency calls emitted from LFC and phocid pinnipeds in water would be more likely to occur. However, without further information regarding these larger direct-drive WTGs, the extent of these effects is unknown.

There is a lack of research regarding the responses of large whale species to extensive networks of new structures due to the novelty of this type of development on the Atlantic OCS. Although new structures are anticipated from multiple offshore wind projects under the planned activities scenario, it is expected that spacing will allow large whales to access areas within and between wind facilities. No physical obstruction of marine mammal migration routes or habitat areas are anticipated, but whether avoidance of offshore wind lease areas will occur due to new structures is unknown. Additionally, while there is some uncertainty regarding how hydrodynamic changes around foundations may affect prey availability, these changes are expected to have limited impacts on the local conditions around WTG foundations. The potential consequences of these impacts on marine mammals of the Atlantic OCS are unknown. Monitoring studies would provide insight into species-specific avoidance behaviors and other potential behavioral reactions to Project structures.

At present, this EIS has no basis to conclude that these IPFs would result in significant adverse impacts on marine mammal populations.

BOEM determined that the overall costs of obtaining the missing information for or addressing these uncertainties are exorbitant, or the means to obtain it are not known. Therefore, to address these gaps as described above, BOEM extrapolated or drew assumptions from known information for similar species and studies using acceptable scientific methodologies to inform the analysis in light of this incomplete or unavailable information, as presented in Section 3.15 and in the BA submitted to NMFS (BOEM 2022). The information and methods used to predict potential impacts on marine mammals represent the best available information, and the information provided in this EIS is sufficient to support sound scientific judgments and informed decision-making. Therefore, BOEM does not believe that there is incomplete or unavailable information on marine mammal resources that is essential to a reasoned choice among alternatives.

D.1.13 Navigation and Vessel Traffic

The navigation and vessel traffic impact analysis in the EIS is based on 1 year's (March 1, 2019, to February 29, 2020) AIS data from vessels required to carry AIS (i.e., those 65 feet [19.8 meters] or greater in length), as well as VMS data (to infer commercial fishing and recreational vessel transits).

Fishing vessels at least 65 feet long were not required to carry AIS until March 2015 (80 *Federal Register* 5282); therefore, AIS data prior to March 2015 are more limited than data available after March 2015. To account for some gaps in the data due to limitations of the AIS carriage requirements, additional vessel transits were added to the risk modeling to account for both current and future traffic not represented in the data. For example, the number of non-AIS commercial fishing transits was estimated by scaling port departures of AIS-carrying commercial fishing vessels per the ratio of registered commercial fishing vessels not required to carry AIS (less than 65 feet in length) (COP Volume III, Appendix M; Ocean Wind 2023).

The combination of AIS and VMS data described above with informed assumptions about smaller vessel numbers represents the best available vessel traffic data and is sufficient to enable BOEM to make a reasoned choice among alternatives.

As stated in Section 3.16, WTG and OSS structures could potentially interfere with marine radars. Marine radars have varied capabilities and the ability of radar equipment to properly detect objects is dependent on radar type, equipment placement, and operator proficiency; however, trained radar operators, properly installed and adjusted vessel equipment, marked wind turbines, and the use of AIS all would enable safe navigation with minimal loss of radar detection (USCG 2020). Based on the foregoing, BOEM does not believe that there is incomplete or unavailable information on navigation and vessel traffic that is essential to a reasoned choice among alternatives.

D.1.14 Other Uses

There is no incomplete or unavailable information related to the analysis of impacts on other uses.

D.1.15 Recreation and Tourism

Evaluations of impacts on recreation and tourism rely on the assessment of impacts on other resources. As a result, incomplete or unavailable information related to other resources, as described in this document, also affect the completeness of the analysis of impacts on recreational tourism. BOEM has determined that incomplete and unavailable resource information for recreation and tourism or for other resources on which the analysis of recreation and tourism impacts rely was either not relevant to reasonably foreseeable significant adverse impacts, was not essential to a reasoned choice among alternatives, alternative data or methods could be used to predict potential impacts and provided the best available information, or the overall costs of obtaining the information were exorbitant or the means to do so were unknown. Therefore, the information provided in the EIS is sufficient to support sound scientific judgments and informed decision-making related to the proposed uses of the onshore and offshore portions of the geographic analysis area.

D.1.16 Sea Turtles

There is incomplete information on the distribution and abundance of sea turtle species that occur in the Atlantic OCS and the Lease Area. The NMFS BA (BOEM 2022) provides a thorough overview of the available information about potential species occurrence and exposure to Project-related IPFs. The studies summarized therein provide a suitable basis for predicting potential species occurrence, relative abundance, and probable distribution of sea turtles in the geographic analysis area.

Some uncertainty exists about the effects of certain IPFs on sea turtles and their habitats. The effects of EMF on sea turtles are not completely understood. However, the available relevant information is summarized in the BOEM-sponsored report by Normandeau et al. (2011). Although the thresholds for EMF disturbing various sea turtle behaviors are not known, the evidence suggests that impacts may only occur on hatchlings over short distances, and no adverse effects on sea turtles have been documented to occur from the numerous submarine power cables around the world. In addition, no nesting beaches, critical habitat, or other biologically important habitats were identified in the offshore export cable corridor.

There is also uncertainty about sea turtle responses to proposed Project construction activities, and data are not available to evaluate potential changes to movements of juvenile and adult sea turtles due to elevated suspended sediments. However, although some exposure may occur, total suspended solid impacts would be limited in magnitude and duration and would occur within the range of exposures periodically experienced by these species. On this basis, any resulting impact on sea turtle behavior due to sediment plumes would likely be too small to be biologically meaningful, and no adverse impacts would be expected (NOAA 2020). Some potential exists for sea turtle displacement, but it is unclear if this would result in adverse impacts (e.g., because of lost foraging opportunities or increased exposure to potentially fatal vessel interactions). Additionally, it is currently unclear whether concurrent construction of multiple projects, increasing the extent and intensity of impacts over a shorter duration, or spreading out project construction with lower-intensity impacts over multiple years would result in the least potential harm to sea turtles. There is also uncertainty regarding the cumulative acoustic impacts associated with pile-driving activities. It is unknown whether sea turtles affected by construction activities would resume normal feeding, migrating, or breeding behaviors once daily pile-driving activities cease, or if secondary impacts would continue. Under the planned activities scenario, individual sea turtles may be exposed to acoustic impacts from multiple projects in a single day or from one or more projects over the course of multiple days. Although the consequences of these exposure scenarios have been analyzed with the best available information, some level of uncertainty remains due to the lack of observational data on species' responses to pile driving.

Some uncertainty exists regarding the potential for sea turtle responses to FAA hazard lights and navigation lighting associated with offshore wind development. Ocean Wind would limit lighting on WTGs and OSS to minimum levels required by regulation for worker safety, navigation, and aviation. Although sea turtles' sensitivity to these minimal light levels is unknown, sea turtles do not appear to be adversely affected by oil and gas platform operations, which produce far more artificial light than offshore wind structures. The placement of new structures would be far from nesting beaches, so no impacts on nesting female or hatchling sea turtles are anticipated.

Considerable uncertainty exists about how sea turtles would interact with the long-term changes in biological productivity and community structure resulting from the reef effect of offshore wind farms across the geographic analysis area. Artificial reef and hydrodynamic impacts could influence predator-prey interactions and foraging opportunities in ways that influence sea turtle behavior and distribution. Also, the extent of sea turtle entanglement on artificial reefs and shipwrecks is not captured in sea turtle stranding records and the significance and potential scale of sea turtle entanglement in lost fishing gear are not quantified. These impacts are expected to interact with the ongoing influence of climate change on sea turtle distribution and behavior over broad spatial scales, but the nature and significance of these interactions are not predictable. BOEM anticipates that ongoing monitoring of offshore energy structures will provide some useful insights into these synergistic effects.

BOEM considered the level of effort required to address the uncertainties described above for sea turtles and determined that the methods necessary to do so are lacking or the associated costs would be exorbitant. Therefore, where appropriate, BOEM inferred conclusions about the likelihood of potential biologically significant impacts from available information for similar species and situations to inform the analysis in light of this incomplete or unavailable information. These methods are described in greater detail in Section 3.19, *Sea Turtles*, and in the BA submitted to NMFS (BOEM 2022). Therefore, the analysis provided is sufficient to support sound scientific judgments and informed decision-making about the proposed Project with respect to its impacts on sea turtles. For these reasons, BOEM does not believe that there is incomplete or unavailable information on turtles that is essential to a reasoned choice among alternatives.

D.1.17 Scenic and Visual Resources

No incomplete or unavailable information related to the analysis of impacts on scenic and visual resources was identified.

D.1.18 Water Quality

No incomplete or unavailable information related to the analysis of impacts on water quality was identified.

D.1.19 Wetlands

No incomplete or unavailable information related to the analysis of impacts on wetlands was identified.

D.2. References Cited

Bureau of Ocean Energy Management (BOEM). 2015. *Virginia Offshore Wind Technology Advancement Project on the Atlantic Outer Continental Shelf Offshore Virginia: Revised Environmental Assessment*. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2015-031. Accessed: September 1, 2020. Available: https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/VA/VOWTAP-EA.pdf.

Bureau of Ocean Energy Management (BOEM). 2021b. *South Fork Wind Farm and South Fork Export Cable Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2020-057. Available: https://www.boem.gov/renewable-energy/state-activities/sfwf-feis.

Bureau of Ocean Energy Management (BOEM). 2022. *Ocean Wind Offshore Wind Farm Biological Assessment for National Marine Fisheries Service*.

Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, and E. Estela-Gomez. 2017. *Habitat Mapping and Assessment of Northeast Wind Energy Areas*. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088. November 1, 2013. Prepared in Collaboration between Gulf of Maine Research Institute and University of Maine

Hayes, S. A., E. Josephson, K. Maze-Foley, and P. E. Rosel. 2020. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2019*. NOAA Tech Memo NMFS-NE 264.

Hayes, S. A., E. Josephson, K. Maze-Foley, P. E. Rosel, and J. Turek. 2021. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020*. NOAA Tech Memo NMFS-NE 271.

Hutchinson, Z. L., D. H. Secor, and A. B. Gill. 2020. The interaction between resource species and electromagnetic fields associated with electricity production by offshore wind farms. *Oceanography* 33(4):96–107.

Inspire. 2021. *Ocean Wind Offshore Wind Farm Benthic Habitat Mapping and Benthic Assessment to Support Essential Fish Habitat Consultation*. Prepared for HDR Engineering. June 2021. Ocean Wind COP Appendix E Supplement.

Kirkpatrick, A. J., S. Benjamin, G. S. DePiper, S. S. T. Murphy, and C. Demarest. 2017. *Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic*. Vol. II—Appendices. U.S. Department of the Interior, Bureau of Ocean Energy Management, Atlantic OCS Region. Washington, D.C.

Lindeboom, H. J., H. J. Kouwenhoven, M. J. N. Bergman, S. Bouma, S. Brasseur, R. Daan, R. C. Fijn, D. de Haan, S. Dirksen, et al. 2011. Short-term ecological effects of an offshore wind farm in the Dutch coastal zone; a compilation. *Environmental Research Letters* 6(3):1–13. Available: https://doi.org/10.1088/1748-9326/6/3/035101.

National Marine Fisheries Service (NMFS). 2021. *Descriptions of Selected Fishery Landings and Estimates of Recreational Party and Charter Vessel Revenue from Areas: A Planning-level Assessment July 2021*. Available: https://www.greateratlantic.fisheries.noaa.gov/ro/fso/reports/WIND/WIND_AREA_REPORTS/party_charter_reports/Ocean_Wind_1_rec.html.

National Oceanic and Atmospheric Administration (NOAA). 2020. Section 7 Effect Analysis: Turbidity in the Greater Atlantic Region. NOAA Greater Atlantic Regional Fisheries Office. Available: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effect-analysis-turbidity-greater-atlantic-region. Accessed November 11, 2021.

Normandeau Associates, Inc. (Normandeau), Exponent, Inc., T. Tricas, and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species*. OCS Study BOEMRE 2011-09. Camarillo, California: U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region.

Ocean Wind LLC. (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Pangerc, T., S. Robinson, P. Theobald, and L. Galley. 2016. Underwater sound measurement data during diamond wire cutting: First description of radiated noise. In Proceedings of the Fourth International Conference on the Effects of Noise on Aquatic Life. July 10–16. Dublin, Ireland.

Petersen, Ib Krag, Thomas Kjær Christensen, Johnny Kahlert, Mark Desholm, and Anthony D. Fox. 2006. *Final Results of Bird Studies at the Offshore Wind Farms at Nysted and Horns Rev, Denmark*. National Environmental Research Institute, Ministry of the Environment, Denmark. Available: https://tethys.pnnl.gov/sites/default/files/publications/NERI_Bird_Studies.pdf. Accessed: September 1, 2020.

Skov, H., S. Heinanen, T. Norman, R. M. Ward, S. Mendez-Roldan, and I. Ellis. 2018. *ORJIP Bird Collision and Avoidance Study*. Final report. The Carbon Trust. United Kingdom. April 2018.

Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene. Jr., and P. L. Tyack. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals* 33(4):411–521.

Southall, B. L., D. P. Nowacek, A. E. Bowles, V. Senigaglia, L. Bejder, and P. L. Tyack. 2021. Marine Mammal Noise Exposure Criteria: Assessing the Severity of Marine Mammal Behavioral Responses to Human Noise. *Aquatic Mammals* 47(5):421–464.

Stöber, U. and F. Thomsen. 2021. How could operational underwater sound from future offshore wind turbines impact marine life? *Journal of the Acoustical Society of America* 149(3):1791–1795.

Taormina, B., J. Bald, A. Want, G. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. A review of potential impacts of submarine power cables on the marine environment: Knowledge gaps, recommendations and future directions. Renewable and Sustainable Energy Reviews, Elsevier, 2018, 96, pp. 380–391. 10.1016/j.rser.2018.07.026. hal-02405630.

Tougaard, J., L. Hermannsen, and P. T. Madsen. 2020. How loud is the underwater noise from operating offshore wind turbines? *Journal of the Acoustical Society of America* 148(5):2885–2893.

Tougaard, J., O. D. Henriksen, and Lee A. Miller. 2009. Underwater noise from three types of offshore wind turbines: Estimation of impact zones for harbor porpoises and harbor seals. *Journal of the Acoustical Society of America* 125(6):3766–3773. doi:10.1121/1.3117444.

U.S. Coast Guard (USCG). 2020. *The Areas Offshore of Massachusetts and Rhode Island Port Access Route Study. USCG 2019-0131*. May 14. Available: https://www.navcen.uscg.gov/pdf/PARS/FINAL_REPORT_PARS_May_14_2020.pdf. Accessed: October 13, 2021.

Appendix E. Project Design Envelope and Maximum-Case Scenario

Ocean Wind proposes the Project using a PDE concept. This concept allows Ocean Wind to define and bracket proposed Project characteristics for environmental review and permitting of the Project while maintaining a reasonable degree of flexibility for selection and purchase of Project components such as WTGs, foundations, export cables, and OSS.[1]

BOEM provides Ocean Wind and other lessees with the option to submit COPs using the PDE concept—providing sufficiently detailed information within a reasonable range of parameters to analyze a "maximum-case scenario" (described below) within those parameters for each affected environmental resource. BOEM identified and verified that the maximum-case scenario based on the PDE provided by Ocean Wind and analyzed in this Final EIS could reasonably occur if approved. This approach is intended to provide flexibility for lessees and allow BOEM to analyze environmental impacts in a manner that minimizes the need for subsequent environmental and technical reviews as design changes occur.

This Final EIS assesses the impacts of the reasonable range of Project designs that are described in the Ocean Wind 1 COP by using the maximum-case scenario process. The maximum-case scenario analyzes the aspects of each design parameter that would result in the greatest impact for each physical, biological, and socioeconomic resource. This Final EIS considers the interrelationship among aspects of the PDE rather than simply viewing each design parameter independently. This Final EIS also analyzes the planned action impacts of the maximum case scenario alongside other reasonably foreseeable past, present, and future actions.

A summary of Ocean Wind 1's PDE parameters is provided in Table E-1. Table E-2 details the full range of maximum-case design parameters for the proposed Project and which parameters are relevant to the analysis for each EIS section in Chapter 3, *Affected Environment and Environmental Consequences*.

Table E-1 Summary of PDE Parameters

Project Parameter Details
General (Layout and Project Size)
• Up to 98 WTGs • Project anticipated to be in service in late 2024 or early 2025
Foundations
• Monopile foundations with transition piece, or one-piece monopile/transition piece, where the transition piece is incorporated into the monopile • Foundation piles would be installed using a pile-driving hammer • Scour protection around all foundations

[1] Additional information and guidance related to the PDE concept can be found here: https://www.boem.gov/Draft-Design-Envelope-Guidance/.

Project Parameter Details
Wind Turbine Generators
• Rotor diameter up to 788 feet (240 meters) • Hub height up to 512 feet (156 meters) above MLLW • Upper blade tip height up to 906 feet (276 meters) above MLLW • Lowest blade tip height 70.8 feet (22 meters) above MLLW
Inter-Array Cables
• Target burial depth of 4 to 6 feet (1.2 to 1.8 meters) depending on site conditions, navigation risk, and third-party requirement (final burial depth dependent on CBRA and coordination with agencies) • Cables could be up to 170 kV (alternating current) • Preliminary layout available; however, final layout pending • Maximum total cable length is 190 miles (approximately 300 kilometers) • Cable lay, installation, and burial: Activities may involve use of a jetting tool (jet ROV or jet sled), vertical injection, leveling, mechanical cutting, plowing (with or without jet-assistance), pre-trenching, controlled-flow excavation
Offshore Export Cables
• Up to three maximum 275 kV alternating current export cables • Target burial depth of 4 to 6 feet (1.2 to 1.8 meters) depending on site conditions, navigation risk, and third-party requirements (final burial depth dependent on burial risk assessment and coordination with agencies) • Two export cable route corridors, Oyster Creek and BL England • Maximum total cable length is 143 miles (230 kilometers) for Oyster Creek and 32 miles (51 kilometers) for BL England • Cable lay, installation, and burial: Activities may involve use of a jetting tool (jet ROV or jet sled), vertical injection, leveling, mechanical cutting, plowing (with or without jet-assistance), pre-trenching, backhoe dredger, controlled-flow excavation
Offshore Substations
• Up to three OSS • Total structure height up to 296 feet (90 meters) above MLLW • Maximum length and width of topside structure 295 feet (90 meters; with ancillary facilities) • OSS installed atop a modular support frame and monopile substructure or atop a piled jacket foundation substructure • Foundation piles to be installed using a pile-driving hammer • Scour protection installed at foundation locations where required
Landfall for the Offshore Export Cable
• Open cut or trenchless (e.g., HDD, direct pipe, or auger bore) installation at landfall • Up to six cable ducts for landfall, if installed by trenchless technology • A reception pit (may be subsea pit, not yet finalized) would be required to be constructed at the exit end of the bore • Construction reception pit: excavator barge, land excavator mounted to a barge, sheet piling from barge used for intertidal cofferdams, swamp excavators • Sheet pile would be used at open cut landfall to stabilize trench through the shoreline

Project Parameter Details
Offshore Substations Interconnector Cable
• Maximum 275 kV alternating current cables • Target burial depth of 4 to 6 feet (1.2 to 1.8 meters) depending on conditions (final burial depth dependent on burial risk assessment and coordination with agencies) • Potential layout available; however, final layout pending • Maximum total cable length is 19 miles (approximately 30 kilometers) • Cable lay, installation, and burial: Activities may involve use of a jetting tool, vertical injection, pre-trenching, scar plow, trenching (including leveling, mechanical cutting), plowing, controlled-flow excavation
Onshore Export Cable
• Connect with offshore cables at TJB and carry electricity to the onshore substation • Would be buried at a target burial depth of 4 feet (1.2 meters) (this represents a target burial depth rather than a minimum or maximum) • Could require up to a 50-foot (15-meter) wide construction corridor and up to a 30-foot (9-meter) wide permanent easement for Oyster Creek and BL England cable corridor excluding landfall locations and cable splice locations to accommodate space for splice vaults, joint bays, and HDD. Permanent easements are expected to be larger at splice vaults and TJB locations. • Up to eight export cables circuits would be required, with each cable circuit comprising up to three single cables. The cables would consist of copper or aluminum conductors wrapped with materials for insulation protection and sealing. • TJBs, splice vaults/grounding link boxes, and fiber optic system, including manholes
Onshore Substations and Interconnector Cable
• Two onshore substations in proximity to existing substations with associated infrastructure • Each onshore substation would require a permanent site (for Oyster Creek interconnection point up to 31.5 acres and for BL England up to 13 acres), including area for the substation equipment and buildings, energy storage, and stormwater management and landscaping • During construction, up to an additional 3 acres would be required for temporary workspace • The main buildings within the substations would be up to 1,017 feet long, 492 feet wide, and 82 feet tall (310 meters long, 150 meters wide, and 25 meters tall) • Secondary buildings may be used to house reactive compensation, transformers, filters, a control room, and a site office. The external electrical equipment may include switchgear, busbars, transformers, high-voltage reactors, SVC/static synchronous compensator, synchronous condensers, harmonic filters, and other auxiliary equipment. Lightning protection would include up to 35 lightning masts at Oyster Creek and up to 25 masts at BL England for a total height up to 98 feet (30 meters). • Maximum height of overhead lines would be 115 feet (35 meters) • Interconnector cable to existing substation

ROV = remotely operated vehicle; SVC = static VAR compensator

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Table E-2 Maximum-Case Design Parameters for the Ocean Wind 1 Project (an "X" indicates that the parameter is relevant to an EIS resource analysis)

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
WIND FARM																				
Wind farm capacity	1,100 MW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WIND TURBINES																				
Parameters per Turbine																				
Minimum lower blade tip height (feet) (relative to MLLW)	70.8		X		X		X	X		X		X		X	X	X		X		
Maximum upper blade tip height (feet) (relative to MLLW)	906		X		X		X	X		X		X		X	X	X		X		
Maximum rotor diameter (feet)	788		X		X			X		X		X		X	X	X		X		
Parameters per Turbine Foundation																				
Outer diameter at seabed of main tubular structure (feet)	37			X			X	X			X		X	X			X		X	
Sea surface diameter (feet)	27						X	X		X	X		X	X			X	X		
Scour protection (if required) diameter (yards)	61			X	X		X			X	X		X	X			X		X	
Scour protection (if required) layer thickness (feet)	8.2			X	X		X			X	X		X	X			X		X	
Seabed structure area per monopile (acres)	0.023			X	X		X	X		X	X		X	X			X		X	
Seabed scour protection (if required) area per monopile (acres)	0.59			X	X		X	X		X	X		X	X			X		X	
Seabed permanent area affected per monopile (acres)	0.85			X	X		X	X		X	X		X	X			X		X	
Scour protection (if required) volume per monopile (cubic yards)	7,764			X	X		X				X		X	X			X		X	
Pile structure grout volume per monopile (cubic yards)	144			X							X		X	X			X		X	
Seabed penetration (feet)	164			X			X	X		X	X		X	X			X		X	
Maximum hammer energy (kilojoules)	4,000		X	X	X		X				X		X	X			X		X	
Indicative continuous piling duration per turbine (hours)	4		X	X	X		X				X		X	X			X		X	
Maximum Total Impacts for Wind Turbine Foundations																				
Maximum number of turbines	98	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	
Total seabed structure area (acres)	2.3			X			X	X		X	X	X	X	X			X	X	X	
Total scour (if required) protection area (acres)	58			X	X		X			X	X		X	X			X		X	
Total permanent affected area (acres)	60.3			X	X		X	X		X	X		X	X			X	X	X	
Total scour (if required) protection volume (cubic yards)	761,000			X	X		X				X		X	X			X		X	
Total pile structure grout volume (cubic yards)	14,000			X							X		X	X			X		X	

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
OFFSHORE SUBSTATIONS																				
Topside Offshore Substations																				
Number of substations	3	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	
Length of topside main structure (feet)	230		X	X	X		X	X		X	X	X	X	X			X	X		
Width of topside main structure (feet)	230		X	X	X		X	X		X	X	X	X	X			X	X		
Length of topside main structure inclusive of ancillary structures (feet)	295		X		X		X	X		X	X	X	X	X			X	X		
Width of topside main structure inclusive of ancillary structures (feet)	295		X		X		X	X		X	X	X	X	X			X	X		
Total structure height: including ancillary structures (feet) (relative to MLLW)	296		X		X		X	X		X		X		X	X			X		
Bridge links link length (feet)	328									X		X		X				X		
Substation Foundations (Parenthesis notes Maximum Scenario Foundation Type)																				
Maximum number of structures	3	X	X	X	X		X	X		X	X	X	X	X	X	X	X		X	
Maximum scour protection (if required) dimension (yards)	72 (Monopile)			X	X		X				X		X	X			X		X	
Maximum structure dimension at seabed (yards)	77 (Piled Jacket)			X	X		X	X			X		X	X			X		X	
Maximum structure dimension at sea surface (yards)	77 (Piled Jacket)						X	X			X		X	X			X		X	
Number of Piles	16 (Piled Jacket)		X	X	X		X	X			X	X	X	X			X		X	
Seabed preparation area (acres)	0			X			X	X			X		X	X			X		X	
Seabed gravel bed area (acres)	0			X	X		X	X		X	X		X	X			X		X	
Seabed structure area (acres)	0.04 (Monopile)			X			X	X		X	X		X	X			X		X	
Seabed scour protection (if required) area (acres)	1 (Monopile)			X	X		X			X	X		X	X			X		X	
Seabed total permanent area (acres)	0.6 (Piled Jacket)			X	X		X	X		X	X		X	X			X		X	
Scour protection (if required) volume (cubic yards)	1,721 (Piled Jacket)			X	X		X				X		X	X			X		X	
Pile-structure grout volume (cubic yards)	222 (Piled Jacket)			X							X		X	X			X		X	
Piled Jacket Foundations for Substations																				
Number of legs per foundation	6		X	X	X		X	X			X		X	X			X		X	
Number of piles per foundation (4 piles per corner)	16		X	X	X		X	X			X		X	X			X		X	
Separation of adjacent legs at seabed (feet)	230			X			X				X		X	X			X			
Separation of adjacent legs at sea surface (feet)	230						X						X	X			X			
Height of platform above MLLW (feet)	131							X						X				X		
Jacket leg diameter (feet)	15			X			X	X			X		X	X			X		X	
Pin pile outer diameter at seabed (feet)	8			X			X	X			X		X	X			X		X	
Mud-mat area (square feet)	4,306			X			X	X			X		X	X			X		X	
Seabed structure area (acre)	<0.1			X	X		X	X		X	X		X	X			X		X	

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
Seabed scour protection (if required) area (acres)	0.2			X	X		X			X	X		X	X			X		X	
Seabed total permanent area (acres)	0.6			X	X		X	X		X	X		X	X			X		X	
Scour protection (if required) volume (cubic yards)	1,721			X	X		X				X		X	X			X		X	
Pile-structure grout volume (cubic yards)	222			X							X		X	X			X		X	
Embedment depth (below seabed) (feet)	230			X			X	X		X	X		X	X			X			
Maximum hammer energy (kilojoule)	2,500		X	X	X		X				X		X	X			X		X	
Maximum piling duration per foundation (days) [1]	15		X	X	X		X				X		X	X			X		X	
Indicative continuous piling duration per pile (hours) [1]	4		X	X	X		X				X		X	X			X		X	
ARRAY CABLES																				
Cable diameter (inches)	8			X				X			X	X	X	X	X		X		X	
Estimated total length of cable (miles)	190	X		X			X	X		X	X	X	X	X	X		X		X	
Typical voltage (kV)	66			X			X				X	X	X	X			X			
Maximum voltage (kV)	170			X			X				X	X	X	X			X			
Target burial depth (feet) (final burial depth based on CBRA)	4–6			X			X	X		X	X	X	X	X	X		X		X	
Cable separation: typical (feet)	328			X			X				X	X	X	X			X			
Offshore Cable disturbance corridor width (feet)	82			X			X	X		X	X	X	X	X	X		X		X	
Maximum Total Impacts for Array Cables																				
Full corridor width seabed disturbance (acres)	1,850 [2]			X			X	X		X	X		X	X			X		X	
Boulder clearance: seabed disturbance (acres)	2,220 [3]			X			X	X		X	X		X	X			X		X	
Sand wave clearance: seabed disturbance (acres)	220 [3]			X			X	X		X	X		X	X			X		X	
Sand wave clearance: material volume (cubic yards)	588,580 [4]			X			X	X			X		X	X			X		X	
Burial spoil: jetting/plowing/control flow excavation material volume (cubic yards)	2,354,000 [5]			X			X				X		X	X			X		X	
Percent of cable requiring protection	10%			X			X				X		X	X			X		X	
Cable protection area (acres) [6]	77			X			X	X		X	X		X	X			X		X	
Cable protection volume (cubic yards)	341,000			X			X				X		X	X			X		X	
Cable/pipe crossings: pre- and post-lay rock berm area (acres)	0			X			X			X	X		X	X			X		X	
Cable/pipe crossings: pre- and post-lay rock berm volume (cubic yards)	0			X			X				X		X	X			X		X	
SUBSTATION INTERCONNECTOR CABLE																				
Number of substation interconnector cables	2			X			X	X			X	X	X	X	X		X		X	
Estimated total length of cable (miles)	19	X		X			X	X		X	X	X	X	X	X		X		X	
Cable diameter (inches)	13			X			X	X			X	X	X	X			X			
Maximum voltage (kV)	275			X			X				X	X	X	X			X			

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
Target burial depth (feet) (final burial depth dependent on CBRA and coordination with agencies)	4–6			X			X	X			X	X	X	X	X		X		X	
Cable seabed disturbance width (feet)	82			X			X	X		X	X	X	X	X	X		X		X	
Maximum Total Impacts for Substation Interconnection Cables																				
Total seabed disturbed: full corridor width (acres)	185 [7]			X			X	X		X	X		X	X			X		X	
Seabed disturbed: boulder clearance (acres)	222 [8]			X			X	X		X	X		X	X			X		X	
Seabed disturbed: sand wave clearance (acres)	2 [8]			X			X	X		X	X		X	X			X		X	
Sand wave clearance volume (cubic yards)	58,860 [9]			X			X	X			X		X	X			X		X	
Burial spoil: jetting/plowing/control flow excavation volume (cubic yards)	235,000 [10]			X			X				X		X	X			X		X	
Cable protection area (acres) [11]	8			X			X	X		X	X		X	X			X		X	
Cable protection volume (cubic yards)	34,000			X			X	X			X		X	X			X		X	
Percent of cable requiring protection	10%			X			X				X		X	X			X		X	
Cable/pipe crossing- pre- and post-lay rock berm area (acres)	0			X			X			X	X		X	X			X		X	
Cable/pipe crossing- pre- and post-lay rock berm volume (cubic yards)	0			X			X				X		X	X			X		X	
OFFSHORE EXPORT CABLE																				
Offshore export cable diameter (inches)	13			X				X			X		X	X			X		X	
Typical export cable voltage (kV)	275			X			X				X		X	X			X			
Cable seabed disturbance width per cable (feet)	82			X			X	X		X	X		X	X			X		X	
Target burial depth (feet)	4–6			X			X	X		X	X		X	X			X		X	
Cable weight in air (kilogram per meter)	138			X			X				X		X				X		X	
Cable weight in water (kilogram per meter)	90			X			X				X		X				X		X	
Maximum Total Impacts for Offshore Export Cables																				
Oyster Creek																				
Number of cable sections per cable	4			X							X		X	X			X			
Number of cable joints	3			X							X		X	X			X			
Offshore cables	2			X			X	X			X		X	X			X		X	
Length of offshore export cable route (miles)	72	X		X			X	X		X	X		X	X	X	X	X		X	
Length of offshore export cable (miles) (2 cables within corridor)	143	X		X			X	X			X		X	X	X	X	X		X	
Full corridor width seabed disturbance (acres)	1,430 [12]			X			X	X		X	X		X	X			X		X	
Boulder clearance: seabed disturbance (acres)	1,710 [13]			X			X	X		X	X		X	X			X		X	
Sand wave clearance: seabed disturbance (acres)	17 [13]			X			X	X		X	X		X	X			X		X	
Sand wave clearance: material volume (cubic yards)	451,240 [14]			X			X	X			X		X	X			X		X	

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
Burial spoil: vertical injection material volume (cubic yards)	665,000 [15]			X			X				X		X	X			X		X	
Burial spoil: plowing/control flow excavation material volume (cubic yards)	1,805,000			X			X				X		X	X			X		X	
Cable protection area (acres) [16]	70			X	X		X	X		X	X		X	X			X		X	
Cable protection volume (cubic yards)	400,000			X	X		X	X			X		X	X			X		X	
Percent of cable requiring protection	10%			X	X		X				X		X	X			X		X	
Cable/pipe crossings: pre- and post-lay rock berm area (acres)	48			X			X			X	X		X	X			X		X	
Cable/pipe crossings: pre- and post-lay rock berm volume (cubic yards)	279,000			X			X				X		X	X			X		X	
BL England																				
Number of cable sections per cable	3			X							X		X	X			X			
Number of cable joints	2			X							X		X	X			X			
Offshore cables	1			X			X	X			X		X	X			X		X	
Length of offshore export cable route (miles)	32	X		X			X	X		X	X		X	X			X		X	
Length of offshore export cable (miles) (1 cable within corridor)	32	X		X			X	X			X		X	X			X		X	
Full corridor width seabed disturbance (acres)	320 [12]			X			X	X		X	X		X	X			X		X	
Boulder clearance: seabed disturbance (acres)	400 [13]			X			X	X		X	X		X	X			X		X	
Sand wave clearance: seabed disturbance (acres)	4 [13]			X			X	X		X	X		X	X			X		X	
Sand wave clearance: material volume (cubic yards)	100,060 [14]			X			X	X			X		X	X			X		X	
Burial spoil: vertical injection material volume (cubic yards)	148,000 [15]			X			X				X		X	X			X		X	
Burial spoil: plowing/control flow excavation material volume (cubic yards)	400,000			X			X				X		X	X			X		X	
Cable protection area (acres) [16]	16			X	X		X	X		X	X		X	X			X		X	
Cable protection volume (cubic yards)	87,000			X	X		X	X			X		X	X			X		X	
Percent of cable requiring protection	10%			X	X		X				X		X	X			X		X	
Cable/pipe crossings: pre- and post-lay rock berm area (acres)	12.6			X			X			X	X		X	X			X		X	
Cable/pipe crossings: pre- and post-lay rock berm volume (cubic yards)	75,000			X			X				X		X	X			X		X	
WIND TURBINE VESSEL TRIPS																				
Wind Turbine Foundation Installation – Maximum Number of Simultaneous Vessels																				
Scour Protection Vessel	1	X	X	X	X		X				X		X	X	X		X	X	X	
Installation Vessel	4	X	X	X	X		X				X		X	X	X		X	X	X	
Support Vessels	16	X	X	X	X		X				X		X	X	X		X	X	X	
Transport / Feeder Vessels (including tugs)	40	X	X	X	X		X				X		X	X	X		X	X	X	
- of which are anchored	2	X	X	X	X		X				X		X	X	X		X	X	X	

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
Wind Turbine Foundation Installation – Maximum Number of Trips per Vessel Type																				
Scour Protection Vessel	50	X	X	X	X		X				X		X	X	X		X	X	X	
Installation Vessel	99	X	X	X	X		X				X		X	X	X		X	X	X	
Support Vessels	396	X	X	X	X		X				X		X	X	X	X	X	X	X	
Transport / Feeder Vessels (including tugs)	396	X	X	X	X		X				X		X	X	X	X	X	X	X	
- of which are anchored	198	X	X	X	X		X				X		X	X	X		X	X	X	
Structure Installation – Maximum Number of Simultaneous Vessels																				
Installation Vessels	2	X	X	X	X		X				X		X	X	X		X	X	X	
Transport / Feeder Vessels	12	X	X	X	X		X				X		X	X	X		X	X	X	
Other Support Vessels	24	X	X	X	X		X				X		X	X	X		X	X	X	
Structure Installation – Maximum Number of Trips per Vessel Type																				
Installation Vessels	99	X	X	X	X		X				X		X	X	X		X	X	X	
Transport / Feeder Vessels	99	X	X	X	X		X				X		X	X	X		X	X	X	
Other Support Vessels	594	X	X	X	X		X				X		X	X	X	X	X	X	X	
VESSELS REQUIRED FOR SUBSTATION INSTALLATION																				
Maximum Design Parameters																				
Primary Installation Vessels	2	X	X	X	X		X				X		X	X	X		X		X	
Support Vessels	11	X	X	X	X		X				X		X	X	X		X		X	
Transport Vessels	4	X	X	X	X		X				X		X	X	X		X		X	
Maximum Duration (days)	67	X	X	X	X		X				X		X	X	X		X		X	
Maximum Return Trips per Vessel Type																				
Primary Installation Vessels	12	X	X	X	X		X				X		X	X	X		X	X	X	
Support Vessels	72	X	X	X	X		X				X		X	X	X		X	X	X	
Transport Vessels	24	X	X	X	X		X				X		X	X	X		X	X	X	
VESSELS REQUIRED FOR ARRAY CABLE INSTALLATION																				
Maximum Number of Simultaneous Vessels																				
Main Laying Vessels	3	X	X	X	X		X				X		X	X	X		X	X	X	
Main Burial Vessels	3	X	X	X	X		X				X		X	X	X		X	X	X	
Support Vessels	12	X	X	X	X		X				X		X	X	X		X	X	X	
Maximum Number of Return Trips per Vessel Type																				
Main Laying Vessels	99	X	X	X	X		X				X		X	X	X		X	X	X	
Main Burial Vessels	99	X	X	X	X		X				X		X	X	X		X	X	X	

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
Support Vessels	594	X	X	X	X		X				X		X	X	X		X	X	X	
Duration per cable section (days)	3.5	X	X	X	X		X				X		X	X	X		X	X	X	
Total Duration (months)	12	X	X	X	X		X				X		X	X	X		X	X	X	
VESSELS REQUIRED FOR SUBSTATION INTERCONNECTION CABLE INSTALLATION																				
Maximum Number of Simultaneous Vessels																				
Main Laying Vessels	Included In numbers for export and array cables	X	X	X	X		X				X		X	X	X		X	X	X	
Main Burial Vessels		X	X	X	X		X				X		X	X	X		X	X	X	
Support Vessels		X	X	X	X		X				X		X	X	X		X	X	X	
Duration: per cable (days)		X	X	X	X		X				X		X	X	X		X	X	X	
Duration: total (months)		X	X	X	X		X				X		X	X	X		X	X	X	
Maximum Number of Return Trips per Vessel Type																				
Main Laying Vessels	8	X	X	X	X		X				X		X	X	X		X	X	X	
Main Burial Vessels	8	X	X	X	X		X				X		X	X	X		X	X	X	
Support Vessels	12	X	X	X	X		X				X		X	X	X		X	X	X	
Duration: per cable (days)	20	X	X	X	X		X				X		X	X	X		X	X	X	
Duration: total (months)	1	X	X	X	X		X				X		X		X		X	X	X	
VESSELS REQUIRED FOR OFFSHORE EXPORT CABLE INSTALLATION																				
Maximum Design Parameters																				
Main Cable Laying Vessels	3	X	X	X	X		X				X		X	X	X		X	X	X	
Main Cable Jointing Vessels	3	X	X	X	X		X				X		X	X	X		X	X	X	
Main Cable Burial Vessels	3	X	X	X	X		X				X		X	X	X		X	X	X	
Support Vessels	15	X	X	X	X		X				X		X	X	X		X	X	X	
Maximum Number of Return Trips per Vessel Type																				
Main Cable Laying Vessels	48	X	X	X	X		X				X		X	X	X		X	X	X	
Main Cable Jointing Vessels	36	X	X	X	X		X				X		X	X	X		X	X	X	
Main Cable Burial Vessels	48	X	X	X	X		X				X		X	X	X		X	X	X	
Support Vessels	72	X	X	X	X		X				X		X	X	X		X	X	X	
Duration per cable section (days)	59	X	X	X	X		X				X		X	X	X		X	X	X	
Typical Duration (months)	6	X	X	X	X		X				X		X	X	X		X	X	X	
TOTAL PROJECT OFFSHORE SURVEYS OF FOUNDATIONS, BATHYMETRY, SCOUR PROTECTION AND CABLE BURIAL																				
All Offshore Facilities: Seabed Surveys: for Bathymetry, Cable Burial Depth, Scour during Project lifetime (events)	38		X	X	X		X				X		X	X			X	X	X	

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
OFFSHORE FOUNDATION OPERATION AND MAINTENANCE ACTIVITIES																				
Wind Turbine Foundations																				
Repainting (events)	347			X			X						X	X			X	X	X	
Cleaning (guano removal) (events)	17,325			X			X						X	X			X	X	X	
Access Ladder Replacement (events)	693			X			X						X	X			X	X		
Anode Replacement (events)	693			X			X				X		X	X			X	X		
J-tube Replacement (events)	198			X			X				X		X	X			X	X		
Concrete Crack Repairs (events)	99			X			X						X	X			X	X	X	
Offshore Substations																				
Repainting (events)	3			X			X				X		X	X			X	X	X	
Cleaning (guano removal) (events)	525			X			X				X		X	X			X	X	X	
Access Ladder Replacement (events)	21			X			X				X		X	X			X	X		
Anode Replacement (events)	21			X			X				X		X	X			X	X		
J-tube Replacement (events)	6			X			X				X		X	X			X	X		
TOTAL WTG OPERATION AND MAINTENANCE ACTIVITIES																				
WTGs: Major Component Replacement (events)	966			X			X				X		X	X			X	X	X	
TOTAL PROJECT OSS OPERATION AND MAINTENANCE ACTIVITIES																				
OSS: Major Faults/Component Replacements (events)	6			X			X				X		X	X			X	X	X	
TOTAL PROJECT OFFSHORE CABLE OPERATION AND MAINTENANCE ACTIVITIES																				
Array Cable																				
Remedial Burial for the life of the Project (miles)	13			X			X	X			X		X	X			X	X	X	
Jetting Remedial Burial: Length per event (miles)	1.24			X			X	X			X		X	X			X		X	
Jetting Remedial Burial: Width per event (feet)	328			X			X	X			X		X	X			X		X	
Jetting Remedial Burial: Seabed disturbance area (acres per event)	49.4			X			X	X			X		X	X			X		X	
Cable Faults (number of events)	6			X			X				X		X	X			X		X	
Cable Faults: Seabed disturbance area per event (acres)	4.9			X			X	X			X		X	X			X		X	
Cable Faults: Rock berm area per event (acres)	1.5			X			X				X		X	X			X		X	
Cable Faults: Rock berm volume per event (cubic yards)	8,800			X			X				X		X	X			X		X	
Substation Interconnector Cables																				
Remedial Burial for the life of the Project (miles)	1.9			X			X	X			X		X	X			X		X	
Jetting Remedial Burial: Length per event (miles)	1.2			X			X	X			X		X	X			X		X	
Jetting Remedial Burial: Width per event (feet)	328			X			X	X			X		X	X			X		X	

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
Jetting Remedial Burial: Seabed disturbance area (acres per event)	49.4			X			X	X			X		X	X			X		X	
Cable Faults (number of events)	2			X			X				X		X	X			X		X	
Cable Faults: Seabed disturbance area per event (acres)	4.9			X			X	X			X		X	X			X		X	
Cable Faults: Rock berm area per event (acres)	1.5			X			X				X		X	X			X		X	
Cable Faults: Rock berm volume per event (cubic yards)	8,800			X			X				X		X	X			X		X	
Offshore Export Cables																				
Jetting Remedial Burial: Length per event (miles)	1.24			X			X	X			X		X	X			X		X	
Jetting Remedial Burial: Width per event (feet)	328			X			X	X			X		X	X			X		X	
Jetting Remedial Burial: Seabed disturbance area (acres per event)	49.4			X			X	X			X		X	X			X		X	
Cable Faults: Seabed disturbance area per event (acres)	4.9			X			X	X			X		X	X			X		X	
Cable Faults: Rock berm area per event (acres)	1.5			X			X				X		X	X			X		X	
Cable Faults: Rock berm volume per event (cubic yards)	8,800			X			X				X		X	X			X		X	
Oyster Creek Export Cables																				
Remedial Burial for the life of the Project (miles)	3.1			X			X	X			X		X	X			X		X	
Cable Faults (number of events)	13			X			X				X		X	X			X		X	
BL England Export Cables																				
Remedial Burial for the life of the Project (miles)	1.2			X			X	X			X		X	X			X		X	
Cable Faults (number of events)	3			X			X				X		X	X			X		X	
OFFSHORE OPERATION AND MAINTENANCE VESSEL SUMMARY OF MAXIMUM ANNUAL VISITS																				
Crew transfer vessels, or service operation vessels	2,278	X	X	X	X		X				X		X	X	X	X	X	X	X	
Jack-Up Vessels	102	X	X	X	X		X				X		X	X	X	X	X	X	X	
Crew Vessels	908	X	X	X	X		X				X		X	X	X	X	X	X	X	
Supply Vessels	104	X	X	X	X		X				X		X	X	X	X	X	X	X	
OPERATIONS JACK-UP AND ANCHORED VESSEL PARAMETERS																				
Number of jack-up vessel legs	6			X			X				X		X	X			X		X	
Area of each leg base at the seabed (square feet)	1,830			X			X				X		X	X			X		X	
Anchored vessel: anchor dimensions (feet)	32.8 x 32.8			X			X				X		X	X			X		X	
Anchored vessel: number of anchors per vessel	8			X			X				X		X	X			X		X	
ONSHORE EXPORT CABLE PARAMETERS																				
Type of cable	XLPE, FF Copper, and Aluminum											X								
Diameter of cable (inches)	8					X		X				X								

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
Diameter of cable ducts (inches)	13					X		X				X								
Maximum voltage (kV)	275					X						X								
Target burial depth (feet)	4 [17]					X		X				X								
Oyster Creek Construction Areas and Volumes																				
Length of onshore cable route (miles)	5.3	X	X		X	X		X		X		X						X	X	X
Cable trenches	2					X		X				X						X	X	X
Total onshore cables	6		X		X	X		X				X						X	X	X
Corridor width: permanent (feet)	30		X		X	X		X				X						X	X	X
Corridor width: temporary and permanent used for construction (feet)	50		X		X	X		X				X						X	X	X
Corridor area: permanent (acres)	9		X		X	X		X				X			X	X		X	X	X
Corridor area: temporary and permanent used for construction (acres)	32	X	X		X	X		X		X		X			X	X		X	X	X
Number of joint bays and splice vaults/grounding link boxes	34					X		X				X						X	X	X
Joint bays total area (acres)	2		X		X	X		X				X							X	X
Joint bays spoil volume per pit (cubic yards)	3,000					X						X							X	X
Joint bays spoil total volume (cubic yards)	97,200					X						X							X	X
Link bays total area (acres)	0.03		X		X	X		X				X							X	X
Link bays spoil volume per pit (cubic yards)	9					X						X							X	X
Link bays spoil total volume (cubic yards)	311					X						X							X	X
Utility bridge length (feet)	200					X		X				X						X		
Utility bridge height and width (feet)	10					X		X				X						X		
BL England Construction Areas and Volumes																				
Length of onshore cable route (miles) [18]	8	X	X		X	X		X	X	X		X			X	X			X	X
Cable trenches	1					X		X	X			X			X	X		X	X	X
Total onshore cables	3		X		X	X		X				X						X	X	X
Corridor width: permanent (feet)	30		X		X	X		X				X						X	X	X
Corridor width: temporary and permanent used for construction (feet)	50		X		X	X		X	X	X		X			X	X		X	X	X
Corridor area: permanent (acres) [18]	29		X		X	X		X		X		X							X	X
Corridor area: temporary and permanent used for construction (acres) [18]	48	X	X		X	X		X	X	X		X			X	X			X	X
Number of joint bays and splice vaults/grounding link boxes [18]	26					X						X						X	X	X
Joint bays total area (acres) [18]	1.5		X		X	X		X				X							X	X
Joint bays spoil volume per pit (cubic yards)	3,000					X						X							X	X
Joint bays spoil total volume (cubic yards) [18]	19,000					X						X							X	X

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
Link bays total area (acres) [18]	0.02		X		X	X		X				X							X	X
Link bays spoil volume per pit (cubic yards)	9					X						X							X	X
Link bays spoil total volume (cubic yards)	55					X						X							X	X
ONSHORE SUBSTATION PARAMETERS																				
Oyster Creek																				
Permanent site area (acres)	31.5	X	X		X	X		X	X	X		X			X	X		X	X	X
Temporary construction workspace (acres)	2	X	X		X	X		X	X	X		X			X	X		X	X	X
Main building length (feet)	1,017		X		X	X		X		X		X						X		
Main building width (feet)	492		X		X	X		X		X		X						X		
Main building area (acres)	11.5		X		X	X		X		X		X							X	X
Main building height (feet)	82		X		X			X		X		X						X		
Maximum secondary building(s) length (feet)	105		X		X	X		X		X		X						X		
Maximum secondary building(s) width (feet)	105		X		X	X		X		X		X						X		
Secondary building(s) height (feet)	33		X		X			X		X		X						X		
Fire-wall height (feet)	82		X		X			X		X		X								
Number of lightning masts	35		X		X	X		X		X		X						X		
Lightning protection height (feet)	98		X		X			X		X		X						X		
Power mast infrastructure height (feet)	115		X		X			X		X		X						X		
Transformer height (feet) [19]	46		X		X			X		X		X						X		
High-voltage reactor height (feet) [19]	46		X		X			X		X		X						X		
SVC/Statcom height (feet) [19]	39		X		X			X		X		X						X		
Harmonic filter height (feet) [19]	49		X		X			X		X		X						X		
Bus duct height (feet) [19]	49		X		X			X		X		X						X		
Other auxiliary equipment height (feet) [19]	33		X		X			X		X		X						X		
BL England																				
Permanent site area (acres)	13	X	X		X	X		X	X	X		X			X	X			X	X
Temporary construction workspace (acres)	3	X	X		X	X		X	X	X		X			X	X			X	X
Main building length (feet)	656		X		X	X		X		X		X						X		
Main building width (feet)	525		X		X	X		X		X		X						X		
Main building area (acres)	7.9		X		X	X		X		X		X							X	X
Main building height (feet)	82		X		X			X		X		X						X		
Maximum secondary building(s) length (feet)	154		X		X	X		X		X		X						X		

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
Maximum secondary building(s) width (feet)	105		X		X	X		X		X		X						X		
Secondary building(s) height (feet)	33		X		X			X		X		X						X		
Fire-wall height (feet)	82		X		X			X		X		X								
Number of lightning masts	25		X		X	X		X		X		X						X		
Lightning protection height (feet)	98		X		X			X		X		X						X		
Power mast infrastructure height (feet)	115		X		X			X		X		X						X		
Transformer height (feet) [19]	46		X		X			X		X		X						X		
High-voltage reactor height (feet) [19]	46		X		X			X		X		X						X		
SVC/Statcom height (feet) [19]	39		X		X			X		X		X						X		
Harmonic filter height (feet) [19]	49		X		X			X		X		X						X		
Bus duct height (feet) [19]	49		X		X			X		X		X						X		
Other auxiliary equipment height (feet) [19]	35		X		X			X		X		X						X		
UNDERGROUND AND OVERHEAD TRANSMISSION LINE PARAMETERS																				
Underground Option																				
Maximum trench depth (feet)	10.25		X		X	X		X	X	X		X				X			X	X
Average trench width (feet)	4.25		X		X	X		X	X	X		X				X		X	X	X
Maximum temporary work space, offset from centerline on each side (feet)	30		X		X	X		X	X	X		X				X		X	X	X
Oyster Creek																				
Maximum length of onshore interconnection cable (miles)	0.5	X	X		X	X		X	X	X		X			X	X			X	X
Number of splice vaults/grounding link boxes associated with interconnection cable	2		X		X			X		X		X				X		X		X
Number of poles	1		X		X			X		X		X				X		X		
Maximum pole height (feet)	117		X		X			X		X		X				X		X		
BL England																				
Maximum length of onshore interconnection cable (miles)	0.5	X	X		X	X		X	X	X		X			X	X			X	X
Number of splice vaults/grounding link boxes associated with interconnection cable	2		X		X			X		X		X				X		X		X
Number of poles	1		X		X			X		X		X				X		X		
Maximum pole height (feet)	117		X		X			X		X		X				X		X		
Overhead Option																				
Oyster Creek																				
Maximum Length of onshore interconnection cable route (miles)	0.5	X	X		X	X		X	X	X		X			X	X			X	X

Design Parameter	Maximum Design Parameters	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel Traffic	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual Resources	3.21 Water Quality	3.22 Wetlands
Number of poles	6		X		X	X		X		X		X						X	X	X
Maximum pole height (feet)	115		X		X			X		X		X				X		X		
BL England																				
Maximum Length of onshore interconnection cable route (miles)	0.5	X	X		X	X		X	X	X		X			X	X			X	X
Number of poles	6		X		X	X		X		X		X						X	X	X
Maximum pole height (feet)	115		X		X			X		X		X				X		X		
LANDFALL PARAMETERS																				
Landfall type	Open cut or trenchless technology			X		X			X	X		X			X	X		X	X	X
HDD noise (decibels) [20]	120		X		X	X			X	X		X				X				
Number of personnel	60		X		X	X			X	X		X							X	
Daily vehicle movements (non-HGV)	10	X	X		X	X				X		X						X		
Daily vehicle movements (HGV)	5	X	X		X	X				X		X						X		
Inadvertent return contingency vehicles	4		X		X	X				X		X								
HDD exit pit depth (feet)	15					X		X				X								
HDD exit pit (acres)	0.4 (164 feet x 98 feet)					X		X				X							X	X
HDD onshore workspace (acres)	15		X		X	X		X				X							X	X
TJB depth (feet)	20					X		X				X						X		
TJB area (acres)	0.06 (33 feet x 82 feet)					X		X				X							X	X
TJB workspace (acres)	0.4 (131 feet x 131 feet)		X		X	X		X				X							X	X
Oyster Creek																				
Number of TJBs	8					X		X				X						X	X	X
Landfall width (feet)	262					X		X				X						X	X	X
BL England																				
Number of TJBs	3					X	X	X				X						X	X	X
Landfall width (feet)	131					X	X	X				X						X	X	X

[1] The 15 days is inclusive of activities (i.e., mobilization, clearance times, demobilization) and not just pile driving. The indicative piling duration per pile is 4 hours. The maximum active piling duration per foundation would be up to 64 hours (16 piles per foundation x 4 hours per pile) spread over up to 15 days.
[2] Assumes 82-foot-wide corridor disturbed.
[3] Assumes 98-foot-wide corridor and 100% of route affected.
[4] Assumes 98-foot-wide corridor, 17-foot average height, and 100% of route affected.
[5] Assumes 95% with shallow burial depth (4 to 6 feet) and 5% with deep burial (33 feet).
[6] Could be rock, mattress, frond mattress, rock bags, or seabed spacers as described in Section 2.1.2.2.3, *Offshore and Nearshore Activities and Facilities*, of the Final EIS.
[7] Assumes 82-foot-wide corridor disturbed.
[8] Assumes 98-foot-wide corridor and 1% of route affected.

[9] Assumes 98-foot-wide corridor, 17-foot average height, and 1% of route affected.
[10] Assumes 95% with shallow burial depth (4 to 6 feet) and 5% with deep burial (33 feet).
[11] Could be rock, mattress, frond mattress, rock bags, or seabed spacers as described in Section 2.1.2.2.3, *Offshore and Nearshore Activities and Facilities*, of the Final EIS.
[12] Assumes 82-foot-wide corridor disturbed.
[13] Assumes 98-foot-wide corridor and 1% of route affected.
[14] Assumes 98-foot-wide corridor, 17-foot average height, and 1% of route affected.
[15] Assumes 95% with shallow burial depth (4–6 feet) and 5% with deep burial (33 feet).
[16] Could be rock, mattress, frond mattress, rock bags, or seabed spacers as described in Section 2.1.2.2.3, *Offshore and Nearshore Activities and Facilities*, of the Final EIS.
[17] Burial depth is target burial rather than maximum burial depth.
[18] Increases reflected for identified parameters are related to removal of the Great Egg Harbor Bay inshore route, with a subsequent use of West Avenue for the eastern two landfall options.
[19] Where located in the open.
[20] Depends on rig spread to be used, phase of drilling, ground conditions, ancillary equipment, etc.
FF = foundation fieldbus; HGV = heavy goods vehicle; Statcom = statis synchronous compensator; SVC = static VAR compensator; XLPE = cross-linked polyethylene

Appendix F. Planned Activities Scenario

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LIST OF ATTACHMENTS

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

Abbreviation	Definition
FERC	Federal Energy Regulatory Commission

F.1. Ongoing and Planned Activities Scenario

This appendix describes the other ongoing and planned activities that could occur within the analysis area for each resource and contribute to baseline conditions and trends for resources considered in this EIS. The *Project* here is the construction, O&M, and conceptual decommissioning of a wind energy facility within BOEM's Renewable Energy Lease Area OCS-A 0498, approximately 13 nm (15 statute miles) southeast of Atlantic City, New Jersey.

The geographic analysis area varies for each resource as described in the individual resource sections of Chapter 3. BOEM anticipates that impacts could occur from the start of Project construction in 2023 through Project decommissioning in approximately 2058.[1] The geographic analysis area is defined by the anticipated geographic extent of impacts for each resource. For the mobile resources—bats, birds, finfish, and invertebrates; marine mammals; and sea turtles—the species potentially affected are those that occur within the area of impact of the Proposed Action. The geographic analysis area for these mobile resources is the general range of the species. The purpose is to capture the cumulative impacts on each of those resources that would be affected by the Proposed Action as well as the impacts that would still occur under the No Action Alternative.

In this appendix, distances in miles are in statute miles (miles used in the traditional sense) or nm (miles used specifically for marine navigation). This appendix uses statute miles more commonly and refers to them simply as *miles*, whereas nm are referred to by name.

F.2. Ongoing and Planned Activities

This section includes a list and description of ongoing and planned activities that could contribute baseline conditions and trends within the geographic analysis area for each resource topic analyzed in this EIS. Projects or actions that are considered speculative per the definition provided in 43 CFR 46.30[2] are noted in subsequent tables but excluded from the cumulative impact analysis in Chapter 3.

Ongoing and planned activities described in this section consist of 10 types of actions: (1) other offshore wind energy development activities; (2) undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); (3) tidal energy projects; (4) marine minerals use and ocean-dredged material disposal; (5) military use; (6) marine transportation (commercial, recreational, and research-related); (7) fisheries use, management, and monitoring surveys; (8) global climate change; (9) oil and gas activities; and (10) onshore development activities.

BOEM analyzed the possible extent of future other offshore wind energy development activities on the Atlantic OCS to determine reasonably foreseeable cumulative effects measured by installed power

[1] Ocean Wind's lease with BOEM (Lease OCS-A 0498) has an operations term of 25 years that commences on the date of COP approval (see https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NJ/NJ-SIGNED-LEASE-OCS-A-0498.pdf; see also 30 CFR 585.235(a)(3).) Ocean Wind would need to request and be granted an extension of its operations term from BOEM in order to operate the proposed Project for 35 years. While Ocean Wind has not made such a request, this EIS uses the longer period in order to avoid possibly underestimating any potential effect.

[2] 43 CFR 46.30 – Reasonably foreseeable future actions include those federal and non-federal activities not yet undertaken, but sufficiently likely to occur, that a responsible official of ordinary prudence would take such activities into account in reaching a decision. The federal and non-federal activities that BOEM must take into account in the analysis of cumulative impacts include, but are not limited to, activities for which there are existing decisions, funding, or proposals identified by BOEM. Reasonably foreseeable future actions do not include those actions that are highly speculative or indefinite.

capacity. Table F2-1 in Attachment 2 represents the status of projects as of August 1, 2021. The methodology for developing the scenario is the same as for the Vineyard Wind 1 project and details of the scenario development are described in the Vineyard Wind 1 Final EIS (BOEM 2021a).

F.2.1 Offshore Wind Energy Development Activities

F.2.1.1. Site Characterization Studies

A lessee is required to provide the results of site characterization activities with its SAP and COP. For the purposes of the cumulative impact analysis, BOEM makes the following assumptions, which represent the maximum-case scenario for survey and sampling activities:

- Site characterization would occur on all existing leases and potential export cable routes.
- Site characterization would likely take place in the first 3 years following execution of a lease, based on the fact that a lessee would likely want to generate data for its COP at the earliest possible opportunity.
- Lessees would likely survey most or all of the proposed Lease Area during the 5-year site assessment term to collect required geophysical information for siting of a meteorological tower, two buoys, and commercial facilities (wind turbines). The surveys may be completed in phases, with the meteorological tower and buoy areas likely to be surveyed first.
- Lessee would not use air guns, which are typically used for deep-penetration two-dimensional or three-dimensional exploratory seismic surveys to determine the location, extent, and properties of oil and gas resources (BOEM 2016).

Table F-1 describes the typical site characterization surveys, the types of equipment and method used, and which resources the survey information would inform.

Table F-1 Site Characterization Survey Assumptions

Survey Type	Survey Equipment and Method	Resource Surveyed or Information Used to Inform
HRG surveys	Side-scan sonar, sub-bottom profiler, magnetometer, multi- beam echosounder	Shallow hazards, archaeological, bathymetric charting, benthic habitat
Geotechnical/sub-bottom sampling	Vibracores, deep borings, cone penetration tests	Geological, marine archaeology
Biological	Grab sampling, benthic sled, underwater imagery/sediment profile imaging	Benthic habitat
	Aerial digital imaging; visual observation from boat or airplane	Birds, marine mammals, sea turtles
	Ultrasonic detectors installed on survey vessels used for other surveys	Bat
	Visual observation from boat or airplane	Marine fauna (marine mammals and sea turtles)
	Direct sampling of fish and invertebrates	Fish and invertebrates

Source: BOEM 2016.

F.2.1.2. Site Assessment Activities

After SAP approval, a lessee can evaluate the meteorological conditions, such as wind resources, with the approved installation of meteorological towers and buoys. Meteorological buoys have become the preferred meteorological and oceanographic (metocean) data collection platform for developers, and

BOEM expects that most future site assessments will use buoys instead of towers (BOEM 2021d). The installation and operation of meteorological buoys involves substantially less activity and a much smaller footprint than the construction and operation of a meteorological tower. Site assessment activities have been approved or are in the process of being approved for multiple lease areas consisting of one to three meteorological buoys per SAP (Table F2-1 in Attachment 2). Site assessment would likely take place starting within 1 to 2 years of lease execution, because preparation of an SAP (and subsequent BOEM review) takes time. The No Action Alternative and cumulative analyses consider these site assessment activities.

F.2.1.3. Construction and Operation of Offshore Wind Facilities

Table F2-1 in Attachment 2 lists all offshore wind development activities that BOEM considers reasonably foreseeable by lease areas and projects.

F.2.2 Commercial Fisheries Cumulative Fishery Effects Analysis

Table F-2 depicts construction of offshore wind projects from Maine to North Carolina including Atlantic Shores South and Ocean Wind 2 that are proposed offshore New Jersey adjacent to Ocean Wind 1, and Empire Wind 1 and Empire Wind 2 that are proposed offshore New York. Also included are all of the projects currently in various stages of planning within BOEM's offshore leases from Massachusetts to North Carolina, including the future development of Atlantic Shores North. Projected construction dates for each offshore wind project are listed in Table F2-1 in Attachment 2, and each project will require a NEPA process with an EIS or environmental assessment prior to approval.

Table F-2 summarizes (1) the incremental number of construction locations that are projected to be active in each region during each year between 2021 and 2030; (2) the number of operational turbines in each region at the beginning of each year between 2021 and 2030; and (3) the total number of active construction locations and operational turbines across the Atlantic OCS by year.

Note that the Kitty Hawk project is included despite its location in the NMFS South Atlantic Region. Fishing vessels operating in fisheries managed by the NMFS Greater Atlantic Regional Office regularly harvest in this area. It is also likely that vessels participating in fisheries managed by the NMFS Southeast Regional Office will be affected by the Kitty Hawk project, although revenues from these fisheries have not been included in the Fishery Management Plan revenue exposure analysis.

Table F-2 Offshore Wind Project Construction Schedule (dates shown as of January 15, 2023)

Project/Region	Number of Foundations										
	Before 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 and Beyond
Aquaventis (state waters)	-	-	-	2	-	-	-	-	-	-	-
Total Other State Waters Projects	-	-	-	*2*	-	-	-	-	-	-	-
Estimated Other State Waters Construction	**-**	**-**	**-**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Estimated O&M Total	**-**	**-**	**-**	**0**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Existing and Ongoing Projects											
Block Island (state waters)	5	-	-	-	-	-	-	-	-	-	-
Vineyard Wind 1 part of OCS-A 0501	-	-	-	63	-	-	-	-	-	-	-
South Fork, OCS-A 0517	-	-	-	13	-	-	-	-	-	-	-
CVOW, OCS-A 0497	2	-	-	-	-	-	-	-	-	-	-
Estimated Existing and Ongoing Project Construction	**7**	**0**	**0**	**76**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Estimated O&M Total	**0**	**7**	**7**	**7**	**83**	**83**	**83**	**83**	**83**	**83**	**83**
Planned Projects											
Massachusetts/Rhode Island Region											
Sunrise, OCS-A 0487	-	-	-	-	95	-	-	-	-	-	-
Revolution, part of OCS-A 0486	-	-	-	102	-	-	-	-	-	-	-
New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 1 [i.e., Park City Wind])	-	-	-	-	64	-	-	-	-	-	-
New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 2 [i.e., Commonwealth Wind])	-	-	-	-	82	-	-	-	-	-	-
SouthCoast OCS-A 0521	-	-	-	-	-	149	-	-	-	-	-
Beacon Wind, part of OCS-A 0520	-	-	-	-	79	-	-	-	-	-	-
Beacon Wind 2, part of OCS-A 0520	-	-	-	-	-	78	-	-	-	-	-
Bay State Wind, part of OCS-A 0500	-	-	-	-	-	112	-	-	-	-	-
OCS-A 0500 remainder	-	-	-	-	-	232	-	-	-	-	-

Project/Region	Number of Foundations										
	Before 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 and Beyond
OCS-A 0487 remainder	-	-	-	-	-	-	-	-	-	-	-
Liberty Wind, part of OCS-A 0522	-	-	-	-		-		-	-	-	-
Estimated annual Massachusetts/Rhode Island construction	**0**	**0**	**0**	**102**	**320**	**571**	**0**	**0**	**0**	**0**	**0**
Estimated O&M Total	**0**	**0**	**0**	**0**	**102**	**422**	**993**	**993**	**993**	**993**	**993**
New York/New Jersey Region											
Ocean Wind 1, OCS-A 0498	-	-	-	-	101		-	-	-	-	-
Atlantic Shores South, OCS-A 0499	-	-	-	-	-	11	200	-	-	-	-
Ocean Wind 2, part of OCS-A 0532, and remainder	-	-	-	-	-	-	113	-	-	-	-
Empire Wind 1, part of OCS-A 0512	-	-	-	58	-	-	-	-	-	-	-
Empire Wind 2, part of OCS-A 0512	-	-	-	91	-	-	-	-	-	-	-
Atlantic Shores North, OCS-A 0549	-	-	-	-	-	-	160	-	-	-	-
OW Ocean Winds East LLC, OCS-A 0537	-	-	-	-	-	-	102	-	-	-	-
Attentive Energy LLC, OCS-A 0538	-	-	-	-	-	-	104	-	-	-	-
Bight Wind Holdings, LLC, OCS-A 0539	-	-	-	-	-	-	148	-	-	-	-
Atlantic Shores Offshore Wind Bight, LLC, OCS-A 0541	-	-	-	-	-	-	95	-	-	-	-
Invenergy Wind Offshore LLC, OCS-A 0542	-	-	-	-	-	-	99	-	-	-	-
Vineyard Mid-Atlantic LLC, OCS-A 0544	-	-	-	-	-	-	104	-	-	-	-
Estimated annual New York/New Jersey construction	**0**	**0**	**0**	**149**	**101**	**11**	**1,125**	**0**	**0**	**0**	**0**
Estimated O&M Total	**0**	**0**	**0**	**0**	**149**	**250**	**261**	**1,386**	**1,386**	**1,386**	**1,386**
Delaware/Maryland Region											
Skipjack, OCS-A 0519	-	-	-	-	17	-	-	-	-	-	-
US Wind, OCS-A 0490	-	-	-	-	126	-	-	-	-	-	-
GSOE I, OCS-A 0482	-	-	-	93							
OCS-A 0519 remainder	-	-	-								

Project/Region	Number of Foundations										
	Before 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 and Beyond
Estimated annual Delaware/Maryland construction	**0**	**0**	**0**	**93**	**143**	**0**	**0**	**0**	**0**	**0**	**0**
Estimated O&M total	**0**	**0**	**0**	**0**	**93**	**236**	**236**	**236**	**236**	**236**	**236**
Virginia/North Carolina Region											
CVOW-C, OCS-A 0483	-	-	-	208	-	-	-	-	-	-	-
Kitty Hawk North, OCS-A 0508	-	-	-	-	70	-	-	-	-	-	-
Kitty Hawk South, OCS-A 0508	-	-	-	-	-	-	-	123	-	-	-
Estimated annual Virginia/North Carolina construction:	**0**	**0**	**0**	**208**	**70**	**0**	**0**	**123**	**0**	**0**	**0**
Estimated O&M Total	**0**	**0**	**0**	**0**	**208**	**278**	**278**	**278**	**401**	**401**	**401**
Total											
Estimated annual total construction	**7**	**0**	**0**	**630**	**634**	**582**	**1,125**	**123**	**0**	**0**	**0**
Estimated O&M total	**7**	**7**	**7**	**7**	**637**	**1,271**	**1,853**	**2,978**	**3,101**	**3,101**	**3,101**

CVOW = Coastal Virginia Offshore Wind

BOEM assumes proposed offshore wind projects will include the same or similar components as the proposed Project: wind turbines, offshore and onshore cable systems, OSS, onshore O&M facilities, and onshore interconnection facilities. BOEM further assumes that other potential offshore wind projects will employ the same or similar construction, O&M, and conceptual decommissioning activities as the proposed Project. However, offshore wind projects would be subject to evolving economic, environmental, and regulatory conditions. Lease areas may be split into multiple projects, expanded, or removed, and development within a particular lease area may occur in phases over long periods of time. Research currently being conducted in combination with data gathered regarding physical, biological, socioeconomic, and cultural resources during development of initial offshore wind projects in the United States could affect the design and implementation of future projects, as could advancements in technology. For the analysis of ongoing and planned activities, the proposed projects included in Table F2-1 in Attachment 2 are analyzed in Chapter 3 of this EIS. For a list of mitigation measures that were considered in the impact analysis in Chapter 3 of this EIS, please see the Project EIS's Appendix H (*Mitigation and Monitoring*).

F.2.3 Incorporation by Reference of Cumulative Impacts Study and the Analyses Therein

BOEM has completed a study of IPFs on the North Atlantic OCS to consider in an offshore wind development cumulative impacts scenario (BOEM 2019). The study is incorporated in this document by reference. The study identifies cause-and-effect relationships between renewable energy projects and resources potentially affected by such projects. It further classifies those relationships into a manageable number of IPFs through which renewable energy projects could affect resources. It also identifies the types of actions and activities to be considered in a cumulative impact scenario. The study identifies actions and activities that may affect the same physical, biological, economic, or cultural resources as renewable energy projects and states that such actions and activities may have the same IPFs as offshore wind projects.

The BOEM (2019) study identifies the relationships between IPFs associated with specific ongoing and planned activities in the North Atlantic OCS to consider in a NEPA cumulative impacts scenario. These IPFs and their relationships were utilized in the EIS analysis of cumulative impacts, and the application of which IPF applied to which resource was decided by BOEM.

As discussed in the BOEM (2019) study, reasonably foreseeable activities other than offshore wind projects may also affect the same resources as the proposed Project or other offshore wind projects, possibly via the same IPFs or via IPFs through which offshore wind projects do not contribute. This appendix lists reasonably foreseeable non-offshore wind activities that may contribute to the cumulative impacts of the proposed Project.

F.2.4 Undersea Transmission Lines, Gas Pipelines, and Other Submarine Cables

Several in-service and abandoned submarine telecommunication cables are present in the offshore export cable corridor and in the vicinity of the Lease Area. In-service cables along the offshore export cable corridor include the TAT 14 Seg G, TAT 12 Seg L, GlobeNet Seg 1, and GlobeNet Seg 5. Out-of-service cables along the offshore export cable corridor include the TAT 3, TAT 4, TAT 7, TAT 8, TAT 9, and TAT 11. NOAA navigation charts identify a number of sewer pipelines, stormwater outfalls, and intake structures along the coast of New Jersey that begin onshore and extend offshore. No undersea transmission lines or gas pipelines have been identified offshore near the Project (Ocean Wind 2023). In compliance with Federal Energy Regulatory Commission (FERC) Order No. 1000, PJM developed the State Agreement Approach to provide for the consideration of transmission needs driven by Public Policy Requirements in the regional transmission planning processes, known as its Regional Transmission

Expansion Plan. BPU/PJM solicited competitive transmission proposals under the State Agreement Approach for four distinct options that include a combination of onshore and offshore transmission lines and substations in April 2021. The solicitation identified possible points of interconnect at Deans, Smithburg, Larrabee, and Cardiff. On October 26, 2023, BPU selected Mid-Atlantic Offshore Development, LLC's and Jersey Central Power & Light Company's jointly submitted Larrabee Tri-Collector Solution (BPU Docket No. QO20100630), consisting of onshore new transmission connection facilities. The offshore wind projects listed in Table F2-1 in Attachment 2 that have a COP under review are presumed to include at least one identified cable route. Cable routes have not yet been announced for the remainder of the projects.

F.2.5 Tidal Energy Projects

The following tidal energy projects have been proposed or studied on the U.S. East Coast and are in operation or considered reasonably foreseeable:

- The Bourne Tidal Test Site, located in the Cape Cod Canal near Bourne, Massachusetts, is a testing platform for tidal turbines that was installed in late 2017 by the Marine Renewable Energy Collaborative.
- Western Passage Tidal Energy Project, a proposed tidal energy site in the Western Passage, received a preliminary permit from FERC in 2016. The preliminary permit allows developers to study a project but does not authorize construction.

F.2.6 Dredging and Port Improvement Projects

The following dredging projects have been proposed or studied at ports that may be used by the Project in New Jersey, Virginia, and South Carolina, and are either in operation or are considered reasonably foreseeable:

- The State of New Jersey is planning to build an offshore wind port on the eastern shore of the Delaware River in Lower Alloways Creek, Salem County, approximately 7.5 miles southwest of the city of Salem. The New Jersey Economic Development Authority is leading the development of the project on behalf of the state, working alongside key departments and agencies such as the Governor's Office, the Department of the Treasury, and the BPU. The development plan includes dredging the Delaware River Channel and construction is planned to commence in 2021 with a targeted completion date of late 2023 (New Jersey Wind Port 2021).
- The City of Atlantic City intends to secure authorization for marina upgrades, namely dredging in the marina and at Absecon Inlet, for the benefit of multiple marina users, and both this in-water activity and upland improvements by Ocean Wind (including office and warehouse) are being separately reviewed and authorized by USACE and state and local agencies (Ocean Wind 2023).
- A channel deepening project at the Port of Virginia is currently underway with USACE and a private contractor engaged in dredging approximately 1.1 million cubic yards of sediment from the federal channel in Norfolk Harbor and Newport News, Virginia (USACE 2019). The project is anticipated to be completed in 2024, resulting in a channel depth of over 50 feet in the harbor, which will allow it to accommodate two ultra-large container vessels simultaneously (Virginia Port Authority 2021).
- USACE has proposed maintenance dredging of portions of the Newark Bay, New Jersey Federal navigation channel, including the removal of material from the Port Elizabeth Channel. Maintenance dredging and associated upland placement activities are planned to occur between July 2021 and February 2022 (USACE 2021a).
- In 2017, the USACE Charleston District awarded contracts as part of the Charleston Harbor Deepening Project, which will create a 52-foot depth at the entrance channel to Charleston Harbor in South Carolina. The project also involves widening a turning basin in the port. The project will

support and enhance the military readiness of Charleston Harbor and joint base Charleston and allow Post-Panamax vessels to call upon the harbor (USACE 2021b).

- In 2018, two New Jersey Department of Transportation projects—High Bar Harbor channel and Barnegat Light Stake channel, both near Barnegat Inlet in Ocean and Long Beach Townships, New Jersey—underwent dredging of approximately 39,150 cubic yards and 3,230 cubic yards, respectively, to maintain the depths of these channels. Maintenance dredging for both projects is authorized until December 2025 and is expected to occur before the permits expire (USACE 2015a, 2015b).
- USACE has also received numerous permit applications for private dock, boat lift, and bulkhead repairs in Barnegat Bay (USACE 2022).
- Maintenance dredging of Barnegat Inlet and the Oyster Creek Channel in Barnegat Bay (Barnegat Inlet Federal Navigation Project) by USACE was conducted in November 2022 and is planned for November 2023.

F.2.7 Marine Minerals Use and Ocean Dredged Material Disposal

The closest previous lease in BOEM's Marine Minerals Program for sand borrow areas for beach replenishment is known as the D2 borrow area, offshore New Jersey near Harvey Cedars, Surf City, Long Beach Township, Ship Bottom, and Beach Haven (Lease Number OCS-A-0505; executed 7/1/2014). The lessee (USACE and NJDEP) was approved through September 30, 2018, for the use of up to 10,000,000 cubic yards of material to be used for the Long Beach Island Coastal Storm Risk Management Project, Barnegat Inlet to Little Egg Inlet. Dredging associated with this lease concluded on September 30, 2018, with a reported total dredge volume of approximately 9,217,383 cubic yards. Periodic nourishment for this project has been authorized in a 7-year cycle, with an estimated final nourishment year of 2055 (Cresitello 2020).

Due to the depletion of sand sources in state waters, it is highly likely that OCS material will be sought for future nourishment cycles on Long Beach Island as well as for projects to the south on Absecon Island and along beaches stretching from Great Egg Harbor Inlet to Townsends Inlet, and to the north along beaches stretching from Barnet Inlet to Sandy Hook (Cresitello 2020).

To help meet the sand resource needs of coastal communities, BOEM-funded reconnaissance or design-level OCS studies along the East Coast from Rhode Island to Florida have identified potential future sand resources in many areas. Sand resources identified nearest the Project include OCS locations offshore of all of the beaches noted above; many of these potential sand resources are within 5 miles of the Project Lease Area and associated planned infrastructure (e.g., export cables).

USEPA Region 2 is responsible for designating and managing ocean disposal sites for materials offshore in the region of the Project. USACE issues permits for ocean disposal sites; all ocean sites are for the disposal of dredged material permitted or authorized under the Marine Protection, Research, and Sanctuaries Act (16 USC 1431 et seq. and 33 USC 1401 et seq.). There are four active projects along the New Jersey Coast, with the closest dredge disposal site offshore Atlantic City, New Jersey (USACE 2021c).

F.2.8 Military Use

The Lease Area is within the Atlantic City Range Complex and the Atlantic City OPAREA. The Atlantic City OPAREA extends from the shoreline seaward to approximately 100 nm from land at its farthest point; the subsurface portion of the Atlantic City OPAREA has the same boundaries as the surface water portion. This range complex is used for U.S. Atlantic Fleet training and testing exercises and supports training and testing by other services, primarily the U.S. Air Force. The AEGIS Combat Systems Center conducts operations in this area. It is controlled by the Fleet Area Control and Surveillance Facility Virginia Capes, Naval Air Station, Oceana. In addition, the complex is composed of Warning Area 107, which is a special-use airspace used for surface and surface-to-air exercises. Subsurface operations are typically not conducted in the area. An aircraft training route is located along the westerly edge of the Lease Area and the U.S. Marine Corps uses a military flight route (VR-1709) that crosses the western portion of the Lease Area (Ocean Wind 2023).

Naval Weapons Station Earle is in Colts Neck, New Jersey. It provides all the ordnance for the Atlantic Fleet Carrier and Expeditionary Strike Groups and supports strategic ordnance requirements. The DOD also operates the North American Aerospace Defense Command national defense radar in the Project vicinity. Joint Base McGuire-Dix-Lakehurst is a military installation approximately 18 miles south of Trenton, New Jersey. Additionally, the Manasquan Inlet USCG is approximately 60 miles north of Oyster Creek in Point Pleasant. Military activities at the Manasquan Inlet Station could include various vessel training exercises, submarine and antisubmarine training, and U.S. Air Force exercises. Even though this installation is north of the Lease Area, vessel training exercises may be conducted closer to the Project (Ocean Wind 2023).

The Atlantic City International Airport is the base for the New Jersey Air National Guard's 177th Fighter Wing and the USCG Air Station Atlantic City. Military activities at these facilities could include squadron training by the New Jersey Air National Guard and SAR missions conducted by USCG (Ocean Wind 2023).

F.2.9 Marine Transportation

Marine transportation in the region is diverse and sourced from many ports and private harbors. Commercial vessel traffic in the region includes research, tug/barge, tankers (such as those used for liquid petroleum), cargo, cruise ships, smaller passenger vessels, and commercial fishing vessels. Recreational vessel traffic includes private motor boats and sailboats. A number of federal agencies, state agencies, educational institutions, and environmental non-governmental organizations participate in ongoing research offshore including oceanographic, biological, geophysical, and archaeological surveys. Most vessel traffic, excluding recreational vessels, tends to travel within established vessel traffic routes and the number of trips, as well as the number of unique vessels, has remained consistent (USCG 2021). In response to future offshore wind projects in the New York Bight, multiple additional fairways and a new anchorage may be established to route existing vessel traffic around wind energy projects (USCG 2021). One new regional maritime highway project received funding from the Maritime Administration. A new barge service (Davisville/Brooklyn/Newark Container-on-Barge Service) is proposed to run twice each week in state waters between Newark, New Jersey and Brooklyn, New York.

USCG chartered a workgroup on May 11, 2011, to gather data, identify existing and future waterway usage, and conduct modeling and analysis of traffic patterns in light of the complex interactions of the various factors that would affect navigational safety along the Atlantic Coast of the United States including potential navigational conflicts with various planned WEAs. USCG published the workgroup's Interim Report (77 *Federal Register* 55781; September 11, 2012) and a notification (81 *Federal Register* 13307; March 14, 2016) that announced the availability of the final report (the Atlantic Port Access Route Study) issued by the Atlantic Coast Port Access Route Study workgroup. USCG announced the final report to be complete as published on April 5, 2017 (82 *Federal Register* 16510). Similarly, and especially relevant to this EIS analysis, USCG completed a Port Access Route Study for the Seacoast of New Jersey including Offshore Approaches to the Delaware Bay, Delaware in 2022 (87 *Federal Register* 16759). The information in the New Jersey Port Access Route Study and the Atlantic Coast Port Access Route Study Final Reports along with the other Port Access Route Studies referenced in Section 3.16, including the *Consolidated Port Approaches and International Entry and Departure Transit Areas Port*

Access Route Studies, served to gauge and inform the navigational assessment of the Proposed Action and cumulative impacts.

F.2.10 National Marine Fisheries Service and New Jersey Department of Environmental Protection Activities

Research and enhancement permits may be issued for marine mammals protected by the MMPA and for threatened and endangered species protected under the ESA. NMFS is anticipated to continue issuing research permits under Section 10(a)(1)(A) of the ESA to allow take of certain ESA-listed species for scientific research. Scientific research permits issued by NMFS currently authorize studies on ESA-listed species in the Atlantic Ocean. Current fisheries management and ecosystem monitoring surveys conducted by or in coordination with NEFSC could overlap with offshore wind lease areas in the New England region and south into the Mid-Atlantic region. Surveys include (1) the NEFSC Bottom Trawl Survey, a more than 50-year multispecies stock assessment tool using a bottom trawl; (2) the NEFSC Sea Scallop/Integrated Habitat Survey, a sea scallop stock assessment and habitat characterization tool, using a bottom dredge and camera tow; (3) the NEFSC Surfclam/Ocean Quahog Survey, a stock assessment tool for both species using a bottom dredge; and (4) the NEFSC Ecosystem Monitoring Program, a more than 40-year shelf ecosystem monitoring program using plankton tows and conductivity, temperature, and depth units. Additionally, NJDEP has conducted the New Jersey Ocean Trawl Program annually for over 30 years to document the occurrence, distribution, and relative abundance of marine recreational and non-recreational fish species in New Jersey coastal waters. Similarly, the NJDEP surfclam surveys were performed annually from 1988–2019 to document the occurrence, distribution, and abundance of surfclams in New Jersey coastal waters. Nearshore survey activities associated with the NEAMAP overlap with the western edge of the Project area. These surveys are anticipated to continue within the region, regardless of offshore wind development.

The regulatory process administered by NMFS, which includes stock assessments for all marine mammals and 5-year reviews for all ESA-listed species, assists in informing decisions on take authorizations and the assessment of project-specific and cumulative impacts that consider ongoing and planned activities in biological opinions. Stock assessments completed regularly under the MMPA include estimates of potential biological removal that stocks of marine mammals can sustainably absorb. MMPA take authorizations require that a proposed action have no more than a negligible impact on species or stocks, and that a proposed action impose the least practicable adverse impact on the species. MMPA authorizations are reinforced by monitoring and reporting requirements so that NMFS is kept informed of deviations from what has been approved. Biological opinions for federal and non-federal actions are similarly grounded in status reviews and conditioned to avoid jeopardy and to allow continued progress toward recovery. These processes help to ensure that, through compliance with these regulatory requirements, a proposed action would not have a measurable impact on the conservation, recovery, and management of the resource.

F.2.10.1. Directed Take Permits for Scientific Research and Enhancement

NMFS issues permits for scientific research on protected species. These research permits include the authorization of directed take for activities such as capturing animals and taking measurements and biological samples to study their health, tagging animals to study their distribution and migration, photographing and counting animals to get population estimates, taking animals in poor health to an animal hospital, and filming animals. NMFS also issues permits for enhancement purposes; these permits are issued to enhance the survival or recovery of a species or stock in the wild by taking actions that increase an individual’s or population’s ability to recover in the wild. Scientific research and enhancement permits have been issued previously for satellite, acoustic, and multi-sensor tagging studies on large and small cetaceans; research on reproduction, mortality, health, and conservation issues for NARWs; and research on population dynamics of harbor and gray seals. Reasonably foreseeable future impacts from scientific research and enhancement permits include physical and behavioral stressors (e.g., restraint and capture, marking, implantable and suction tagging, biological sampling).

F.2.10.2. Fisheries Use and Management

NMFS implements regulations to manage commercial and recreational fisheries in federal waters, including those within which the Project would be located; the State of New Jersey regulates commercial fisheries in state waters (within 3 nm of the coastline). No shellfish aquaculture leases presently occur in the vicinity of the BL England onshore interconnection. Four shellfish leases (37 acres) and one research lease occur in the vicinity of Oyster Creek with the primary shellfish growout of oysters and hard clams; however, these areas would be avoided (Ocean Wind 2023). The Project overlaps two of NMFS’s eight regional councils to manage federal fisheries: MAFMC, which includes New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina; and NEFMC, which includes Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut (NEFMC 2016). The councils manage species with many FMPs that are frequently updated, revised, and amended and coordinate with each other to jointly manage species across jurisdictional boundaries (MAFMC 2019). Many of the fisheries managed by the councils are fished for in state waters or outside of the Mid-Atlantic region, so the council works with ASMFC. ASMFC is composed of the 15 Atlantic coast states and coordinates the management of marine and anadromous resources found in the states’ marine waters. In addition, the states and NMFS, under the framework of ASMFC’s *Amendment 3 to the Interstate Fishery Management Plan for American Lobster*, cooperatively manage the American lobster resource and fishery (NOAA 1997).

The FMPs of the councils and ASMFC were established, in part, to manage fisheries to avoid overfishing. They accomplish this through an array of management measures, including annual catch quotas, minimum size limits, and closed areas. These various measures can further reduce (or increase) the size of landings of commercial fisheries in the Northeast and Mid-Atlantic regions.

NMFS also manages highly migratory species, such as tuna and sharks, that can travel long distances and cross domestic boundaries. Table F-3 summarizes other FMPs and actions in the region.

Table F-3 Other Fishery Management Plans

Area	Plan and Projects
ASMFC	ASMFC *Five-Year Strategic Plan 2014–2018* (ASMFC 2014); Draft 2019 strategic management plan under review *Management, Policy and Science Strategies for Adapting Fisheries Management to Changes in Species Abundance and Distribution Resulting from Climate Change* (ASMFC 2018)
New York	*New York Ocean Action Plan 2017–2027*: adaptive management plan (NYSDEC 2017) New York State filed a petition with NOAA, NMFS, and MAFMC to demand that commercial fluke allocations be revised to provide fishers with equitable access to summer flounder. New York is also reviewing other species where there is an unfair allocation, including black sea bass and bluefish, and may pursue similar actions (BOEM 2021b).
Long Island Regional Development Council	East Hampton Shellfish Hatchery project to consolidate the hatchery’s municipal hatchery and nursing facilities. Haskell’s seafood facility in East Quogue is proposed become a fully functioning seafood processing plant. Shinnecock Dock Revitalization to provide better processing and packing facilities for local fishermen (LIRDC 2018).

Area	Plan and Projects
New Jersey	NJDEP Division of Fish and Wildlife Marine Fisheries Management Rule Amendment Proposal with amendments to rules governing crab and lobster management, commercial Atlantic menhaden fishery, marine fisheries, and fishery management in New Jersey was published in the March 1, 2021, New Jersey Register (New Jersey Division of Fish and Wildlife 2021).

F.2.11 Global Climate Change

Climate change results primarily from the increasing concentration of GHGs in the atmosphere, which causes planet-wide physical, chemical, and biological changes, substantially affecting the world's oceans and lands. Changes include increases in global atmospheric and oceanic temperature, shifting weather patterns, rising sea levels, and changes in atmospheric and oceanic chemistry (Blunden and Arndt 2020). Section 7.6.1.4 of the *Programmatic EIS for Alternative Energy Development and Production and Alternate Use of Activities on the Outer Continental Shelf* (Minerals Management Service 2007) describes global climate change with respect to assessing renewable energy development. Key drivers of climate change are increasing atmospheric concentrations of CO_2 and other GHGs, such as methane and nitrous oxide. These GHGs reduce the ability of solar radiation to re-radiate out of Earth's atmosphere and into space. Although all three of these GHGs have natural sources, the majority of these GHGs are released from anthropogenic activity. Since the industrial revolution, the rate at which solar radiation is re-radiated back into space has slowed, resulting in a net increase of energy in Earth's system (Solomon et al. 2007). This energy increase presents as heat, raising the planet's temperature and causing climate change.

Fluorinated gases are a type of GHG released in trace amounts but are highly efficient at preventing solar radiation from being re-radiated back into space. They have a much longer lifespan than CO_2, methane, and nitrous oxide. Fluorinated gases have no natural sources, are either a product or byproduct of manufacturing, and can have 23,000 times the warming potential of an equal amount of CO_2. These gases include hydrofluorocarbons, perfluorocarbons, nitrogen trifluoride, and sulfur hexafluoride. These gases are currently being phased out; however, sulfur hexafluoride is still used in WTG switchgears and OSS high-voltage and medium-voltage gas-insulated switchgears.

Local emissions, such as those from wind energy projects, would contribute to global emissions and those global emissions do have impacts whose local effects are increasingly elucidated through research. For example, a recent study concerning the NARW provides evidence that the whale's feeding area moved north following relocation of its food source related to climate change, and whale mortality may have increased because of fewer controls on fishing activities in the new, more northerly area (Meyer-Gutbrod et al. 2021). Climate change is predicted to affect Northeast fishery species in different ways (Hare et al. 2016), and the NMFS biological opinion discusses in detail the potential impacts of global climate change on protected species that occur within the Proposed Action area (NMFS 2013).

The Intergovernmental Panel on Climate Change released a special report in October 2018 that compared risks associated with an increase of global warming of 1.5 degrees Celsius (°C) and an increase of 2°C. The report found that climate-related risks depend on the rate, peak, and duration of global warming, and that an increase of 2°C was associated with greater risks associated with climatic changes such as extreme weather and drought; global sea level rise; impacts on terrestrial ecosystems; impacts on marine biodiversity, fisheries, and ecosystems and their functions and services to humans; and impacts on health, livelihoods, food security, water supply, and economic growth (IPCC 2018). High global temperatures increase the chances of sea level rise by the end of the century, with a projected relative seal level rise of 0.6 to 2.2 meters along the contiguous United States coastline by 2100 (NOAA 2022). Expected relative sea level rise would cause tide and storm surge heights to increase, leading to a shift in the U.S. coastal flood regimes by 2050 with major and moderate high tide flood events occurring as frequently as moderate and minor high tide flood events occur today (NOAA 2022).

New Jersey has been warming faster than the rest of the Northeast region, with annual average temperatures increasing by 4.1 to 5.7 degrees Fahrenheit (°F) by 2050 (NJDEP 2020). Sea levels have also increased at a greater rate in New Jersey as compared to the global change in mean sea level and are likely to experience a sea level rise of 0.9 to 2.1 feet between 2000 and 2050 (Kopp et al. 2019).

Table F-4 summarizes regional plans and policies that are in place to address climate change, and Table F-5 summarizes resiliency plans.

Table F-4 Climate Change Plans and Policies

Plans and Policies	Summary/Goal
New York	
Reforming the Energy Vision (New York State 2014)	State's energy policy to build integrated energy network; clean energy goal to reduce GHGs 40% by 2030 and 80% by 2050.
Order Adopting a Clean Energy Standard (State of New York Public Service Commission 2016)	Requirement that 50% of New York's electricity come from renewable energy sources by 2030.
New York State Energy Plan 2015; 2017 Biennial Report to 2015 Plan (NYSERDA 2015, 2017a)	Requires 40% reduction in GHG from 1990 levels, 50% electricity to come from renewable energy resources, and a 600-trillion-British-thermal-unit increase in statewide energy efficiency.
Governor Cuomo State of State Address 2017, 2018, 2021	2017: Set offshore wind energy development goal of 2,400 MW by 2030 (Governor's Office 2017). 2018: Procurement of at least 800 MW of offshore wind power between two solicitations in 2018 and 2019; new energy efficiency target for investor-owned utilities to more than double utility energy efficiency progress by 2025; energy storage initiative to achieve 1,500 MW of storage by 2025 and up to 3,000 MW by 2030 (Governor's Office 2018). 2021: The governor's 2021 agenda—Reimagine | Rebuild | Renew—establishes a goal of building out the renewable energy program. The agenda notes the development of two new offshore wind farms more than 20 miles offshore of Long Island, as well as the creation of dedicated offshore port facilities and additional transmission capacity development.
New York State Offshore Wind Master Plan (2017) (NYSERDA 2017b)	Grants NYSERDA ability to award 25-year long-term contracts for projects ranging from approximately 200 MW to approximately 800 MW, with an ability to award larger quantities if sufficiently attractive proposals are received. Each proposer is also required to submit at least one proposal of approximately 400 MW. Bids are due in February 2019; awards are expected in spring 2019; and contracts are expected to be executed thereafter.

Plans and Policies	Summary/Goal
2020 Offshore Wind Solicitation	As noted above, NYSERDA has provisionally awarded two offshore wind projects, totaling 2,490 MW. Empire Wind 2 (1,260 MW) and Beacon Wind (1,230 MW) of Equinor Wind US, LLC will generate enough clean energy to power 1.3 million homes and will be major economic drivers, supporting the following: • More than 5,200 direct jobs • Combined economic activity of $8.9 billion in labor, supplies, development, and manufacturing statewide • $47 million in workforce development and just access funding
The Climate Leadership and Community Protection Act, enacted on July 18, 2019, signed into law in July 2019, and effective January 1, 2020	The act establishes economy-wide targets to reduce GHG emissions by 40% of 1990 levels by 2030 and 85% of 1990 levels by 2050.
New Jersey	
New Jersey Energy Master Plan (New Jersey State 2019)	Updated in 2019, the plan sets the framework to implement Executive Order 28 by decarbonizing and modernizing New Jersey's energy system, expanding the clean energy innovation economy, and accelerating the deployment of renewable energy resources to meet the offshore wind energy generation goal established in Executive Order 92.
Executive Order 28: Measures to Advance New Jersey's Clean Energy Economy (2018)	Sets target of total conversion of the state's energy production profile to 100% clean energy sources on or before January 1, 2050.
Executive Order 92: Increase Offshore Wind Goal to 7,500 Megawatts by 2036 (2019)	Establishes a goal of 3,500 MW of offshore wind energy generation by 2030.
Executive Order 100: Protecting Against Climate Threats (PACT); Land Use Regulations and Permitting (2020)	Establishes a GHG monitoring and reporting program, establishes criteria to govern and reduce emissions, and integrates climate change considerations, such as sea level rise, into regulatory and permitting programs.
South Carolina	
None identified.	Not applicable.
Virginia	
Virginia Carbon Rule (June 25, 2020)	Under the Virginia Carbon Rule, Virginia is to establish a GHG cap-and-trade program and is to join the Regional Greenhouse Gas Initiative, a regional cap-and trade-program that reduces climate pollution from fossil fuel-fired power plants.
Virginia Clean Economy Act (April 12, 2020)	The Virginia Clean Economy Act establishes an electric power renewable portfolio standard for Virginia electric power companies to become 100% carbon-free by 2050 and requires closure of coal-fired electric power plants, establishes energy efficiency standards, and promotes offshore wind development and solar and distributed generation (Virginia State 2020).

Plans and Policies	Summary/Goal
Virginia Department of Environmental Quality Strategic Plan (2021)	The Virginia Department of Environmental Quality Strategic Plan establishes the objective to support the Commonwealth's resilience efforts by encouraging climate adaption through programmatic outreach and requirements, and strategies to make climate change adaptation an explicit, expected outcome of appropriate Virginia agency programs and initiatives. The Strategic Plan incorporates climate resilience, adaptation, and mitigation.

NYSERDA = New York State Energy Research and Development Authority

Table F-5 Resiliency Plans and Policies in the Lease Area

Plans and Policies	Summary
New York	
Part 490 of Community Risk and Resiliency Act of 2014	Establishes statewide science-based sea-level rise projections for coastal regions of the state. As of 2019, NYSDEC is in the process of developing a State Flood Risk Management Guidance document for state agencies (NYSDEC n.d.).
NY Rising Community Reconstruction Program (2018)	$20.4 million in projects on Long Island to help flood-prone communities plan and prepare for extreme weather events as they continue projects to recover from Superstorm Sandy, Hurricane Irene, and Tropical Storm Lee. Three projects were announced for Suffolk County and five for Nassau County (BOEM 2021b).
New Jersey	
New Jersey Draft Climate Change Resilience Strategy (NJDEP 2021)	This is New Jersey's first statewide climate resiliency strategy and was released as a draft in April 2021. The *Draft Climate Change Resilience Strategy* develops a framework for policy, regulatory, and operational changes to support the resilience of New Jersey's communities, economy, and infrastructure. It includes 125 recommended actions across the following six priority areas: build resilient and healthy communities, strengthen the resilience of New Jersey's ecosystems, promote coordinated governance, invest in information, increase public understanding, promote climate-informed investments and innovative financing, and coastal resilience plan.
South Carolina	
South Carolina Disaster Relief and Resilience Act (2020)	This act established the South Carolina Office of Resilience to coordinate disaster recovery and resilience efforts within the state, created the Disaster Relief and Resilience Reserve Fund to finance disaster recovery efforts and hazard mitigation projects, and created the Resilience Revolving Fund to provide low-interest loans to local governments performing floodplain buyouts and restoration.
Virginia	
Virginia Coastal Zone Management Program 2020 Coastal Needs Assessment and Fiscal Year 2021–2025 Strategies (Section 309)	The Virginia Coastal Zone Management Program assesses Virginia's coastal resources and management efforts every 5 years, including coastal hazards and ocean resources (Virginia Department of Environmental Quality 2021). The 5-year grant strategies are applied to result in new enforceable policies to better manage high-priority resources or issues; initiatives include responses to results of the Virginia Coastal Zone Management Program Phase I Coastal Hazards Assessment. Climate resiliency was selected by the Coastal Policy Team as a Fiscal Year 2020–2023 focal area theme to help meet the goals and needs in the statewide resiliency plan.

Plans and Policies	Summary
Virginia Clean Energy and Community Flood Preparedness Act	This act creates a Virginia Community Flood Preparedness Fund to enhance flood prevention, flood protection, and coastal resilience.

NYSDEC = New York State Department of Environmental Conservation

F.2.12 Oil and Gas Activities

The proposed Project area is in the North Atlantic Planning Area of the OCS Oil and Gas Leasing Program (National OCS Program). On September 8, 2020, the White House issued a presidential memorandum for the Secretary of the Interior on the withdrawal of certain areas of the United States OCS from leasing disposition for 10 years, including the areas currently designated by BOEM as the South Atlantic and Straits of Florida Planning Areas (The White House 2020a). The South Atlantic Planning Area includes the OCS off South Carolina, Georgia, and northern Florida. On September 25, 2020, the White House issued a similar memorandum for the Mid-Atlantic Planning Area that lies south of the northern administrative boundary of North Carolina (The White House 2020b). This withdrawal prevents consideration of these areas for any leasing for purposes of exploration, development, or production during the 10-year period beginning July 1, 2022 and ending June 30, 2032. However, currently, there has been no decision by the Secretary of the Interior regarding future oil and gas leasing in the North Atlantic or remainder of the Mid-Atlantic Planning Areas. Existing leases in the withdrawn areas are not affected.

BOEM issues geological and geophysical permits to obtain data for hydrocarbon exploration and production; locate and monitor marine mineral resources; aid in locating sites for alternative energy structures and pipelines; identify possible manmade, seafloor, or geological hazards; and locate potential archaeological and benthic resources. Geological and geophysical surveys are typically classified into categories by equipment type and survey technique. There are currently no such permits under review for areas offshore New York and New Jersey (BOEM 2021c).

Several liquefied natural gas ports are on the East Coast of the United States. Table F-6 lists existing, approved, and proposed liquified natural gas ports on the East Coast that provide (or may provide in the future) services such as natural gas export, natural gas supply to the interstate pipeline system or local distribution companies, storage of liquified natural gas for periods of peak demand, or production of liquified natural gas for fuel and industrial use (FERC 2018).

Table F-6 Liquid Natural Gas Terminals in the Northeastern United States

Terminal Name	Type	Company	Jurisdiction	Distance from Project (approximate)	Status
Everett, MA	Import terminal	GDF SUEZ—DOMAC	FERC	90 miles north	Existing
Offshore Boston, MA	Import terminal	Neptune LNG	MARAD/ USCG	100 miles north	Existing
Offshore Boston, MA	Import terminal, authorized to re-export delivered LNG	Excelerate Energy—Northeast Gateway	MARAD/ USCG	95 miles north (Buoy B)	Existing
Cove Point, MD (Chesapeake Bay)	Import terminal	Dominion—Cove Point LNG	FERC	340 miles southwest	Existing
Elba Island, GA (Savannah River)	Import terminal	El Paso—Southern LNG	FERC	835 miles southwest	Existing

Terminal Name	Type	Company	Jurisdiction	Distance from Project (approximate)	Status
Elba Island, GA (Savannah River)	Export terminal	Southern LNG Company	FERC	835 miles southwest	Approved
Jacksonville, FL	Export terminal	Eagle LNG Partners	FERC	960 miles southwest	Proposed

Source: FERC 2018.
DOMAC = Distrigas of Massachusetts; FL = Florida; GA = Georgia; LNG = liquified natural gas; MA = Massachusetts; MARAD = U.S. Department of Transportation Maritime Administration; MD = Maryland

F.2.13 Onshore Development Activities

Onshore development activities that may contribute to cumulative impacts include visible infrastructure such as onshore wind turbines and cell towers, port development, and other energy projects such as transmission and pipeline projects. Coastal development projects permitted through regional planning commissions, counties, and towns may also contribute to cumulative impacts. These may include residential, commercial, and industrial developments spurred by population growth in the region (Table F-7).

Table F-7 Existing, Approved, and Proposed Onshore Development Activities

Type	Description
Local planning documents	*Ocean County Planning Board Comprehensive Master Plan* (Ocean County 2011) *Cape May County Comprehensive Plan* (Cape May County 2005) City of Sea Isle City *2017 Master Plan Reexamination Report* (City of Sea Isle City 2017) Berkeley Township *General Reexamination of the Master Plan* (Berkeley Township 2019) City of Ocean City *Master Plan Reexamination Report* (City of Ocean City 2019)
Onshore wind projects	According to the U.S. Geological Survey, there is one onshore wind project within the 40-mile viewshed of the Project. The Jersey Atlantic Wind Farm consists of five 1.5 MW turbines with a tip height of 118.6 meters and rotor diameter of 77.0 meters (Hoen et al. 2021).
Communications towers	There are numerous communication towers in communities within the viewshed of the Project. For example, there are 102 communication towers within a 3-mile radius of Atlantic City; 78 communication towers within a 3-mile radius of Ocean City; and 23 communication towers within a 3-mile radius of Cape May (AntennaSearch.com 2023).

Type	Description
Development projects	As part of New York State's $100 billion infrastructure project, $5.6 billion will go to transform the Long Island Railroad to improve system connectivity. Within Suffolk County, the following stations will receive funds for upgrades: Brentwood, Deer Park, East Hampton, Northport, Ronkonkoma, Stony Brook, Port Jefferson, and Wyandanch. The East Hampton historic Long Island Railroad station will undergo upgrades and modernizations (Metropolitan Transit Authority 2017; BOEM 2021b). Additional plans for transit-oriented design and highway improvements are planned in Suffolk County in state and county planning documents. The Fire Island Inlet to Montauk Point Project is a $1.2 billion project by USACE, NYSDEC, and Long Island, New York municipalities to engage in inlet management; beach, dune, and berm construction; breach response plans; raising and retrofitting 4,400 homes; road-raising; groin modifications; and coastal process features. Within Suffolk County, portions of the Towns of Babylon, Islip, Brookhaven, Southampton, and East Hampton; 12 incorporated villages along Long Island's south shore (mainland); Fire Island National Seashore; and the Poospatuck and Shinnecock Indian Reservations will be involved in this project (USACE 2018). As part of a comprehensive flood-control strategy, Ocean City, New Jersey is spending $25 million over the next 5 years to build new pumping stations, drainage systems, berms and retention walls, and new elevated road construction to control flooding in low-lying areas.
Port studies/ upgrades	The State of New Jersey is planning to build an offshore wind port on the eastern shore of the Delaware River in Lower Alloways Creek, Salem County, approximately 7.5 miles southwest of the city of Salem. The port site is adjacent to PSEG's Hope Creek Nuclear Generating Station. NJEDA is leading the development of the project on behalf of the state, working alongside key departments and agencies such as the Governor's Office, the Department of the Treasury, and BPU. Construction is planned to commence in 2021 with a targeted completion date of late 2023. The development plan includes construction of a heavy-lift wharf with a dedicated delivery berth and an installation berth that can accommodate jack-up vessels, a 30-acre marshalling area for component assembly and staging, a dedicated overland heavy-haul transportation corridor, and potential for additional laydown areas. NJEDA estimates the project will cost $300 to $400 million (New Jersey Wind Port 2021). Both the Atlantic Shores South and Ocean Wind 2 projects have committed to building a nacelle assembly facility at the New Jersey Wind Port. The nacelle houses the components that convert the mechanical energy of the rotating blades into electrical energy and is the highest value-added offshore wind component. Atlantic Shores plans to partner with MHI Vestas for this facility while Ocean Wind will collaborate with General Electric (BPU 2021). In 2020, the State of New Jersey announced a $250 million investment in a manufacturing facility to build steel components for offshore wind turbines at the Port of Paulsboro on the Delaware River in New Jersey (New Jersey State 2020). Construction on the facility began in January 2021, with production anticipated to begin in 2023 (New Jersey Business 2020). Both the Atlantic Shores South and Ocean Wind 2 projects will utilize the foundation manufacturing facility at the Port of Paulsboro (BPU 2021). Ports in New York may require upgrades to support the offshore wind industry developing in the northeastern United States. Upgrades may include onshore developments or underwater improvements (such as dredging). In December 2017, NYSERDA issued an offshore wind master plan that assessed 54 distinct waterfront sites along the New York Harbor and Hudson River and 11 distinct areas with multiple small sites along the Long Island coast. Twelve waterfront areas and five distinct areas were singled out for "potential to be used or developed into facilities capable of supporting OSW projects" (Table 26, NYSERDA

<table>
<tr><th>Type</th><th>Description</th></tr>
<tr><td></td><td>2017b). Nearly all identified sites would require some level of infrastructure upgrade (from minimal to significant) depending on offshore wind activities intended for the site. Particular sites of interest include Red Hook-Brooklyn, South Brooklyn Marine Terminal, and the Port of Coeymans (NYSERDA 2017b). For additional information regarding specific proposed improvements to these ports, see Capital Region Economic Development Council 2018, American Association of Port Authorities 2016, Rulison 2018, and NYCEDC 2018.

New York State proposed port improvements include the governor’s 2021 agenda “Reimagine | Rebuild | Renew,” which includes upgrades to create five dedicated port facilities for offshore wind, including the following:
• The nation’s first offshore wind tower manufacturing facility, to be built at the Port of Albany
• An offshore wind turbine staging facility and O&M hub to be established at the South Brooklyn Marine Terminal
• Increasing the use of the Port of Coeymans for cutting-edge turbine foundation manufacturing
• Buttressing ongoing O&M out of Port Jefferson and Port of Montauk Harbor in Long Island

A study commissioned by the Virginia Department of Mines Minerals and Energy and published in 2015 evaluated 10 Virginia ports for their readiness to accommodate offshore wind manufacturing and construction activities and also evaluated five commercial shipyards for their readiness to manufacture offshore electrical substations. Using requirements including water-side infrastructure, onshore infrastructure, and access requirements, five ports in Virginia identified with a high level of readiness to support offshore wind, including the following:
• Portsmouth Marine Terminal
• Newport News Marine Terminal
• Peck Marine Terminal
• Virginia Renaissance Center
• BASF Portsmouth

Portsmouth and Newport News Marine Terminals were identified by the study team to have the highest level of port readiness due to the ample space available to accommodate multiple co-located offshore wind construction and deployment activities (BVG Associates 2015). Following the study, the State of Virginia plans to invest $40 million from its 2021 budget to upgrade the Portsmouth Marine Terminal, near Norfolk, Virginia to handle offshore wind manufacturing, handling, and transportation (Reuters 2021).</td></tr>
</table>

NJEDA = New Jersey Economic Development Authority; NYSDEC = New York State Department of Environmental Conservation; NYSERDA = New York State Energy Research and Development Authority; PSEG = Public Service Enterprise Group

F.3. References Cited

American Association of Port Authorities. 2016. *Port-Related Projects Awarded $61.8 Million in TIGER VIII Infrastructure Grants*. Available: https://www.aapa-ports.org/advocating/PRDetail.aspx?ItemNumber=21393. Accessed: December 20, 2018.

AntennaSearch.com. 2023. Tower and Antenna Database. Available: www.antennasearch.com. Accessed: January 22, 2023.

Atlantic States Marine Fisheries Commission (ASMFC). 2014. *Five-Year Strategic Plan 2014–2018*. Available: http://www.asmfc.org/files/pub/2014-2018StrategicPlan_Final.pdf. Accessed: January 7, 2019.

Atlantic States Marine Fisheries Commission (ASMFC). 2018. *Management, Policy and Science Strategies for Adapting Fisheries Management to Changes in Species Abundance and Distribution Resulting from Climate Change*. February. Available: http://www.asmfc.org/files/pub/ClimateChangeWorkGroupGuidanceDocument_Feb2018.pdf. Accessed: January 7, 2019.

Berkeley Township. 2019. *General Reexamination of the Master Plan*. March. Available: https://cms6.revize.com/revize/berkeleynj/document_center/planning%20agendas/2019/Reexamination%20Report_signed.pdf. Accessed: July 22, 2021.

Blunden, J., and D. S. Arndt. 2020. State of the climate in 2019. *Bulletin of the American Meteorological Society* 101(8):S1–S429.

Bureau of Ocean Energy Management (BOEM). 2016. *Revised Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New York*. OCS EIS/EA BOEM 2016-070. October 2016.

Bureau of Ocean Energy Management (BOEM). 2019. *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Continental Shelf*. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Sterling, VA. OCS Study 2019-036.

Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA, BOEM 2021-0012. March.

Bureau of Ocean Energy Management (BOEM). 2021b. *South Fork Wind Farm and South Fork Export Cable Project Final Environmental Impact Statement*. OCS EIS/EA, BOEM 2020-057. August.

Bureau of Ocean Energy Management (BOEM). 2021c. Submitted Atlantic OCS Region Permit Requests. Available: https://www.boem.gov/submitted-atlantic-ocs-region-permit-requests. Accessed: July 16, 2021.

Bureau of Ocean Energy Management (BOEM). 2021d. *Commercial and Research Wind Lease and Grant Issuance and Associated Site Assessment Activities on the Atlantic Outer Continental Shelf of the New York Bight*. OCS EIS/EA BOEM 2021-073. December.

BVG Associates. 2015. *Virginia offshore port readiness evaluation. Report 1: An evaluation of 10 Virginia ports.* A report to the Virginia Department of Mines, Minerals and Energy. April. Available: https://www.dmme.virginia.gov/de/LinkDocuments/OffshoreWind/PortsStudy-Report1.pdf. Accessed: July 22, 2021.

Cape May County, New Jersey. 2005. *Cape May County Comprehensive Plan*. Available: https://www.capemaycountynj.gov/DocumentCenter/View/422/Comprehensive-Plan-2002-PDF?bidId=. Accessed: July 22, 2021.

Capital Region Economic Development Council. 2018. *Capital Region Creates 2018 Progress Report*. Available: http://www.regionalcouncils.ny.gov/sites/default/files/2018-10/CapitalRegion2018ProgressReport.pdf. Accessed: December 18, 2018.

City of Ocean City. 2019. *Master Plan Reexamination Report.* January. Available: https://services.ocnj.us/government/documents/department-documents/planning-department/93-2018-master-plan-re-examination-adopted-1-10-19-1/file. Accessed: July 22, 2021.

City of Sea Isle City. 2017. *2017 Master Plan Reexamination Report.* August. Available: https://drive.google.com/file/d/12A9D8hpf34is4hCL1ODlMmGZ6RuXjUPh/view. Accessed: July 21, 2021.

Cresitello, Donald E. 2020. Senior Coastal Planner, Planning and Policy Division, U.S. Army Corps of Engineers – North Atlantic Division. Emailed transmittal of unpublished NAD Sediment Needs Analysis to Jeffrey Waldner, P.G., Physical Scientist/Oceanographer, Bureau of Ocean Energy Management, Marine Minerals Division on September 1, 2020.

Federal Energy Regulatory Commission (FERC). 2018. Website for Liquefied Natural Gas with Listings for Existing, Approved, and Proposed LNG Import/Export Terminals. Available: https://www.ferc.gov/industries/gas/indus-act/lng.asp. Accessed: October 30, 2018.

Governor's Office. 2017. 2017 *State of the State Book.* Available: https://www.governor.ny.gov/sites/governor.ny.gov/files/atoms/files/2017StateoftheStateBook.pdf. Accessed: January 9, 2019.

Governor's Office. 2018. *2018 State of the State Book.* Available: https://www.governor.ny.gov/sites/governor.ny.gov/files/atoms/files/2018-stateofthestatebook.pdf. Accessed: January 9, 2019.

Hare, J. A., W. E. Morrison, M. W. Nelson, M. M. Stachura, E. J. Teeters, and R. B. Griffis. 2016. A Vulnerability Assessment of Fish and Invertebrates to Climate Change on the Northeast U.S. Continental Shelf. *PLoS ONE* 11(2): e0146756. DOI:10.1371/journal.pone.0146756.

Hoen, B. D., J. E. Diffendorfer, J. T. Rand, L. A. Kramer, C. P. Garrity, and H. E. Hunt. 2021. United States Wind Turbine Database V4.0 (April 9, 2021): U.S. Geological Survey, American Clean Power Association, and Lawrence Berkeley National Laboratory data release. Available: https://doi.org/10.5066/F7TX3DN0.

Intergovernmental Panel on Climate Change (IPCC). 2018. *IPCC Special Report on Impacts of Global Warming of 1.5 Degrees Celsius Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty: Summary for Policymakers*. Available: http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf. Accessed: November 5, 2018.

Kopp, R. E, C. Andrews, A. Broccoli, A. Garner, D. Kreeger, R. Leichenko, N. Lin, C. Little, J. A. Miller, J. K. Miller, K. G. Miller, R. Moss, P. Orton, A. Parris, D. Robinson, W. Sweet, J. Walker, C. P. Weaver, K. White, M. Campo, M. Kaplan, J. Herb, and L. Auermuller. 2019. *New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel*. Rutgers, The State University of New Jersey. Prepared for the New Jersey Department of Environmental Protection. Available: https://climatechange.rutgers.edu/images/STAP_FINAL_FINAL_12-4-19.pdf.

Long Island Regional Development Council (LIRDC). 2018. *Long Island Completing the Puzzle 2018 Update*. Available: http://regionalcouncils.ny.gov/sites/default/files/2018-10/LongIsland2018REDCReport_0.pdf. Accessed: December 20, 2018.

Metropolitan Transit Authority. 2017. "Governor Cuomo Proposes $120 Million to Enhance 16 LIRR Stations and Improve System Connectivity with MacArthur Airport and Brookhaven National Laboratory." January 10. Available: http://www.mta.info/news/2017/01/10/governor-cuomo-proposes-120-million-enhance-16-lirr-stations-and-improve-system. Accessed: December 19, 2018.

Meyer-Gutbrod, E. L., C. H. Greene, K. T. A. Davies, and D. G. Johns. 2021. Ocean Regime Shift is Driving Collapse of the North Atlantic Right Whale Population. *Oceanography* 34(3):22–31 (September 2021). Available: https://tos.org/oceanography/assets/docs/34-3_meyer-gutbrod.pdf. Accessed: January 27, 2022.

Mid-Atlantic Fishery Management Council (MAFMC). 2019. "About the Council." Available: http://www.mafmc.org/about/. Accessed: January 8, 2019.

Minerals Management Service. 2007. *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf*. Available: https://www.boem.gov/Guide-To-EIS/. Accessed: January 1, 2019.

National Marine Fisheries Service (NMFS). 2013. *Endangered Species Act Section 7 Consultation Biological Opinion for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf in Massachusetts, Rhode Island, New York and New Jersey Wind Energy Areas*. NER-2012-9211.

National Oceanic and Atmospheric Administration (NOAA). 1997. *Amendment 3 to the Interstate Fishery Management Plan for American Lobster*. Available: http://www.asmfc.org/uploads/file/lobsterAmendment3.pdf. Accessed: February 28, 2019.

National Oceanic and Atmospheric Administration (NOAA). 2022. *Global and Regional Sea Level Rise Scenarios for the United States*. Available: https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report-sections.html. Accessed: March 24, 2022.

New England Fishery Management Council (NEFMC). 2016. *Omnibus Essential Fish Habitat Amendment 2, Volume 6: Cumulative Effects, Compliance with Applicable Law and References*. Available: https://s3.amazonaws.com/nefmc.org/OA2-FEIS_Vol_6_FINAL_170303.pdf. Accessed: October 30, 2018.

New Jersey Board of Public Utilities (BPU). 2021. *NJBPU Approves Nation's Largest Combined Offshore Wind Award to Atlantic Shores and Ocean Wind II.* Press Release. Available: https://www.bpu.state.nj.us/bpu/newsroom/2021/approved/20210630.html. Accessed: July 28, 2021.

New Jersey Business. 2020. *Paulsboro Marine Terminal Gets Record Offshore Wind Manufacturing Investment.* Available: https://njbmagazine.com/njb-news-now/paulsboro-marine-terminal-gets-biggest-offshore-wind-manufacturing-investment-in-us-history/. Accessed: July 22, 2021.

New Jersey Department of Environmental Protection (NJDEP). 2020. *New Jersey Scientific Report on Climate Change*. Available: https://nj.gov/dep/climatechange/docs/nj-scientific-report-2020.pdf. Accessed: March 24, 2022.

New Jersey Department of Environmental Protection (NJDEP). 2021. *Draft Climate Change Resilience Strategy.* Available: https://www.nj.gov/dep/climatechange/resilience-strategy.html. Accessed: July 21, 2021.

New Jersey Division of Fish and Wildlife. 2021. *Marine Fisheries Management Rule Amendment Proposal with Amendments to Rules governing Crab and Lobster Management, Commercial Atlantic Menhaden Fishery, Marine Fisheries, and Fishery Management in New Jersey*. Published March 1, 2021, NJ Register. Available: https://www.nj.gov/dep/fgw/news/2021/marine_rules_proposed.htm. Accessed: July 22, 2021.

New Jersey State. 2019. *Energy Master Plan Pathway to 2050*. Available: https://nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf. Accessed: July 20, 2021.

New Jersey State. 2020. Governor Murphy Announces $250 Million Total Investment in State-of-the-Art Manufacturing Facility to Build Wind Turbine Components to Serve Entire U.S. Offshore Wind Industry. December 21. Available: https://www.nj.gov/governor/news/news/562020/20201222a.shtml. Accessed: July 22, 2021.

New Jersey Wind Port. 2021. "About the New Jersey Wind Port." Available: https://nj.gov/windport/about/index.shtml. Accessed: July 16, 2021.

New York City Economic Development Corporation (NYCEDC). 2018. *New York Works: NYCDC Announces Transformation of South Brooklyn Maritime Shipping Hub, Creating over 250 Jobs in the Near-Term*. May 8, 2018. Available: https://www.nycedc.com/press-release/new-york-works-nycedc-announces-transformation-south-brooklyn-maritime-shipping-hub. Accessed: December 19, 2018.

New York State. 2014. Reforming the Energy Vision. Available: https://rev.ny.gov. Accessed: February 24, 2019.

New York State Department of Environmental Conservation (NYSDEC). No date. Community Risk and Resiliency Act (CRRA). Available: https://www.dec.ny.gov/energy/102559.html. Accessed: January 17, 2019.

New York State Department of Environmental Conservation (NYSDEC). 2017. *New York Ocean Action Plan 2017–2027*. Available: https://www.dec.ny.gov/docs/fish_marine_pdf/nyoceanactionplan.pdf. Accessed: January 13, 2019.

New York State Energy Research and Development Authority (NYSERDA). 2015. *Clean Energy Plan*. Available: https://energyplan.ny.gov/-/media/nysenergyplan/2015-state-energy-plan.pdf. Accessed: January 5, 2019.

New York State Energy Research and Development Authority (NYSERDA). 2017a. *Biennial Report to the 2015 State Energy Plan*. Available: https://energyplan.ny.gov/-/media/nysenergyplan/2017-BiennialReport-printer-friendly.pdf. Accessed: February 1, 2019.

New York State Energy Research and Development Authority (NYSERDA). 2017b. *New York State Offshore Wind Master Plan*. NYSERDA Report 17-25b. Available: https://www.nyserda.ny.gov/All-Programs/Programs/Offshore-Wind/Offshore-Wind-in-New-York-State-Overview/NYS-Offshore-Wind-Master-Plan. Accessed: December 20, 2018.

Ocean County, New Jersey. 2011. *Ocean County Planning Board Comprehensive Master Plan*. December. Available: https://www.co.ocean.nj.us/WebContentFiles/fedb8826-cb81-4b9f-be8d-e71e4fcd1fa4.pdf. Accessed: July 22, 2021.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Reuters. 2021. *US port spend brings offshore wind factories closer*. Reporting by: Neil Ford. Editing by: Robin Sayles. Available: https://www.reutersevents.com/renewables/wind/us-port-spend-brings-offshore-wind-factories-closer. Accessed: July 22, 2021.

Rulison, L. 2018. Port of Albany Plans Giant Warehouse in Bethlehem. *Times Union.* Published August 24, 2018. Available: https://www.timesunion.com/business/article/Port-of-Albany-plans-giant-warehouse-in-Bethlehem-13180505.php. Accessed: December 20, 2018.

Solomon, S., D. Qin, M. Manning, R. B. Alley, T. Berntsen, et al. 2007. Technical summary. Climate change 2007: the physical science basis In: Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, editors. *Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. p. 75.

State of New York Public Service Commission. 2016. Order Adopting a Clean Energy Standard. 8/1/2016.

The White House. 2020a. Memorandum on the Withdrawal of Certain Areas of the United States Outer Continental Shelf from Leasing Disposition. Available: https://www.whitehouse.gov/presidential-actions/memorandum-withdrawal-certain-areas-united-states-outer-continental-shelf-leasing-disposition/. Accessed: September 25, 2020.

The White House. 2020b. Presidential Determination on the Withdrawal of Certain Areas of the United States Outer Continental Shelf from Leasing Disposition. Available: https://www.whitehouse.gov/presidential-actions/presidential-determination-withdrawal-certain-areas-united-states-outer-continental-shelf-leasing-disposition/. Accessed: October 8, 2020.

U.S. Army Corps of Engineers (USACE). 2015a. New Jersey Department of Transportation, Permit CENAP-OP-R-2015-510-35.

U.S. Army Corps of Engineers (USACE). 2015b. New Jersey Department of Transportation, Permit CENAP-OP-R-2015-511-35.

U.S. Army Corps of Engineers (USACE). 2018. Fire Island Inlet to Montauk Point (FIMP) Project. Available: https://www.nan.usace.army.mil/Missions/Civil-Works/Projects-in-New-York/Fire-Island-to-Montauk-Point-Reformulation-Study/. Accessed: December 2018.

U.S. Army Corps of Engineers (USACE). 2019. *Dredging to start in Norfolk Harbor inner channels*. U.S. Army Corps of Engineers Headquarters Website. By: Vince Little. December 26. Available: https://www.usace.army.mil/Media/News/NewsSearch/Article/2047595/dredging-to-start-in-norfolk-harbor-inner-channels/. Accessed: July 22, 2021.

U.S. Army Corps of Engineers (USACE). 2021a. *Newark Bay, New Jersey Federal Navigation Project Maintenance Dredging*. Public Notice No. Newark Bay, NJ FY21. May.

U.S. Army Corps of Engineers (USACE). 2021b. *Charleston Harbor Post 45 Overview*. Charleston District Website. Available: https://www.sac.usace.army.mil/Missions/Civil-Works/Charleston-Harbor-Post-45/. Accessed: July 22, 2021.

U.S. Army Corps of Engineers (USACE). 2021c. Ocean Dredged Material Disposal Site Database. Available: https://odd.el.erdc.dren.mil/ODMDSSearch.cfm. Accessed: July 15, 2021.

U.S. Army Corps of Engineers (USACE). 2022. USACE project list for Barnegat Bay. Personal communication with Brian R. Anthony, Senior Staff Biologist, U.S. Army Corps of Engineers, Philadelphia District, Regulatory Branch. April 1.

U.S. Coast Guard (USCG). 2021. *Port Access Route Study: Northern New York Bight.* USCG-2020-0278. December 2021. Available: https://www.regulations.gov/document/USCG-2020-0278-0067. Accessed: March 23, 2022.

Verdant Power. 2018. Roosevelt Island Tidal Energy Project – FERC No. P-12611. Available: https://www.verdantpower.com/rite. Accessed: December 21, 2018.

Virginia Department of Environmental Quality. 2021. *Virginia Section 309 Coastal Needs Assessment.* Virginia Department of Environmental Quality, Coastal Zone Management Program. Approved by NOAA February 4, 2021. Available: https://www.deq.virginia.gov/home/showpublisheddocument/8346/637540014441970000. Accessed: March 24, 2022.

Virginia Port Authority. 2021. *Dredging to Make Virginia the East Coast's Deepest Port is Underway*. Port of Virginia Press Release. Contact Joseph D. Harris. Available: https://www.portofvirginia.com/who-we-are/newsroom/dredging-to-make-virginia-the-east-coasts-deepest-port-is-underway/. Accessed: July 22, 2021.

Virginia State. 2020. *Governor Northam Signs Clean Energy Legislation. Press Release.* State of Virginia, Office of the Governor, April 12, 2020. Available: https://www.governor.virginia.gov/newsroom/all-releases/2020/april/headline-856056-en.html. Accessed: March 24, 2022.

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ATTACHMENT 1
ONGOING AND FUTURE NON-OFFSHORE WIND ACTIVITY ANALYSIS

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LIST OF TABLES

BOEM developed the following tables based on its 2019 study *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf* (BOEM 2019), which evaluates potential impacts associated with ongoing and future non-offshore wind activities.

Table F1-1 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Air Quality

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	Accidental releases of air toxics HAPs are due to potential chemical spills. Ongoing releases occur in low frequencies. These may lead to short-term periods of toxic pollutant emissions through surface evaporation. According to the U.S. Department of Energy, 31,000 barrels of petroleum are spilled into U.S. waters from vessels and pipelines in a typical year. Approximately 40.5 million barrels of oil were lost as a result of tanker incidents from 1970 to 2009, according to International Tanker Owners Pollution Federation Limited, which collects data on oil spills from tankers and other sources. From 1990 to 1999, the average annual input to the coastal Northeast was 220,000 barrels of petroleum and offshore it was up to less than 70,000 barrels.	Accidental releases of air toxics or HAPs will be due to potential chemical spills. See Table F1-22 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 35 years would increase the risk of accidental releases. These may lead to short-term periods of toxic pollutant emissions through evaporation. Air quality impacts will be short-term and limited to the local area at and around the accidental release location.
Air emissions: Construction and decommissioning	Air emissions originate from combustion engines and electric power generated by burning fuel. These activities are regulated under the CAA to meet set standards. Air quality has generally improved over the last 35 years; however, some areas in the Northeast have experienced a decline in air quality over the last 2 years. Some areas of the Atlantic coast remain in nonattainment for ozone, with the source of this pollution from power generation. Many of these states have made commitments toward cleaner energy goals to improve this, and offshore wind is part of these goals. Primary processes and activities that can affect the air quality impacts are expansions and modifications to existing fossil fuel power plants, onshore and offshore	The largest air quality impacts over the next 35 years will occur during the construction phase of any one project; however, projects will be required to comply with the CAA. During the limited construction and decommissioning phases, emissions may occur that are above *de minimis* thresholds and will require offsets and mitigation. Primary emission sources will be increased commercial vehicular traffic, air traffic, public vehicular traffic, and combustion emissions from construction equipment and fugitive emissions from construction-generated dust. As projects come online, power generation emissions overall will decline and the industry as a whole will have a net benefit on air quality.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Air emissions: O&M	activities involving renewable energy facilities, and various construction activities.	Activities associated with O&M of onshore wind projects will have a proportionally very small contribution to emissions compared to the construction and decommissioning activities over the next 35 years. Emissions will largely be due to commercial vehicular traffic and operation of emergency diesel generators. Such activity will result in short-term, intermittent, and widely dispersed emissions and small air quality impacts.
Air emissions: Power generation emissions reductions		Many Atlantic states have committed to clean energy goals, with offshore wind being a large part of that. Other reductions include transitioning to onshore wind and solar. The No Action Alternative without implementation of other future offshore wind projects would likely result in increased air quality impacts regionally due to the need to construct and operate new energy generation facilities to meet future power demands. These facilities may consist of new natural-gas-fired power plants, coal-fired, oil-fired, or clean-coal-fired plants. These types of facilities would likely have larger and continuous emissions and result in greater regional scale impacts on air quality.
Climate change	The construction, operation, and decommissioning of offshore wind projects would produce GHG emissions (nearly all CO_2) that can contribute to climate change; however, these contributions would be minuscule compared to aggregate global emissions. CO_2 is relatively stable in the atmosphere and generally mixed uniformly throughout the troposphere and stratosphere. Hence the impact of GHG emissions does not depend upon the source location. Increasing energy production from offshore wind projects will likely decrease GHGs emissions by replacing energy from fossil fuels.	Development of future onshore wind projects will produce a small overall increase in GHG emissions over the next 35 years. However, these contributions would be very small compared to the aggregate global emissions. The impact on climate change from these activities would be very small. As more projects come online, some reduction in GHG emissions from modifications of existing fossil fuel facilities to reduce power generation. Overall, it is anticipated that there would be no cumulative impact on global warming as a result of onshore wind project activities.

CAA = Clean Air Act; hazmat = hazardous materials

Table F1-2 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Bats

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded and would result in high-intensity, low-exposure level, long-term, but localized intermittent risk to bats in nearshore waters. Direct impacts are not expected to occur as recent research has shown that bats may be less sensitive to TTS than other terrestrial mammals (Simmons et al. 2016). Indirect impacts (i.e., displacement from potentially suitable habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior (Schaub et al. 2008). Construction activity would be temporary and highly localized.	Similar to ongoing activities, noise associated with pile driving activities would be limited to nearshore waters, and these high-intensity, but low-exposure risks would not be expected to result in direct impacts. Some indirect impacts (i.e., displacement from potentially suitable foraging habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior (Schaub et al. 2008). Construction activity would be temporary and highly localized, and no population-level effects would be expected.
Noise: Construction	Onshore construction occurs regularly for generic infrastructure projects in the bats geographic analysis area. There is a potential for displacement caused by equipment if construction occurs at night (Schaub et al. 2008). Any displacement would only be temporary. No individual or population level impacts would be expected. Some bats roosting in the vicinity of construction activities may be disturbed during construction but would be expected to move to a different roost farther from construction noise. This would not be expected to result in any impacts as frequent roost switching is a common component of a bat’s life history (Hann et al. 2017; Whitaker 1998).	Onshore construction is expected to continue at current trends. Some behavioral responses and avoidance of construction areas may occur (Schaub et al. 2008). However, no injury or mortality would be expected.
Presence of structures: Migration disturbances	There may be few structures scattered throughout the offshore bats geographic analysis area, such as navigation and weather buoys and light towers. Migrating bats can easily fly around or over these sparsely distributed structures, and no migration disturbance would be expected. Bat use of offshore areas is very limited and generally restricted to spring and fall migration. Very few bats would be expected to encounter structures on the OCS and no population-level effects would be expected.	The infrequent installation of future new structures in the marine environment of the next 35 years is expected to continue. As described under Ongoing Activities, these structures would not be expected to cause disturbance to migrating tree bats in the marine environment.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Turbine strikes	There may be few structures in the offshore bats geographic analysis area, such as navigation and weather buoys, turbines, and light towers. Migrating tree bats can easily fly around or over these sparsely distributed structures, and no strikes would be expected.	The infrequent installation of future new structures in the marine environment of the next 35 years is expected to continue. As described under Ongoing Activities, these structures would not be expected to result in increased collision risk to migrating tree bats in the marine environment.
Land disturbance: onshore construction	Onshore construction activities are expected to continue at current trends. Potential direct effects on individuals may occur if construction activities include tree removal when bats are potentially present. Injury or mortality may occur if trees being removed are occupied by bats at the time of removal. While there is some potential for indirect impacts associated with habitat loss, no individual or population-level effects would be expected.	Future non-offshore wind development would continue to occur at the current rate. This development has the potential to result in habitat loss and could result in injury or mortality of individuals.
Climate change: Warming and sea level rise, storm severity/frequency	Storms during breeding and roosting season can reduce productivity and increase mortality. Intensity of this impact is speculative.	No future activities were identified within the bats geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Climate change: Ocean acidification; warming and sea level rise, altered habitat/ecology; warming and sea level rise, altered migration patterns; warming and sea level rise, property/ infrastructure damage; warming and sea level rise, protective measures (barriers, sea walls); warming and sea level rise, storm severity/frequency, sediment erosion, deposition	These sub-IPFs would have no impacts on bats.	No future activities were identified within the bats geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, increased disease frequency	Disease can weaken, lower reproductive output, and/or kill individuals. Some tropical diseases will move northward. Extent and intensity of this impact is highly speculative.	No future activities were identified within the bats geographic analysis area other than ongoing activities.

Table F1-3 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Benthic Resources

Associated IPFs: Sub-IFPs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-22 for a discussion of ongoing accidental releases. Accidental releases of hazmat occur periodically, mostly consisting of fuels, lubricating oils, and other petroleum compounds. Because most of these materials tend to float in seawater, they rarely contact benthic resources. The chemicals with potential to sink or dissolve rapidly often dilute to non-toxic levels before they affect benthic resources. The corresponding impacts on benthic resources are rarely noticeable.	Gradually increasing vessel traffic over the next 35 years would increase the risk of accidental releases. See previous cell and Table F1-22 on water quality for details.
Accidental releases: Invasive species	Invasive species are periodically released accidentally during ongoing activities, including the discharge of ballast water and bilge water from marine vessels. The impacts on benthic resources (e.g., competitive disadvantage, smothering) depend on many factors, but can be noticeable, widespread, and permanent.	No future activities were identified within the geographic analysis area other than ongoing activities.
Accidental releases: Trash and debris	Ongoing releases of trash and debris occurs from onshore sources, fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying. However, there does not appear to be evidence that ongoing releases have detectable impacts on benthic resources.	No future activities were identified within the geographic analysis area other than ongoing activities.
Anchoring	Regular vessel anchoring related to ongoing military, survey, commercial, and recreational activities continue to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. These impacts include increased turbidity levels and the potential for direct contact to cause injury and mortality of benthic resources, as well as physical damage to their habitats. All impacts are localized; turbidity is temporary; injury and mortality are recovered in the short term; and physical damage can be permanent if it occurs in eelgrass beds or hard bottom.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IFPs	Ongoing Activities	Planned Activities Intensity/Extent
EMFs	EMFs continuously emanate from existing telecommunication and electrical power transmission cables. New cables generating EMFs are infrequently installed in the geographic analysis area. Some benthic species can detect EMFs, although EMFs do not appear to present a barrier to movement. The extent of impacts (behavioral changes) is likely less than 50 feet (15.2 meters) from the cable and the intensity of impacts on benthic resources is likely undetectable.	No future activities were identified within the geographic analysis area other than ongoing activities.
New cable emplacement/ maintenance	Cable maintenance activities infrequently disturb benthic resources and cause temporary increases in suspended sediment; these disturbances would be local and limited to the emplacement corridor. New cables are infrequently added near shore. Cable emplacement/maintenance activities injure and kill benthic resources, and result in temporary to long-term habitat alterations. The intensity of impacts depends on the time (season) and place (habitat type) where the activities occur. (See also the IPFs of Seabed profile alterations and Sediment deposition and burial.)	No future activities were identified within the geographic analysis area other than ongoing activities.
Noise: Onshore/ offshore construction	See Table F1-11 on finfish, invertebrates, and EFH. Detectable impacts of construction noise on benthic resources rarely, if ever, overlap from multiple sources.	See Table F1-11 on finfish, invertebrates, and EFH. Detectable impacts of construction noise on benthic resources would rarely, if ever, overlap from multiple sources.
Noise: G&G	See Table F1-11 on finfish, invertebrates, and EFH. Detectable impacts of G&G noise on benthic resources rarely, if ever, overlap from multiple sources.	See Table F1-11 on finfish, invertebrates, and EFH. Detectable impacts of G&G noise on benthic resources would rarely, if ever, overlap from multiple sources.
Noise: O&M	See Table F1-11 on finfish, invertebrates, and EFH.	See Table F1-11 on finfish, invertebrates, and EFH.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can cause injury and/or mortality to benthic resources in a small area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IFPs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: Cable laying/ trenching	Infrequent trenching activities for pipeline and cable laying, as well as other cable burial methods, emit noise. These disturbances are local, temporary, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	New or expanded submarine cables and pipelines are likely to occur in the geographic analysis area. These disturbances would be infrequent over the next 35 years, local, temporary, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.
Port utilization: Expansion	See Table F1-11 on finfish, invertebrates, and EFH.	See Table F1-11 on finfish, invertebrates, and EFH.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear are periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb, injure, or kill benthic resources, creating small, short-term, localized impacts.	Future new cables would present additional risk of gear loss, resulting in small, short-term, localized impacts (disturbance, injury).
Presence of structures: Hydrodynamic disturbance	See Table F1-11 on finfish, invertebrates, and EFH.	See Table F1-11 on finfish, invertebrates, and EFH.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables continuously create uncommon relief in a mostly sandy seascape. Structure-oriented fishes are attracted to these locations. Increased predation upon benthic resources by structure-oriented fishes can adversely affect populations and communities of benthic resources. These impacts are local and permanent.	New cables installed in the geographic analysis area over the next 35 years would likely require hard protection atop portions of the route (see the “new cable emplacement/maintenance” row in this table). Any new towers, buoy, or piers would also create uncommon relief in a mostly flat, sandy seascape. Structure-oriented fishes could be attracted to these locations. Increased predation upon benthic resources by structure-oriented fishes could adversely affect populations and communities of benthic resources. These impacts are expected to be local and to be permanent as long as the structures remain.

Associated IPFs: Sub-IFPs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Habitat conversion	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables continuously provide uncommon hard-bottom habitat. A large portion is homogeneous sandy seascape but there is some other hard and/or complex habitat. Benthic species dependent on hard-bottom habitat can benefit on a constant basis, although the new habitat can also be colonized by invasive species (e.g., certain tunicate species). Structures are periodically added, resulting in the conversion of existing soft-bottom and hard-bottom habitat to the new hard-structure habitat.	See above for quantification and timing. Any new towers, buoy, piers, or cable protection structures would create uncommon relief in a mostly sandy seascape. Benthic species dependent on hard-bottom habitat could benefit, although the new habitat could also be colonized by invasive species (e.g., certain tunicate species). Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010).
Presence of structures: Cable infrastructure	The presence of cable infrastructure, especially hard protection atop cables, causes impacts through entanglement/gear loss/damage, fish aggregation, and habitat conversion.	See other sub-IPFs within Presence of structures.
Discharges	The gradually increasing amount of vessel traffic is increasing the cumulative permitted discharges from vessels. Many discharges are required to comply with permitting standards established to ensure potential impacts on the environment are minimized or mitigated. However, there does not appear to be evidence that the volumes and extents have any impact on benthic resources.	There is the potential for new ocean dumping/dredge disposal sites in the Northeast. Impacts (disturbance, reduction in fitness) of infrequent ocean disposal to benthic resources are short-term because spoils are typically recolonized naturally. In addition, USEPA has established dredge spoil criteria and it regulates the disposal permits issued by USACE; these discharges are required to comply with permitting standards established to ensure potential impacts on the environment are minimized or mitigated.
Regulated fishing effort	Ongoing commercial and recreational regulations for finfish and shellfish implemented and enforced by states, towns, and/or NOAA, depending on jurisdiction, affect benthic resources by modifying the nature, distribution and intensity of fishing-related impacts, including those that disturb the seafloor (trawling, dredge fishing).	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IFPs	Ongoing Activities	Planned Activities Intensity/Extent
Seabed profile alterations	Ongoing sediment dredging for navigation purposes results in localized short-term impacts (habitat alteration, injury, and mortality) on benthic resources through this IPF. Dredging typically occurs only in sandy or silty habitats, which are abundant in the geographic analysis area and are quick to recover from disturbance. Therefore, such impacts, while locally intense, have little impact on benthic resources in the geographic analysis area.	No future activities were identified within the geographic analysis area other than ongoing activities.
Sediment deposition and burial	Ongoing sediment dredging for navigation purposes results in fine sediment deposition. Ongoing cable maintenance activities also infrequently disturb bottom sediments; these disturbances are local, limited to the emplacement corridor. Sediment deposition could have adverse impacts on some benthic resources, especially eggs and larvae, including smothering and loss of fitness. Impacts may vary based on season/time of year. Where dredged materials are disposed, benthic resources are smothered. However, such areas are typically recolonized naturally in the short term. Most sediment dredging projects have time-of-year restrictions to minimize impacts on benthic resources. Most benthic resources in the geographic analysis area are adapted to the turbidity and periodic sediment deposition that occur naturally in the geographic analysis area.	USACE and/or private ports may undertake dredging projects periodically. Where dredged materials are disposed, benthic resources are buried. However, such areas are typically recolonized naturally in the short term. Most benthic resources in the geographic analysis area are adapted to the turbidity and periodic sediment deposition that occur naturally in the geographic analysis area.
Climate change: Ocean acidification	Ongoing CO_2 emissions causing ocean acidification may contribute to reduced growth or the decline of benthic invertebrates that have calcareous shells, as well as reefs and other habitats formed by shells.	No future activities were identified within the geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat, ecology, and migration patterns	Climate change, influenced in part by ongoing GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the distributions of benthic species and altering ecological relationships, likely causing permanent changes of unknown intensity gradually over the next 35 years.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IFPs	Ongoing Activities	Planned Activities Intensity/Extent
Climate change: Warming and sea level rise, disease frequency	Climate change, influenced in part by ongoing GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the frequencies of various diseases of benthic species, and likely causing permanent changes of unknown intensity over the next 35 years.	No future activities were identified within the geographic analysis area other than ongoing activities.

hazmat = hazardous materials

Table F1-4 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Birds

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-22 for a quantitative analysis of these risks. Ongoing releases are frequent/chronic. Ingestion of hydrocarbons can lead to morbidity and mortality due to decreased hematological function, dehydration, drowning, hypothermia, starvation, and weight loss (Briggs et al. 1997; Haney et al. 2017; Paruk et al. 2016). Additionally, even small exposures that result in feather oiling can lead to sublethal effects that include changes in flight efficiencies and result in increased energy expenditure during daily and seasonal activities including chick provisioning, commuting, courtship, foraging, long-distance migration, predator evasion, and territory defense (Maggini et al. 2017). These impacts rarely result in population-level impacts.	See Table F1-22 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 35 years would increase the potential risk of accidental releases and associated impacts, including mortality, decreased fitness, and health effects on individuals. Impacts are unlikely to affect populations.
Accidental releases: Trash and debris	Trash and debris are accidentally discharged through onshore sources; fisheries use; dredged material ocean disposal; marine minerals extraction; marine transportation, navigation, and traffic; survey activities; and cables, lines, and pipeline laying on an ongoing basis. In a study from 2010, students at sea collected more than 520,000 bits of plastic debris per square mile. In addition, many fragments come from consumer products blown out of landfills or tossed out as litter (Law et al. 2010). Birds may accidentally ingest trash mistaken for prey. Mortality is typically a result of blockages caused by both hard and soft plastic debris (Roman et al. 2019).	As population and vessel traffic increase gradually over the next 35 years, accidental release of trash and debris may increase. This may result in increased injury or mortality of individuals. However, there does not appear to be evidence that the volumes and extents would have any impact on bird populations.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Light: Vessels	Ocean vessels have an array of lights including navigational lights, deck lights, and interior lights. Such lights can attract some birds. The impact is localized and temporary. This attraction would not be expected to result in an increased risk of collision with vessels. Population-level impacts would not be expected.	Gradually increasing vessel traffic over the next 35 years would increase the potential for bird and vessel interactions. While birds may be attracted to vessel lights, this attraction would not be expected to result in increased risk of collision with vessels. No population-level impacts would be expected.
Light: Structures	Buoys, towers, and onshore structures with lights can attract birds. Onshore structures like houses and ports emit a great deal more light than offshore buoys and towers. This attraction has the potential to result in an increased risk of collision with lighted structures (Hüppop et al. 2006). Light from structures is widespread and permanent near the coast, but minimal offshore.	Light from onshore structures is expected to gradually increase in proportion with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Cable emplacement and maintenance activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances will be temporary and generally limited to the emplacement corridor. Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances will be temporary and limited to the emplacement corridor. Suspended sediment could impair the vision of diving birds that are foraging in the water column (Cook and Burton 2010). However, given the localized nature of the potential impacts, individuals would be expected to successfully forage in nearby areas not affected by increased sedimentation and no biologically significant impacts on individuals or populations would be expected.	Future new cables, would occasionally disturb the seafloor and cause temporary increases in suspended sediment, resulting in localized, short-term impacts. Impacts would be temporary and localized, with no biologically significant impacts on individuals or populations.
Noise: Aircraft	Aircraft routinely travel in the geographic analysis area for birds. With the possible exception of rescue operations and survey aircraft, no ongoing aircraft flights would occur at altitudes that would elicit a response from birds. If flights are at a sufficiently low altitude, birds may flush, resulting in non-biologically significant increased energy expenditure. Disturbance, if any, would be localized and temporary and impacts would be expected to dissipate once the aircraft has left the area.	Aircraft noise is likely to continue to increase as commercial air traffic increases; however, very few flights would be expected to be at a sufficiently low altitude to elicit a response from birds. If flights are at a sufficiently low altitude, birds may flush, resulting in non-biologically significant increased energy expenditure. Disturbance, if any, would be localized and temporary and impacts would be expected to dissipate once the aircraft has left the area.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: G&G	Infrequent site characterization surveys and scientific surveys produce high-intensity impulsive noise around sites of investigation. These activities could result in diving birds leaving the local area. Non-diving birds would be unaffected. Any displacement would only be temporary during non-migratory periods, but impacts could be greater if displacement were to occur in preferred feeding areas during seasonal migration periods.	Same as ongoing activities, with the addition of possible future oil and gas surveys.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water could result in intermittent, temporary, localized impacts on diving birds due to displacement from foraging areas if birds are present in the vicinity of pile-driving activity. The extent of these impacts depends on pile size, hammer energy, and local acoustic conditions. No biologically significant impacts on individuals or populations would be expected.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Noise: Onshore construction	Onshore construction is routinely used in generic infrastructure projects. Equipment could potentially cause displacement. Any displacement would only be temporary and no individual fitness or population-level impacts would be expected.	Onshore construction will continue at current trends. Some behavior responses could range from escape behavior to mild annoyance, but no individual injury or mortality would be expected.
Noise: Vessels	Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Sub-surface noise from vessels could disturb diving birds foraging for prey below the surface. The consequence to birds would be similar to noise from G&G but likely less because noise levels are lower.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Presence of structures: Entanglement, gear loss, gear damage	Each year, 2,551 seabirds die annually from interactions with U.S. commercial fisheries on the Atlantic (Sigourney et al. 2019). Even more die due to abandoned commercial fishing gear (nets). In addition, recreational fishing gear (hooks and lines) is periodically lost on existing buoys, pilings, hard protection, and other structures and has the potential to entangle birds.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various hard protections atop cables create uncommon relief in a mostly flat seascape. Structure-oriented fishes are attracted to these objects. These impacts are local and can be short-term to permanent. These fish aggregations can provide localized, short-term to permanent, beneficial impacts on some bird species because it could increase prey species availability.	New cables, installed incrementally in the geographic analysis area for birds over the next 20 to 35 years, would likely require hard protection atop portions of the cables (see New cable emplacement/maintenance row). Any new towers, buoys, or piers would also create uncommon relief in a mostly flat seascape. Structure-oriented fishes could be attracted to these locations. Abundance of certain fishes may increase. These impacts are expected to be local and may be short-term to permanent. These fish aggregations can provide localized, short-term to permanent beneficial impacts on some bird species due to increased prey species availability.
Presence of structures: Migration disturbances	A few structures may be scattered about the offshore geographic analysis area for birds, such as navigation and weather buoys and light towers. Migrating birds can easily fly around or over these sparsely distributed structures.	The infrequent installation of future new structures in the marine or onshore environment over the next 35 years would not be expected to result in migration disturbances.
Presence of structures: Turbine strikes, displacement, and attraction	A few structures may be in the offshore geographic analysis area for birds, such as navigation and weather buoys, turbines, and light towers. Given the limited number of structures currently in the geographic analysis area, individual- and population-level impacts due to displacement from current foraging habitat would not be expected. Stationary structures in the offshore environment would not be expected to pose a collision risk to birds. Some birds like cormorants and gulls may be attracted to these structures and opportunistically roost on these structures.	The installation of future new structures in the marine or onshore environment over the next 35 years would not be expected to result in an increase in collision risk or to result in displacement. Some potential for attraction and opportunistic roosting exists but would be expected to be limited given the anticipated number of structures.
Traffic: Aircraft	General aviation accounts for approximately two bird strikes per 100,000 flights (Dolbeer et al. 2019). In addition to general aviation, aircraft are used for scientific and academic surveys in marine environments.	Bird fatalities associated with general aviation would be expected to increase with the current trend in commercial air travel. Aircraft will continue to be used to conduct scientific research studies as well as wildlife monitoring and pre-construction surveys. These flights would be well below the 100,000 flights and no bird strikes would be expected to occur.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Land disturbance: Onshore construction	Onshore construction activity will continue at current trends. There is some potential for indirect impacts associated with habitat loss and fragmentation.	Future non-offshore wind development would continue to occur at the current rate. This development has the potential to result in habitat loss but would not be expected to result in injury or mortality of individuals.
Climate change: Warming and sea level rise, storm severity/frequency	Increased storm frequency and severity during the breeding season can reduce productivity of bird nesting colonies and kill adults, eggs, and chicks.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Ocean acidification	Increasing ocean acidification may affect prey species upon which some birds feed and could lead to shifts in prey distribution and abundance. Intensity of impacts on birds is speculative.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters over the next 35 years, influencing the distribution of bird prey resources.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, altered migration patterns	Birds rely on cues from the weather to start migration. Wind direction and speed influence the amount of energy used during migration. For nocturnal migrants, wind assistance is projected to increase across eastern portions of the continent (0.32 m/s; 9.6%) during spring migration by 2091, and wind assistance is projected to decrease within eastern portions of the continent (0.17 m/s; 6.6%) during autumn migration (La Sorte et al. 2018).	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, property/ infrastructure damage	This sub-IPF would have no impacts on birds.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, protective measures (barriers, seawalls)	The proliferation of coastline protections have the potential to result in long-term, high-consequence, impacts on bird nesting habitat.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Climate change: Warming and sea level rise, increased disease frequency	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters over the next 35 years, influencing the frequencies and distributions of various diseases of birds.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.

hazmat = hazardous materials

Table F1-5 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Coastal Habitat and Fauna

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: Onshore construction	Onshore construction noise is expected to result in short-term, temporary, localized impacts. Impacts are expected to be limited to avoidance of construction activity and noise.	Onshore residential, commercial, and industrial development are expected to continue at current trends. Impacts would be similar to those from ongoing activities.
Land disturbance: Onshore construction	Onshore residential, commercial, and industrial development are expected to continue at current trends. Construction activities may result in loss of coastal habitat and temporary or permanent displacement and injury to or mortality of individual animals, but population-level effects would not be expected.	Onshore residential, commercial, and industrial development are expected to continue at current trends. Impacts would be similar to those from ongoing activities.
Land disturbance: Onshore, land use changes	Ongoing development of onshore properties, especially shoreline parcels, periodically causes the conversion of onshore coastal habitats to developed space.	No future activities were identified within the geographic analysis area other than ongoing activities.
Traffic: Vehicle collisions	Vehicle collisions may result in injury to or mortality of individual animals, but population-level effects would not be expected.	Impacts from vehicle collisions with wildlife are expected to continue and to be similar to those from ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	Climate change and associated sea level rise results in dieback of coastal habitats caused by rising groundwater tables and increased saltwater inundation from storm surges and exceptionally high tides. Climate change may also affect coastal habitats through increases in instances and severity of droughts and range expansion of invasive species. The effects of climate change on animals will likely include loss of habitat, population declines, increased risk of extinction, decreased reproductive productivity, and changes in species distribution.	Impacts from climate change are expected to continue. Impacts are the same as those described under ongoing activities.

Table F1-6 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Commercial Fisheries and For-Hire Recreational Fishing

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Anchoring	Impacts from anchoring occur due to ongoing military, survey, commercial, and recreational activities. The short-term, localized impact on this resource is the presence of a navigational hazard (anchored vessel) to fishing vessels.	Impacts from anchoring may occur on a semi-regular basis over the next 35 years due to offshore military operations, survey activities, commercial vessel traffic, and/or recreational vessel traffic. Anchoring could pose a temporary (hours to days), localized (within a few hundred meters of anchored vessel) navigational hazard to fishing vessels.
New cable emplacement/ maintenance	New cable emplacement and infrequent cable maintenance activities disturb the seafloor, increase suspended sediment, and cause temporary displacement of fishing vessels. These disturbances would be local and limited to the emplacement corridor.	Future new cables and cable maintenance would occasionally disturb the seafloor and cause temporary displacement in fishing vessels and increases in suspended sediment resulting in local, short-term impacts. If the cable routes enter the geographic analysis area for this resource, short-term disruption of fishing activities would be expected.
Noise: Construction, trenching, O&M	Noise from construction occurs frequently in coastal habitats in populated areas in New England and the Mid-Atlantic, but infrequently offshore. The intensity and extent of noise from construction is difficult to generalize, but impacts are local and temporary. Infrequent offshore trenching could occur in connection with cable installation. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Low levels of elevated noise from operational WTGs likely have low to no impacts on fish and no impacts at a fishery level. Noise is also created by O&M of marine minerals extraction, which has small, local impacts on fish, but likely no impacts at a fishery level.	Noise from construction near shore is expected to gradually increase in line with human population growth along the coast of the geographic analysis area for this resource. Noise from dredging and sand and gravel mining could occur. New or expanded marine minerals extraction may increase noise during their O&M over the next 35 years. Impacts from construction, operations, and maintenance would likely be small and local on fish, and not seen at a fishery level. Periodic trenching would be needed for repair or new installation of underground infrastructure. These disturbances would be temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise on commercial fish species are typically less prominent than the impacts of the physical disturbance and sediment suspension. Therefore, fishery-level impacts are unlikely.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: G&G	Ongoing site characterization surveys and scientific surveys produce noise around sites of investigation. These activities can disturb fish and invertebrates in the immediate vicinity of the investigation and can cause temporary behavioral changes. The extent depends on equipment used, noise levels, and local acoustic conditions.	Site characterization surveys, scientific surveys, and exploratory oil and gas surveys are anticipated to occur infrequently over the next 35 years. Seismic surveys used in oil and gas exploration create high-intensity impulsive noise to penetrate deep into the seabed, potentially resulting in injury or mortality to finfish and invertebrates in a small area around each sound source and short-term stress and behavioral changes to individuals over a greater area. Site characterization surveys typically use sub-bottom profiler technologies that generate less-intense sound waves more similar to common deep-water echosounders. The intensity and extent of the resulting impacts are difficult to generalize but are likely local and temporary.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when ports or marinas, piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can cause injury and/or mortality to finfish and invertebrates in a small area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area, leading to temporary local impacts on commercial fisheries and for-hire recreational fishing. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the analysis area other than ongoing activities.
Noise: Vessels	Vessel noise is anticipated to continue at levels similar to current levels. While vessel noise may have some impact on behavior, it is likely limited to brief startle and temporary stress responses. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels.	Planned new barge route and dredging disposal sites would generate vessel noise when implemented.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance, including dredging. Port utilization is expected to increase over the next 35 years.	Ports would need to perform maintenance and upgrades to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size. Port utilization is expected to increase over the next 35 years, with increased activity during construction. The ability of ports to receive the increase in vessel traffic may require port modifications, such as channel deepening, leading to local impacts on fish populations. Port expansions could also increase vessel traffic and competition for dockside services, which could affect fishing vessels.
Presence of structures: Navigation hazard and allisions	Structures within and near the cumulative lease areas that pose potential navigation hazards include offshore wind turbines, buoys, and shoreline developments such as docks and ports. An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. Two types of allisions occur: drift and powered. A drift allision generally occurs when a vessel is powered down due to operator choice or power failure. A powered allision generally occurs when an operator fails to adequately control their vessel movements or is distracted.	No known reasonably foreseeable structures are proposed to be located in the geographic analysis area that could affect commercial fisheries. Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb habitats and potentially harm individuals, creating small, localized, short-term impacts on fish, but likely no impacts at a fishery level.	No future activities were identified within the analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Habitat conversion and fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly sandy seascape. A large portion is homogeneous sandy seascape but there is some other hard and/or complex habitat. Structures are periodically added, resulting in the conversion of existing soft-bottom and hard-bottom habitat to the new hard-structure habitat. Structure-oriented fishes are attracted to these locations. These impacts are local and can be short-term to permanent. Fish aggregation may be considered adverse, beneficial, or neither. Commercial and for-hire recreational fishing can occur near these structures. For-hire recreational fishing is more popular, as commercial mobile fishing gear risk snagging on the structures.	New cables, installed incrementally in the analysis area over the next 20 to 35 years, would likely require hard protection atop portions of the route (see New cable emplacement/maintenance IPF above). Any new towers, buoys, or piers would also create uncommon relief in a mostly flat seascape. Structure-oriented species could be attracted to these locations. Structure-oriented species would benefit (Claisse et al. 2014; Smith et al. 2016). This may lead to more and larger structure-oriented fish communities and larger predators opportunistically feeding on the communities, as well as increased private and for-hire recreational fishing opportunities. Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010). These impacts are expected to be local and may be long term.
Presence of structures: Migration disturbances	Human structures in the marine environment, e.g., shipwrecks, artificial reefs, buoys, and oil platforms, can attract finfish and invertebrates that approach the structures during their migrations. This could slow species migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement than structure (Secor et al. 2018). There is no evidence to suggest that structures pose a barrier to migratory animals.	The infrequent installation of future new structures in the marine environment over the next 35 years may attract finfish and invertebrates that approach the structures during their migrations. This could tend to slow migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement (Secor et al. 2018). Migratory animals would likely be able to proceed from structures unimpeded. Therefore, fishery-level impacts are not anticipated.
Presence of structures: Space-use conflicts	Current structures do not result in space-use conflicts.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Presence of structures: Cable infrastructure	The existing offshore cable infrastructure supports the economy by transmitting electric power and communications between mainland and islands. Shoreline developments are ongoing and include docks, ports, and other commercial, industrial, and residential structures.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Traffic: Vessels and vessel collisions	No substantial changes are anticipated to the vessel traffic volumes. The geographic analysis area would continue to have numerous ports and the extensive marine traffic related to shipping, fishing, and recreation would continue to be important to the region's economy. The region's substantial marine traffic may result in occasional collisions. Vessels need to navigate around structures to avoid allisions. When multiple vessels need to navigate around a structure, then navigation is more complex, as the vessels need to avoid both the structure and each other. The risk for collisions is ongoing but infrequent.	New vessel traffic in the geographic analysis area would consistently be generated by proposed barge routes and dredging demolition sites. Marine commerce and related industries would continue to be important to the regional economy.
Climate change	Impacts to commercial fisheries and for-hire recreational fishing are expected to result from climate change events such as increased magnitude or frequency of storms, shoreline changes, ocean acidification, and water temperature changes. Risks to fisheries associated with these events include habitat/distribution shifts, disease incidence, and risk of invasive species. If these risk factors result in a decrease in catch and/or an increase in fishing costs (e.g., transiting time), the profitability of businesses engaged in commercial fisheries and for-hire recreational fishing would be adversely affected. While climate change is predicted to have adverse impacts on the distribution and/or productivity of some stocks targeted by commercial fisheries and for-hire recreational fishing, other stocks may be beneficially affected. The economies of communities reliant on marine species that are vulnerable to the effects of climate change could be adversely affected. If the distribution of important stocks changes, it could affect where commercial and for-hire recreational fisheries are located. Furthermore, coastal communities with fishing businesses that have infrastructure near the shore could be adversely affected by sea level rise.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Regulated fishing effort	Commercial and recreational regulations for finfish and shellfish implemented and enforced by NMFS and coastal states, affect how the commercial and for-hire recreational fisheries operate. Commercial and recreational for-hire fisheries are managed by FMPs, which are established to manage fisheries to avoid overfishing through catch quotas, special management areas, and closed area regulations. These can reduce or increase the size of available landings to commercial and for-hire recreational fisheries. For example, ongoing fishing restrictions designed to rebuild depleted stocks in the Northeast Multispecies (large-mesh) fishery will continue to reduce landings in that fishery.	Reasonably foreseeable fishery management actions include measures to reduce the risk of interactions between fishing gear and the NARW by 60% (McCreary and Brooks 2019). This will likely have a have a major adverse impact on fishing effort in the lobster and Jonah crab fisheries in the geographic analysis area for this resource. As discussed in Karp et al. (Karp et al. 2019), changing climate and ocean conditions and the resultant effects on species distributions and productivity can have significant effects on management decisions, such as allocation, spatiotemporal closures, stock status determinations, and catch limits. See No Action alternative for additional fishery management actions that will affect commercial fisheries and for-hire recreational fishing.

Table F1-7 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Cultural Resources

Associated IPF: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-22 for water quality for a quantitative analysis of these risks. Accidental releases of fuel/fluids/hazmat occur during vessel use for recreational, fisheries, marine transportation, or military purposes, and other ongoing activities. Both released fluids and cleanup activities that require the removal of contaminated soils and/or seafloor sediments can cause impacts on cultural resources because resources are affected during by the released chemicals as well as the ensuing cleanup activities.	Gradually increasing vessel traffic over the next 35 years would increase the risk of accidental releases within the geographic analysis area for cultural resources, increasing the frequency of small releases. Although the majority of anticipated accidental releases would be small, resulting in small-scale impacts on cultural resources, a single, large-scale accidental release such as an oil spill, could have significant impacts on marine and coastal cultural resources. A large-scale release would require extensive cleanup activities to remove contaminated materials resulting in damage to or the complete removal of terrestrial and marine cultural resources. In addition, the accidentally released materials in deep water settings could settle on seafloor cultural resources such as wreck sites, accelerating their decomposition and/or covering them and making them inaccessible/unrecognizable to researchers, resulting in a significant loss of historic information. As a result, although considered unlikely, a large-scale accidental release and associated cleanup could result in permanent, geographically extensive, and large-scale impacts on cultural resources.

Associated IPF: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Trash and debris	Accidental releases of trash and debris occur during vessel use for recreational, fisheries, marine transportation, or military purposes and other ongoing activities. While the released trash and debris can directly affect cultural resources, the majority of impacts associated with accidental releases occur during cleanup activities, especially if soil or sediment removed during cleanup affect known and undiscovered archaeological resources. In addition, the presence of large amounts of trash on shorelines or the ocean surface can impact the cultural value of TCPs for stakeholders. State and federal laws prohibiting large releases of trash would limit the size of any individual release and ongoing local, state, and federal efforts to clean up trash on beaches and waterways would continue to mitigate the effects of small-scale accidental releases of trash.	Future activities with the potential to result in accidental releases include construction and operations of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications). Accidental releases would continue at current rates along the northeast Atlantic coast.
Anchoring	The use of vessel anchoring and gear (i.e., wire ropes, cables, chain, sweep on the seafloor) that disturbs the seafloor, such as bottom trawls and anchors, by military, recreational, industrial, and commercial vessels can impact cultural resources by physically damaging maritime archaeological resources such as shipwrecks and debris fields.	Future activities with the potential to result in anchoring/ gear utilization include construction and operations of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); military use; marine transportation; fisheries use and management; and oil and gas activities. These activities are likely to continue to occur at current rates along the entire coast of the eastern United States.
Gear utilization: Dredging	Activities associated with dredge operations and activities could damage marine archaeological resources. Ongoing activities identified by BOEM with the potential to result in dredging impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; and oil and gas activities.	Dredging activities would gradually increase through time as new offshore infrastructure is built, such as gas pipelines and electrical lines, and as ports and harbors are expanded or maintained.

Associated IPF: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Light: Vessels	Light associated with military, commercial, or construction vessel traffic can temporarily affect coastal historic structures and TCP resources when the addition of intrusive, modern lighting changes the physical environment ("setting") of cultural resources. The impacts of construction and operational lighting would be limited to cultural resources on the shoreline for which a nighttime sky is a contributing element to historic integrity. This excludes resources that are closed at night, such as historic buildings, lighthouses, and battlefields, and resources that generate their own nighttime light, such as historic districts. Offshore construction activities that require increased vessel traffic, construction vessels stationed offshore, and construction area lighting for prolonged periods can cause more sustained and significant visual impacts on coastal historic structure and TCP resources.	Future activities with the potential to result in vessel lighting impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; and oil and gas activities. Light pollution from vessel traffic would continue at the current intensity along the northeast coast, with a slight increase due to population increase and development over time.
Light: Structures	The construction of new structures that introduce new light sources into the setting of historic architectural properties or TCPs can result in impacts, particularly if the historic and/or cultural significance of the resource is associated with uninterrupted nighttime skies or periods of darkness. Any tall structure (commercial building, radio antenna, large satellite dishes, etc.) requiring nighttime hazard lighting to prevent aircraft collision can cause these types of impacts.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
Port utilization: Expansion	Major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Expansion of port facilities can introduce large, modern port infrastructure into the viewsheds of nearby historic properties, affecting their setting and historic significance.	Future activities with the potential to result in port expansion impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; and oil and gas activities. Port expansion would continue at current levels, which reflect efforts to capture business associated with the offshore wind industry (irrespective of specific projects).

Associated IPF: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures	The only existing offshore structures within the viewshed of the geographic analysis area are minor features such as buoys.	Non-offshore wind structures that could be viewed would be limited to meteorological towers. Marine activity would also occur within the marine viewshed of the geographic analysis area.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and could cause impacts on submerged archaeological resources. These disturbances would be local and limited to emplacement corridors.	Future activities with the potential to result in seafloor disturbances similar to offshore impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; and oil and gas activities. Such activities could cause impacts on submerged archaeological resources including shipwrecks and formerly subaerially exposed pre-contact Native American archaeological sites.
Land disturbance: Onshore construction	Onshore construction activities can affect archaeological resources by damaging or removing resources.	Future activities that could result in terrestrial land disturbance impacts include onshore residential, commercial, industrial, and military development activities in central Cape Cod, particularly those proximate to OECRs and interconnection facilities. Onshore construction would continue at current rates.
Climate change: Warming and sea level rise, storm severity/frequency	Sea level rise and increased storm severity and frequency would result in impacts on archaeological, architectural, and TCP resources. Increased storm frequency and severity would also result in damage to or destruction of architectural properties. Sea level rise would increase erosion-related impacts on archaeological and architectural resources, while sea level rise would inundate archaeological, architectural, and TCP resources.	Sea level rise and storm severity/frequency would increase due to the effects of climate change.
Climate change: Warming and sea level rise, altered habitat/ecology	Altered habitat/ecology related to warming seas and sea level rise would impact the ability of Native Americans and other communities to use maritime TCPs for traditional fishing, shell fishing, and fowling activities.	The rate of change to habitats/ecology would increase as a result of climate change.

Associated IPF: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Climate change: Warming and sea level rise, altered migration patterns	Altered migration patterns related to warming seas and sea level rise would impact the ability of Native Americans and other communities to use maritime TCPs for traditional fishing, shell fishing, and fowling activities.	The rate of change to migratory animal patterns would increase as a result of climate change.
Climate change: Warming and sea level rise, property/ infrastructure damage	Sea level rise and increased storm severity and frequency would result in impacts on archaeological, architectural, and TCP resources. Increased storm frequency and severity would result in damage to and/or destruction of architectural properties. Sea level rise would increase erosion-related impacts on archaeological and architectural resources while sea level rise would inundate archaeological, architectural, and TCP resources.	The rate of property and infrastructure damage would increase as a result of climate change.
Climate change: Warming and sea level rise, protective measures (barriers, sea walls)	The installation of protective measures such as barriers and sea walls would impact archaeological resources during associated ground-disturbing activities. Construction of these modern protective structures would alter the viewsheds from historic properties and/or TCPs, resulting in impacts on the historic and/or cultural significance of resources.	The installation of coastal protective measures would increase as a result of climate change.
Climate change: Warming and sea level rise, storm severity/frequency, sediment erosion, deposition	Sea level rise and increased storm severity and frequency would result in impacts on archaeological, architectural, and TCP resources. Increased storm frequency and severity would result in damage to and/or destruction of architectural properties. Sea level rise would increase erosion related impacts on archaeological and architectural resources while sea level rise would inundate archaeological, architectural, and TCP resources.	Sea level rise and storm severity/frequency would increase due to the effects of climate change.

hazmat = hazardous materials; OECR = onshore export cable route

Table F1-8 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Demographics, Employment, and Economics

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Energy generation/ security	In 2019, New Jersey energy production totaled 328 trillion Btu, of which 13.8 trillion Btu was from renewable sources, including geothermal, hydroelectric, wind, solar, and biomass (U.S. Energy Information Administration 2020).	Ongoing development of onshore solar and wind energy would provide diversified, small-scale energy generation. State and regional energy markets would require additional peaker plants and energy storage to meet the electricity needs when utility scale renewables are not producing.
Light: Structures	Offshore buoys and towers emit low-intensity light, while onshore structures, including houses and ports, emit substantially more light on an ongoing basis.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
Light: Vessels	Ocean vessels have an array of lights including navigational lights and deck lights.	Anticipated modest growth in vessel traffic would result in some growth in the nighttime traffic of vessels with lighting.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances would be local and limited to emplacement corridors. In the geographic analysis area for demographics, employment, and economics there are six existing power cables.	Future new cables would disturb the seafloor and cause temporary increases in suspended sediment resulting in infrequent, localized, short-term impacts over the next 35 years.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. These disturbances are temporary, local, and extend only a short distance beyond the work area.	No future activities were identified within the geographic analysis area for demographics, employment, and economics other than ongoing activities.
Noise: Cable laying/ trenching	Infrequent trenching for pipeline and cable laying activities emit noise. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	Periodic trenching would be needed over the next 35 years for repair or new installation of underground infrastructure.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: Vessels	Vessel noise occurs offshore and more frequently near ports and docks. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Vessel noise is anticipated to continue at or near current levels.	Planned new barge route and dredging disposal sites would generate vessel noise when implemented. The number and location of such routes are uncertain.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The New Jersey Wind Port is being developed and the Port of Paulsboro is being upgraded specifically to support the construction of offshore wind energy facilities.	Ports would need to perform maintenance and upgrade facilities over the next 35 years to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Port utilization: Maintenance/ dredging	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. As ports expand, maintenance dredging of shipping channels is expected to increase.	Ports would need to perform maintenance and upgrades over the next 35 years to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Presence of structures: Allisions	An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. The likelihood of allisions is expected to continue at or near current levels.	Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. Such loss and damage are direct costs for gear owners and are expected to continue at or near current levels.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented fishes are attracted to these locations, which may be known as FADs. Recreational and commercial fishing can occur near the FADs, although recreational fishing is more popular, because commercial mobile fishing gear is more likely to snag on FADs.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Habitat conversion	Structures, including foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented species thus benefit on a constant basis.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions, especially in nearshore areas. This navigation becomes more complex when multiple vessels must navigate around a structure, because vessels need to avoid both the structure and each other.	Vessel traffic, overall, is not expected to meaningfully increase over the next 35 years. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space-use conflicts	Current structures do not result in space-use conflicts.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Viewshed	No existing offshore structures are within the viewshed of the offshore wind lease area except buoys.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Transmission cable infrastructure	The existing offshore cable infrastructure supports the economy by transmitting electric power and communications between mainland and islands. Additional communication cables run between the U.S. East Coast and European countries along the eastern Atlantic.	No known proposed structures not associated with offshore wind development are reasonably foreseeable.
Traffic: Vessels	Ports and marine traffic related to shipping, fishing, and recreation are important to the region's economy. No substantial changes are anticipated to existing vessel traffic volumes.	New vessel traffic near the geographic analysis area would be generated by proposed barge routes and dredging demolition sites over the next 35 years. Marine commerce and related industries would continue to be important to the geographic analysis area economy.
Traffic: Vessel collisions	The region's substantial marine traffic may result in occasional vessel collisions, which would result in costs to the vessels involved. The likelihood of collisions is expected to continue at or near current rates.	No substantial changes anticipated.
Land disturbance: Onshore construction	Onshore development activities support local population growth, employment, and economies. Disturbances can cause temporary, localized traffic delays and restricted access to adjacent properties. The rate of onshore land disturbance is expected to continue at or near current rates.	Onshore development projects would be ongoing in accordance with local government land use plans and regulations.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Climate change	Climate models predict climate change if current trends continue. Climate change has adverse implications for demographics and economic health of coastal communities, due in part to the costs of resultant damage to property and infrastructure, fisheries and other natural resources, increased disease frequency, and sedimentation, among other factors.	Onshore projects that reduce air emissions could contribute to the effort to limit climate change. Onshore solar and wind energy projects, although producing less energy than potential offshore wind developments, would also provide incremental reductions.
Regulated fishing effort	Commercial and recreational regulations for finfish and shellfish implemented and enforced by NMFS and coastal states affect how commercial and for-hire recreational fisheries operate. Commercial and recreational for-hire fisheries are managed by FMPs, which are established to manage fisheries to avoid overfishing through catch quotas, special management areas, and closed area regulations. These can reduce or increase the size of available landings to commercial and for-hire recreational fisheries.	Reasonably foreseeable fishery management actions include measures to reduce the risk of interactions between fishing gear and the NARW by 60% (McCreary and Brooks 2019). This will likely have a significant impact on fishing effort in the lobster and Jonah crab fisheries in the geographic analysis area for this resource.

Btu = British thermal unit; FAD = fish aggregating device

Table F1-9 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Environmental Justice

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Air emissions: Construction/ decommissioning	Ongoing population growth and new development within the analysis area is likely to increase traffic with resulting increase in emissions from motor vehicles. Some new industrial development may result in emissions-producing uses. At the same time, many industrial waterfront areas near environmental justice communities are losing industrial uses and converting to more commercial or residential uses.	New development may include emissions-producing industry and new development that would increase emissions from motor vehicles. Some historically industrial waterfront locations will continue to lose industrial uses, with no new industrial development to replace it.
Air emissions: O&M	Ongoing population growth and new development within the analysis area is likely to increase traffic with resulting increase in emissions from motor vehicles. Some new industrial development may result in emissions-producing uses. At the same time, many industrial waterfront areas near environmental justice communities are losing industrial uses and converting to more commercial or residential uses.	New development may include emissions-producing industry and new development that would increase emissions from motor vehicles. Some historically industrial waterfront locations will continue to lose industrial uses, with no new industrial development to replace it.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Light: Structures	Offshore buoys and towers emit low-intensity light, while onshore structures, including houses and ports, emit substantially more light on an ongoing basis.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances would be local and limited to emplacement corridors.	Future new cables would disturb the seafloor and cause temporary increases in suspended sediment, resulting in infrequent, localized, short-term impacts over the next 35 years.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. These disturbances are temporary, local, and extend only a short distance beyond the work area.	No future activities were identified within the analysis area other than ongoing activities.
Noise: Trenching	Infrequent trenching for pipeline and cable laying activities emits noise. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	Periodic trenching would be needed over the next 35 years for repair or new installation of underground infrastructure.
Noise: Vessels	Vessel noise occurs offshore and more frequently near ports and docks. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels.	Vessel noise is anticipated to continue at or near current levels.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The New Jersey Wind Port is being developed and the Port of Paulsboro is being upgraded specifically to support the construction of offshore wind energy facilities.	Ports would need to perform maintenance and upgrade facilities to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Presence of structures: Entanglement, gear loss/damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. Such loss and damage are direct costs for gear owners and are expected to continue at or near current levels.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions, especially in nearshore areas. This navigation becomes more complex when multiple vessels must navigate around a structure, because vessels need to avoid both the structure, and each other.	Vessel traffic is generally not expected to meaningfully increase over the next 35 years. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space-use conflicts	Current structures do not result in space-use conflicts.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Viewshed	There are no existing offshore structures within the viewshed of the offshore wind lease area except buoys.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: cable infrastructure	Existing submarine cables cross cumulative lease areas.	Existing cable O&M activities would continue within the analysis area.
Traffic: Vessels	Ports and marine traffic related to shipping, fishing and recreation are important to the region’s economy. No substantial changes are anticipated to existing vessel traffic volumes.	Vessel traffic is not expected to meaningfully increase over the next 35 years. Marine commerce and related industries would continue to be important to area employment.
Land disturbance: Erosion and sedimentation	Potential erosion and sedimentation from development and construction is controlled by local and state development regulations.	New development activities would be subject to erosion and sedimentation regulations.
Land disturbance: Onshore construction	Onshore development supports local population growth, employment, and economics.	Onshore development would continue in accordance with local government land use plans and regulations.
Land disturbance: Onshore, land use changes	Onshore development would result in changes in land use in accordance with local government land use plans and regulations.	Development of onshore solar and wind energy would provide diversified, small-scale energy generation.
Climate change	Climate models predict climate change if current trends continue. Climate change has adverse implications for demographics and the economic health of coastal communities, due in part to the costs of resultant damage to property and infrastructure, fisheries, and other natural resources; increased disease frequency; and sedimentation, among other factors.	Onshore projects that reduce air emissions could contribute to the effort to limit climate change. Onshore solar and wind energy projects, although producing less energy than potential offshore wind developments, would also provide incremental reductions.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Regulated fishing effort	Commercial and recreational regulations for finfish and shellfish implemented and enforced by NMFS and coastal states affect how commercial and for-hire recreational fisheries operate. Commercial and recreational for-hire fisheries are managed by FMPs, which are established to manage fisheries to avoid overfishing through catch quotas, special management areas, and closed area regulations. These can reduce or increase the size of available landings to commercial and for-hire recreational fisheries.	Reasonably foreseeable fishery management actions include measures to reduce the risk of interactions between fishing gear and the NARW by 60% (McCreary and Brooks 2019). This will likely have a significant impact on the fishing effort in the lobster and Jonah crab fisheries in the geographic analysis area for this resource. See No Action alternative for additional fishery management actions that will affect commercial fisheries and for-hire recreational fishing.

Table F1-10 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Finfish, Invertebrates, and Essential Fish Habitat

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-22 for a quantitative analysis of these risks. Ongoing releases are frequent/chronic. Impacts, including mortality, decreased fitness, and contamination of habitat, are localized and temporary, and rarely affect populations.	See Table F1-22 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 35 years would increase the risk of accidental releases. Impacts are unlikely to affect populations.
Accidental releases: Invasive species	Invasive species are periodically released accidentally during ongoing activities, including the discharge of ballast water and bilge water from marine vessels. The impacts on finfish, invertebrates, and EFH depend on many factors, but can be widespread and permanent.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Anchoring	Vessel anchoring related to ongoing military use, and survey, commercial, and recreational activities continue to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. Impacts on finfish, invertebrates, and EFH are greatest for sensitive EFH (e.g., eelgrass, hard bottom) and sessile or slow-moving species (e.g., corals, sponges, and sedentary shellfish).	Impacts from anchoring may occur on a semi-regular basis over the next 35 years due to offshore military operations, survey activities, commercial vessel traffic, and/or recreational vessel traffic. These impacts would include increased turbidity levels and potential for direct contact causing mortality of benthic species and, possibly, degradation of sensitive habitats. All impacts would be localized; turbidity would be temporary; impacts from direct contact would be recovered in the short term. Degradation of sensitive habitats such as certain types of hard bottom (e.g., boulder piles), if it occurs, could be long term.
EMF	EMF emanates continuously from installed telecommunication and electrical power transmission cables. Biologically significant impacts on finfish, invertebrates, and EFH have not been documented for AC cables (CSA Ocean Sciences, Inc. and Exponent 2019; Thomsen et al. 2015), but behavioral impacts have been documented for benthic species (skates and lobster) near operating DC cables (Hutchison et al. 2018). The impacts are localized and affect the animals only while they are within the EMF. There is no evidence to indicate that EMF from undersea AC power cables negatively affects commercially and recreationally important fish species (CSA Ocean Sciences, Inc. and Exponent 2019).	During operation, future new cables would produce EMF. Submarine power cables in the geographic analysis area are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF to low levels. Although the EMF would exist as long as a cable was in operation, impacts, on finfish, invertebrates, and EFH would likely be difficult to detect.
Light: Vessels	Marine vessels have an array of lights including navigational lights and deck lights. There is little downward-focused lighting, and therefore only a small fraction of the emitted light enters the water. Light can attract finfish and invertebrates, potentially affecting distributions in a highly localized area. Light may also disrupt natural cycles, e.g., spawning, possibly leading to short-term impacts.	Vessels would continue to be a light source within the analysis area.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Light: Structures	Offshore buoys and towers emit light, and onshore structures, including buildings and ports, emit a great deal more on an ongoing basis. Light can attract finfish and invertebrates, potentially affecting distributions in a highly localized area. Light may also disrupt natural cycles, e.g., spawning, possibly leading to short-term impacts. Light from structures is widespread and permanent near the coast, but minimal offshore.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances are local, limited to the cable corridor. New cables are infrequently added near shore. Cable emplacement/maintenance activities disturb, displace, and injure finfish and invertebrates and result in temporary to long-term habitat alterations. The intensity of impacts depends on the time (season) and place (habitat type) where the activities occur. (See also the IPF of Sediment deposition and burial.)	Future new cables would occasionally disturb the seafloor and cause temporary increases in suspended sediment, resulting in local short-term impacts. If the cable routes enter the geographic analysis area for this resource, short-term disturbance would be expected. The intensity of impacts would depend on the time (season) and place (habitat type) where the activities would occur.
Noise: Aircraft	Noise from aircraft reaches the sea surface on a regular basis. However, there is not likely to be any impact of aircraft noise on finfish, invertebrates, and EFH, as very little of the aircraft noise propagates through the water.	Aircraft noise is likely to continue to increase as commercial air traffic increases. However, there is not likely to be any impact of aircraft noise on finfish, invertebrates, and EFH.
Noise: Onshore/ offshore construction	Noise from construction occurs frequently in near shores of populated areas in New England and the mid-Atlantic but infrequently offshore. The intensity and extent of noise from construction is difficult to generalize, but impacts are local and temporary. See also sub-IPF for Noise: Pile driving.	Noise from construction near shores is expected to gradually increase in line with human population growth along the coast of the geographic analysis area for this resource.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: G&G	Ongoing site characterization surveys and scientific surveys produce noise around sites of investigation. These activities can disturb finfish and invertebrates in the immediate vicinity of the investigation and can cause temporary behavioral changes. The extent depends on equipment used, noise levels, and local acoustic conditions.	Site characterization surveys, scientific surveys, and exploratory oil and gas surveys are anticipated to occur infrequently over the next 35 years. Seismic surveys used in oil and gas exploration create high-intensity impulsive noise to penetrate deep into the seabed, potentially resulting in injury or mortality to finfish and invertebrates in a small area around each sound source and short-term stress and behavioral changes to individuals over a greater area. Site characterization surveys typically use sub-bottom profiler technologies that generate less-intense sound waves more similar to common deep-water echosounders. The intensity and extent of the resulting impacts are difficult to generalize but are likely local and temporary.
Noise: O&M	Some finfish and invertebrates may be able to hear the continuous underwater noise of operational WTGs. As measured at the Block Island Wind Farm, this low frequency noise barley exceeds ambient levels at 164 feet (50 meters) from the WTG base. Based on the results of Thomsen et al. (Thomsen et al. 2015), SPLs would be expected to be at or below ambient levels at relatively short distances (approximately 164 feet [50 meters]) from WTG foundations. These low levels of elevated noise likely have little to no impact. Noise is also created by O&M of marine minerals extraction and commercial fisheries, each of which has small local impacts.	New or expanded marine minerals extraction and commercial fisheries may intermittently increase noise during their O&M over the next 35 years. Impacts would likely be small and local.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can cause injury and/or mortality to finfish and invertebrates in a small area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area. Eggs, embryos, and larvae of finfish and invertebrates could also experience developmental abnormalities or mortality resulting from this noise, although thresholds of exposure are not known (Weilgart 2018; Hawkins and Popper 2017). Potentially injurious noise could also be considered as rendering EFH temporarily unavailable or unsuitable for the duration of the noise. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Noise: Cable laying/ trenching	Infrequent trenching activities for pipeline and cable laying, as well as other cable burial methods, emit noise. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	New or expanded submarine cables and pipelines are likely to occur in the geographic analysis area for this resource. These disturbances would be infrequent over the next 35 years, temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.
Noise: Vessels	While ongoing vessel noise may have some effect on behavior, it is likely limited to brief startle and temporary stress responses. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels.	See cell to the left.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance, including dredging. Port utilization is expected to increase over the next 35 years.	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future. In addition, the general trend along the coast from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase may require port modifications, leading to local impacts. Future channel deepening activities will likely be undertaken. Existing ports have already affected finfish, invertebrates, and EFH, and future port projects would implement BMPs to minimize impacts. Although the degree of impacts on EFH would likely be undetectable outside the immediate vicinity of the ports, adverse impacts on EFH for certain species and/or life stages may lead to impacts on finfish and invertebrates beyond the vicinity of the port.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb habitats and potentially harm individuals, creating small, localized, short-term impacts.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Presence of structures: Hydrodynamic disturbance	Manmade structures, especially tall vertical structures such as foundations for towers of various purposes, continuously alter local water flow at a fine scale. Water flow typically returns to background levels within a relatively short distance from the structure. Therefore, impacts on finfish, invertebrates, and EFH are typically undetectable. Indirect impacts of structures influencing primary productivity and higher trophic levels are possible but are not well understood. New structures are periodically added.	Tall vertical structures can increase seabed scour and sediment suspension. Impacts would likely be highly localized and difficult to detect. Indirect impacts of structures influencing primary productivity and higher trophic levels are possible but are not well understood.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly sandy seascape. Structure-oriented fishes are attracted to these locations. These impacts are local and often permanent. Fish aggregation may be considered adverse, beneficial, or neutral.	New cables, installed incrementally in the geographic analysis area for this resource over the next 20 to 35 years, would likely require hard protection atop portions of the route (see the New cable emplacement/ maintenance IPF). Any new towers, buoys, or piers would also create uncommon relief in a mostly sandy seascape. Structure-oriented fishes could be attracted to these locations. Abundance of certain fishes may increase. These impacts are local and may be permanent.
Presence of structures: Habitat conversion	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly sandy seascape. A large portion is homogeneous sandy seascape but there is some other hard and/or complex habitat. Structure-oriented species thus benefit on a constant basis; however, the diversity may decline over time as early colonizers are replaced by successional communities dominated by blue mussels and anemones (Degraer et al. 2019 [Chapter 7]). Structures are periodically added, resulting in the conversion of existing soft-bottom and hard-bottom habitat to the new hard-structure habitat.	New cable, installed incrementally in the analysis area over the next 20 to 35 years, would likely require hard protection atop portions of the route (see New cable emplacement/maintenance). Any new towers, buoys, or piers would also create uncommon relief in a mostly sandy seascape. Structure-oriented species would benefit (Claisse et al. 2014; Smith et al. 2016); however, the diversity may decline over time as early colonizers are replaced by successional communities dominated by blue mussels and anemones (Degraer et al. 2019 [Chapter 7]). Soft bottom is the dominant habitat type from Cape Hatteras to the Gulf of Maine (over 60 million acres), and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010).
Presence of structures: Migration disturbances	Human structures in the marine environment, e.g., shipwrecks, artificial reefs, and oil platforms, can attract finfish and invertebrates that approach the structures during their migrations. This could slow migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement than structure is (Moser and Shepherd 2009; Fabrizio et al. 2014; Secor et al. 2018). There is no evidence to suggest that structures pose a barrier to migratory animals.	The infrequent installation of future new structures in the marine environment over the next 35 years may attract finfish and invertebrates that approach the structures during their migrations. This could tend to slow migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement (Moser and Shepherd 2009; Fabrizio et al. 2014; Secor et al. 2018). Migratory animals would likely be able to proceed from structures unimpeded.
Presence of structures: Cable infrastructure	See other sub-IPFs within the Presence of structures IPF. See Table F1-6 on Coastal Habitats.	See other sub-IPFs within the Presence of structures IPF. See Table F1-6 on Coastal Habitats.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Regulated fishing effort	Regulated fishing effort results in the removal of a substantial amount of the annually produced biomass of commercially regulated finfish and invertebrates and can also influence bycatch of non-regulated species. Ongoing commercial and recreational regulations for finfish and shellfish implemented and enforced by states, municipalities, and/or NOAA, depending on jurisdiction, affect finfish, invertebrates, and EFH by modifying the nature, distribution and intensity of fishing-related impacts, including those that disturb the seafloor (trawling, dredge fishing).	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Seabed profile alterations	Ongoing sediment dredging for navigation purposes results in localized short-term impacts (habitat alteration, change in complexity) on finfish, invertebrates, and EFH through this IPF. Dredging is most likely in sand wave areas where typical jet plowing is insufficient to meet target cable burial depth. Sand waves that are dredged would likely be redeposited in like-sediment areas. Any particular sand wave may not recover to the same height and width as pre-disturbance; however, the habitat function would largely recover post-disturbance. Therefore, seabed profile alterations, while locally intense, have little impact on finfish, invertebrates, and EFH on a regional (Cape Hatteras to Gulf of Maine) scale.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Sediment deposition and burial	Ongoing sediment dredging for navigation purposes results in fine sediment deposition. Ongoing cable maintenance activities also infrequently disturb bottom sediments; these disturbances are local, limited to the emplacement corridor. Sediment deposition could have negative impacts on eggs and larvae, particularly demersal eggs such as longfin squid, which are known to have high rates of egg mortality if egg masses are exposed to abrasion or burial. Impacts may vary based on season/time of year.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Climate change: Ocean acidification	Continuous CO_2 emissions causing ocean acidification may contribute to reduced growth or the decline of invertebrates that have calcareous shells over the course of the next 35 years.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Climate change: Warming and sea level rise, altered habitat, ecology, and migration patterns	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters over the next 35 years, influencing the distributions of finfish, invertebrates, and EFH. This sub-IPF has been shown to affect the distribution of fish in the northeast United States, with several species shifting their centers of biomass either northward or to deeper waters (Hare et al. 2016).	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Climate change: Warming and sea level rise, disease frequency	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters over the next 35 years, influencing the frequencies of various diseases of finfish and invertebrates.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.

AC = alternating current; DC = direct current; hazmat = hazardous materials

Table F1-11 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Land Use and Coastal Infrastructure

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	Various ongoing onshore and coastal construction projects include the use of vehicles and equipment that contain fuel, fluids, and hazardous materials that could be released.	Ongoing onshore construction projects involve vehicles and equipment that use fuel, fluids, or hazardous materials could result in an accidental release. Intensity and extent would vary, depending on the size, location, and materials involved in the release.
Light: Structures	Various ongoing onshore and coastal construction projects have nighttime activities, as well as existing structures, facilities, and vehicles that would use nighttime lighting.	Ongoing onshore construction projects involving nighttime activity could generate nighttime lighting. Intensity and extent would vary, depending on the location, type, direction, and duration of nighttime lighting.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The New Jersey Wind Port is being developed and the Port of Paulsboro is being upgraded specifically to support the construction of offshore wind energy facilities.	Ports would need to perform maintenance and upgrade facilities to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Viewshed	The only existing offshore structures within the offshore viewshed are minor features such as buoys.	Non-offshore wind structures that could be viewed in conjunction with the offshore components would be limited to met towers. Marine activity would also occur within the marine viewshed.
Presence of structures: Cable infrastructure	Onshore buried cables would only occur where permitted by local land use authorities, which would avoid long-term land use conflicts.	No known proposed structures are reasonably foreseeable and proposed to be located in the geographic analysis area for land use and coastal infrastructure.
Land disturbance: Onshore construction	Onshore construction supports local population growth, employment, and economics.	Onshore development would continue in accordance with local government land use plans and regulations.
Land disturbance: Onshore, land use changes	New development or redevelopment would result in changes in land use in accordance with local government land use plans and regulations.	Ongoing and future development and redevelopment is anticipated to reinforce existing land use patterns, based on local government planning documents.

hazmat = hazardous materials; met = meteorological

Table F1-12 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Marine Mammals

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-22 for a quantitative analysis of these risks. Ongoing releases are frequent/chronic. Marine mammal exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality or sublethal effects on the individual fitness, including adrenal effects, hematological effects, liver effects lung disease, poor body condition, skin lesions, and several other health affects attributed to oil exposure (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008; Smith et al. 2017; Sullivan et al. 2019; Takeshita et al. 2017). Additionally, accidental releases may result in impacts on marine mammals due to effects on prey species (Table F1-11).	See Table F1-22 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 35 years would increase the risk of accidental releases. Marine mammal exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality or sublethal effects on the individual fitness, including adrenal effects, hematological effects, liver effects lung disease, poor body condition, skin lesions, and several other health affects attributed to oil exposure (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008; Smith et al. 2017; Sullivan et al. 2019; Takeshita et al. 2017). Additionally, accidental releases may result in impacts on marine mammals due to effects on prey species (Table F1-11).

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Trash and debris	Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying, and debris carried in river outflows or windblown from onshore. Accidental releases of trash and debris are expected to be low quantity, local, and low-impact events. Worldwide 62 of 123 (50.4%) marine mammal species have been documented ingesting marine litter (Werner et al. 2016). Stranding data indicate potential debris induced mortality rates of 0 to 22%. Mortality has been documented in cases of debris interactions, as well as blockage of the digestive track, disease, injury, and malnutrition (Baulch and Perry 2014). However, it is difficult to link physiological effects to individuals to population level impacts (Browne et al. 2015).	As population and vessel traffic increase gradually over the next 35 years, accidental release of trash and debris may increase. Trash and debris may continue to be accidentally released through fisheries use and other offshore and onshore activities. There may also be a long-term risk from exposure to plastics and other debris in the ocean. Worldwide 62 of 123 (50.4%) of marine mammal species have been documented ingesting marine litter (Werner et al. 2016). Mortality has been documented in cases of debris interacts, as well as blockage of the digestive track, disease, injury, and malnutrition (Baulch and Perry 2014).
EMF	EMFs emanate constantly from installed telecommunication and electrical power transmission cables. Marine mammals appear to have a detection threshold for magnetic intensity gradients (i.e., changes in magnetic field levels with distance) of 0.1% of the earth's magnetic field or about 0.05 μT (Kirschvink 1990) and are thus likely to be very sensitive to minor changes in magnetic fields (Walker et al. 2003). There is a potential for animals to react to local variations of the geomagnetic field caused by power cable EMFs. Depending on the magnitude and persistence of the confounding magnetic field, such an effect could cause a trivial temporary change in swim direction or a longer detour during the animal's migration (Gill et al. 2005). Such an effect on marine mammals is more likely to occur with direct current cables than with AC cables (Normandeau et al. 2011). However, there are numerous transmission cables installed across the seafloor and no impacts on marine mammals have been demonstrated from this source of EMF.	During operation, future new cables would produce EMF. Submarine power cables in the marine mammal geographic analysis area are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF to low levels. EMF of any two sources would not overlap. Although the EMF would exist as long as a cable was in operation, impacts, if any, would likely be difficult to detect, if they occur at all. Marine mammals have the potential to react to submarine cable EMF; however, no effects from the numerous submarine cables have been observed. Furthermore, this IPF would be limited to extremely small portions of the areas used by migrating marine mammals. As such, exposure to this IPF would be low, and as a result impacts on marine mammals would not be expected.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Cable emplacement and maintenance	Cable maintenance activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances will be local and generally limited to the emplacement corridor. Data are not available regarding marine mammal avoidance of localized turbidity plumes; however, Todd et al. (Todd et al. 2015) suggest that since some marine mammals often live in turbid waters and some species of mysticetes and sirenians employ feeding methods that create sediment plumes, some species of marine mammals have a tolerance for increased turbidity. Similarly, McConnell et al. (McConnell et al. 1999) documented movements and foraging of grey seals in the North Sea. One tracked individual was blind in both eyes, but otherwise healthy. Despite being blind, observed movements were typical of the other study individuals, indicating that visual cues are not essential for grey seal foraging and movement (McConnell et al. 1999). If elevated turbidity caused any behavioral responses such as avoiding the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any impacts would be temporary and short term. Turbidity associated with increased sedimentation may result in temporary, short-term impacts on marine mammal prey species (Table F1-11).	The impact on water quality from accidental sediment suspension during cable emplacement is temporary and short term. If elevated turbidity caused any behavioral responses such as avoidance of the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any negative impacts would be temporary and short term. Turbidity associated with increased sedimentation may result in temporary, short-term impacts on some marine mammal prey species (Table F1-11).

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: Aircraft	Aircraft routinely travel in the marine mammal geographic analysis area. With the possible exception of rescue operations, no ongoing aircraft flights would occur at altitudes that would elicit a response from marine mammals. If flights are at a sufficiently low altitude, marine mammals may respond with behavioral changes, including short surface durations, abrupt dives, and percussive behaviors (i.e., breaching and tail slapping) (Patenaude et al. 2002). These brief responses would be expected to dissipate once the aircraft has left the area. Similarly, aircraft have the potential to disturb hauled-out seals if aircraft overflights occur within 2,000 feet (610 meters) of a haul out area (Efroymson et al. 2000). However, this disturbance would be temporary, short-term, and result in minimal energy expenditure. These brief responses would be expected to dissipate once the aircraft has left the area.	Future low altitude aircraft activities such as survey activities and navy training operations could result short-term responses of marine mammals to aircraft noise. If flights are at a sufficiently low altitude, marine mammals may respond with a behavior changes, including short surface durations, abrupt dives, and percussive behaviors (i.e., breaching and tail slapping) (Patenaude et al. 2002). These brief responses would be expected to dissipate once the aircraft has left the area.
Noise: G&G	Infrequent site characterization surveys and scientific surveys produce high-intensity impulsive noise around sites of investigation. These activities have the potential to result in high intensity, high consequence impacts, including auditory injuries, stress, disturbance, and behavioral responses, if present within the ensonified area (NOAA 2018). Survey protocols and underwater noise mitigation procedures are typically implemented to decrease the potential for any marine mammal to be within the area where sound levels are above relevant harassment thresholds associated with an operating sound source to reduce the potential for behavioral responses and injury (PTS/TTS) close to the sound source. The magnitude of effects, if any, is intrinsically related to many factors, including acoustic signal characteristics, behavioral state (e.g., migrating), biological condition, distance from the source, duration and level of the sound exposure, as well as environmental and physical conditions that affect acoustic propagation (NOAA 2018).	Same as ongoing activities, with the addition of possible future oil and gas exploration surveys. Exploratory oil and gas surveys are anticipated to occur infrequently over the next 35 years.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: Turbines	Marine mammals would be able to hear the continuous underwater noise of operational WTGs. As measured at the Block Island Wind Facility, this low frequency noise barely exceeds ambient levels at 164 feet (50 meters) from the WTG base. Based on the results of Thomsen et al. (Thomsen et al. 2015) and Kraus et al. (Kraus et al. 2016), SPLs would be expected to be at or below ambient levels at relatively short distances from the WTG foundations.	This sub-IPF does not apply to future non-offshore wind development.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can result in high-intensity, low-exposure level, long-term, but localized intermittent risk to marine mammals. Impacts would be localized in nearshore waters. Pile driving activities may negatively affect marine mammals during foraging, orientation, migration, predator detection, social interactions, or other activities (Southall et al. 2007). Noise exposure associated with pile-driving activities can interfere with these functions and have the potential to cause a range of responses, including insignificant behavioral changes, avoidance of the ensonified area, PTS, harassment, and ear injury, depending on the intensity and duration of the exposure. BOEM assumes that all ongoing and potential future activities will be conducted in accordance with a project-specific IHA to minimize impacts on marine mammals.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Noise: Cable emplacement and maintenance	Noise from cable laying could periodically occur in the analysis area.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: Vessels	Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, scientific and academic research vessels, as well as other construction vessels. The frequency range for vessel noise falls within marine mammals' known range of hearing and would be audible. Noise from vessels presents a long-term and widespread impact on marine mammals across in most oceanic regions. While vessel noise may have some effect on marine mammal behavior, it would be expected to be limited to brief startle and temporary stress response. Results from studies on acoustic impacts from vessel noise on odontocetes indicate that small vessels at a speed of 5 knots in shallow coastal water can reduce the communication range for bottlenose dolphins within 164 feet (50 meters) of the vessel by 26% (Jensen et al. 2009). Pilot whales in a quieter, deep-water habitat could experience a 50% reduction in communication range from a similar size boat and speed (Jensen et al. 2009). Since lower frequencies propagate farther away from the sound source compared to higher frequencies, LFCs are at a greater risk of experiencing Level B Harassment produced by vessel traffic.	Any offshore projects that require the use of ocean vessels could potentially result in long term but infrequent impacts on marine mammals, including temporary startle responses, masking of biologically relevant sounds, physiological stress, and behavioral changes. However, BOEM expects that these brief responses of individuals to passing vessels would be unlikely given the patchy distribution of marine mammals and no stock or population level effects would be expected.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Port expansion activities are localized to nearshore habitats, and are expected to result in temporary, short-term impacts, if any, on marine mammals. Vessel noise may affect marine mammals, but response would be expected to be temporary and short-term (see Vessels: Noise sub-IPF above). The impacts on water quality from sediment suspension during port expansion activities is temporary, short-term, and would be similar to those described under the New cable emplacement/maintenance IPF above.	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. In addition, the general trend along the coastal region from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require port modifications. Future channel deepening activities are being undertaken to accommodate deeper-draft vessels for the Panama Canal Locks. The additional traffic and larger vessels could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. The increased sediment suspension could be long-term depending on the vessel traffic increase. Certain types of vessel traffic have increased recently (e.g. ferry use and cruise industry) and may continue to increase in the foreseeable future. Additional impacts associated with the increased risk of vessel strike could also occur (see the Traffic: Vessel collisions sub-IPF below).
Presence of structures: Entanglement or ingestion of lost fishing gear	There are more than 130 artificial reefs in the Mid-Atlantic region. This sub-IPF may result in long-term, high intensity impacts, but with low exposure due to localized and geographic spacing of artificial reefs, long-term. Currently bridge foundations and the Block Island Wind Facility may be considered artificial reefs and may have higher levels of recreational fishing, which increases the chances of marine mammals encountering lost fishing gear, resulting in possible ingestions, entanglement, injury, or death of individuals (Moore and van der Hoop 2012), if present nearshore where these structures are located. There are very few, if any, areas within the OCS geographic analysis area for marine mammals that would serve to concentrate recreational fishing and increase the likelihood that marine mammals would encounter lost fishing gear.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Habitat conversion and prey aggregation	There are more than 130 artificial reefs in the Mid-Atlantic region. Hard-bottom (scour control and rock mattresses) and vertical structures (bridge foundations and Block Inland Wind Facility WTGs) in a soft-bottom habitat can create artificial reefs, thus inducing the “reef” effect (Taormina et al. 2018; NMFS 2015). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans (Taormina et al. 2018), providing a potential increase in available forage items and shelter for seals and small odontocetes compared to the surrounding soft-bottoms.	The presence of structures associated with non-offshore wind development in near shore coastal waters have the potential to provide habitat for seals and small odontocetes as well as preferred prey species. This “reef effect” has the potential to result in long term, low-intensity benefits. Bridge foundations will continue to provide foraging opportunities for seals and small odontocetes with measurable benefits to some individuals. Hard-bottom (scour control and rock mattresses used to bury the offshore export cables) and vertical structures (i.e., WTG and OSS foundations) in a soft-bottom habitat can create artificial reefs, thus inducing the “reef effect” (Taormina et al. 2018; Causon and Gill 2018). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans (Taormina et al. 2018), providing a potential increase in available forage items and shelter for marine mammals compared to the surrounding soft-bottoms.
Presence of structures: Avoidance/ displacement	No ongoing activities in the marine mammal geographic analysis area beyond offshore wind facilities are measurably contributing to this sub-IPF. There may be some impacts resulting from the existing Block Island Wind Facility, but given that there are only 5 WTGs, no measurable impacts are occurring.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Behavioral disruption - breeding and migration	No ongoing activities in the marine mammal geographic analysis area beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Displacement into higher risk areas (vessels and fishing)	No ongoing activities in the marine mammal geographic analysis area beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Traffic: Vessel collisions	Current activities that are contributing to this sub-IPF include port traffic levels, fairways, TSS, commercial vessel traffic, recreational and fishing activity, and scientific and academic vessel traffic. Vessel strike is relatively common with cetaceans (Kraus et al. 2005) and one of the primary causes of death to NARWs with as many as 75% of known anthropogenic mortalities of NARWs likely resulting from collisions with large ships along the U.S. and Canadian eastern seaboard (Kite-Powell et al. 2007). Marine mammals are more vulnerable to vessel strike when they are within the draft of the vessel and when they are beneath the surface and not detectable by visual observers. Some conditions that make marine mammals less detectable include weather conditions with poor visibility (e.g., fog, rain, and wave height) or nighttime operations. Vessels operating at speeds exceeding 10 knots have been associated with the highest risk for vessel strikes of NARWs (Vanderlaan and Taggart 2007). Reported vessel collisions with whales show that serious injury rarely occurs at speeds below 10 knots (Laist et al. 2001). Data show that the probability of a vessel strike increases with the velocity of a vessel (Pace and Silber 2005; Vanderlaan and Taggart 2007).	Vessel traffic associated with non-offshore wind development has the potential to result in an increased collision risk. While these impacts would be high consequence, the patchy distribution of marine mammals makes stock or population-level effects unlikely (Navy 2018).
Climate change: Warming and sea level rise, storm severity/frequency	Increased storm frequency could result in increased energetic costs for marine mammals and reduced fitness, particularly for juveniles, calves and pups.	No future activities were identified within the geographic analysis area for marine mammals other than ongoing activities.
Climate change: Ocean acidification	This sub-IPF has the potential to lead to long-term, high-consequence impacts on marine ecosystems by contributing to reduced growth or the decline of invertebrates that have calcareous shells.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	This sub-IPF has the potential to lead to long-term, high-consequence impacts on marine mammals as a result of changes in distribution, reduced breeding, and/or foraging habitat availability, and disruptions in migration.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Climate change: Warming and sea level rise, altered migration patterns	This sub-IPF has the potential to lead to long-term, high-consequence impacts on marine mammal habitat use and migratory patterns. For example, the NARW appears to be migrating differently and feeding in different areas in response to changes in prey densities related to climate change (Record et al. 2019; MacLeod 2009; Nunny and Simmonds 2019).	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, increased disease frequency	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the frequencies of various diseases of marine mammals, such as Phocine distemper. Climate change is clearly influencing infectious disease dynamics in the marine environment; however, no studies have shown a definitive causal relationship between any components of climate change and increases in infectious disease among marine mammals. This is due in large part to a lack of sufficient data and to the likely indirect nature of climate change's impact on these diseases. Climate change could potentially affect the incidence or prevalence of infection, the frequency or magnitude of epizootics, and/or the severity or presence of clinical disease in infected individuals. There are a number of potential proposed mechanisms by which this might occur (see summary in Burge et al. 2014 Climate Change Influences on Marine Infectious Diseases: Implications for Management and Society).	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, storm severity/frequency, sediment erosion, deposition	Increased storm frequency could result in increased energetic costs for marine mammals, reduced fitness, particularly for juveniles, calves and pups. Erosion could impact seal haul outs reducing their habitat availability, especially as things like sea walls are added, blocking seals access to shore.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.

μT = microtesla; AC = alternating current; hazmat = hazardous materials; IHA = Incidental Harassment Authorization

Table F1-13 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Navigation and Vessel Traffic

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Anchoring	Larger commercial vessels (specifically tankers) sometimes anchor outside of major ports to transfer their cargo to smaller vessels for transport into port, an operation known as lightering. These anchors have deeper ground penetration and are under higher stresses. Smaller vessels (commercial fishing or recreational vessels) would anchor for fishing and other recreational activities. These activities cause temporary to short-term impacts on navigation in the immediate anchorage area. All vessels may anchor in an emergency scenario (such as power loss) if they lose power to prevent them from drifting and creating navigational hazards for other vessels or drifting into structures.	Lightering and anchoring operations are expected to continue at or near current levels, with the expectation of moderate increase commensurate with any increase in tankers visiting ports. Deep-draft visits to major port visits are expected to increase as well, increasing the potential for an emergency need to anchor, creating navigational hazards for other vessels. Recreational activity and commercial fishing activity would likely stay largely the same related to this IPF.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Impacts from these activities would be short term and could include congestion in ports, delays, and changes in port usage by some fishing or recreational vessel operators.	Ports would need to perform maintenance and perform upgrades to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size. Impacts would be short term and could include congestion in ports, delays, and changes in port usage by some fishing or recreational vessel operators.
Presence of structures: Allisions	An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. There are two types of allisions that occur: drift and powered. A drift allision generally occurs when a vessel is powered down due to operator choice or power failure. A powered allision generally occurs when an operator fails to adequately control their vessel movements or is distracted.	Although there are some exceptions (ferry traffic and cruise ships), BOEM expects vessel traffic to remain relatively steady into the reasonably foreseeable future (BOEM 2019:57). Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Fish aggregation	Items in the water, such as ghost fishing gear, buoys, and energy platform foundations can create an artificial reef effect, aggregating fish. Recreational and commercial fishing can occur near the artificial reefs. Recreational fishing is more popular than commercial near artificial reefs as commercial mobile fishing gear can risk snagging on the artificial reef structure.	Fishing near artificial reefs is not expected to change meaningfully over the next 35 years.
Presence of structures: Habitat conversion	Equipment in the ocean can create a substrate for mollusks to attach to, and fish eggs to settle near. This can create a reef-like habitat and benefit structure-oriented species on a constant basis.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Migration disturbances	Noise-producing activities, such as pile driving and vessel traffic, may interfere and adversely affect marine mammals during foraging, orientation, migration, response to predators, social interactions, or other activities. Marine mammals may also be sensitive to changes in magnetic field levels. The presence of structures and operational noise could cause mammals to avoid areas.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions. When multiple vessels need to navigate around a structure, then navigation is made more complex, as the vessels need to avoid both the structure and each other.	Although there are some exceptions (ferry traffic and cruise ships), BOEM expects vessel traffic to remain relatively steady into the reasonably foreseeable future (BOEM 2019:57). Even with increased port visits by deep-draft vessels, this is still a relatively small effect when considering the whole of Atlantic Coast vessel traffic. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space-use conflicts	Currently, the offshore area is occupied by marine trade, stationary and mobile fishing, and survey activities.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Cable infrastructure	See IPF for Anchoring.	See IPF for Anchoring.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
New cable emplacement/ maintenance	Within the geographic analysis area for navigation and vessel traffic, existing cables may require access for maintenance activities. Infrequent cable maintenance activities may cause temporary increases in vessel traffic and navigational complexity.	Future new cables would cause temporary increases in vessel traffic during installation or maintenance, resulting in infrequent, localized, short-term impacts over the next 35 years. Care would need to be taken by vessels that are crossing the cable routes during these activities.
Traffic: Aircraft	USCG SAR helicopters are the main aircraft that may be flying at low enough heights to risk interaction with WTGs. USCG SAR aircraft need to fly low enough that they can spot objects in the water.	SAR operations could be expected to increase with any increase in vessel traffic. However, as vessel traffic volume is not expected to increase appreciably, neither should SAR operations. Final EIS Section 3.16 provides a discussion of navigation impacts on fishing vessel traffic.
Traffic: Vessels	See the sub-IPF for Presence of structures: Navigation hazard.	See the sub-IPF for Presence of structures: Navigation hazard.
Traffic: Vessels, collisions	See the sub-IPF for Presence of structures: Navigation hazard.	See the sub-IPF for Presence of structures: Navigation hazard.

Table F1-14 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Military and National Security Uses

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Allisions	Existing stationary facilities that present allision risks include buoys that are used to mark inlet approaches, channels, and shoals (NOAA 2021), dock facilities, meteorological buoys associated with offshore wind lease areas, and other offshore or shoreline-based structures.	No additional non-offshore wind stationary structures were identified within the geographic analysis area. Stationary structures such as private or commercial docks may be added close to the shoreline.
Presence of structures: Fish aggregation	No existing stationary structures that would act as FADs were identified within the geographic analysis area.	No future non-offshore wind additional stationary structures that would act as FADs were identified within the geographic analysis area.
Presence of structures: Navigation hazard	Existing stationary facilities within the geographic analysis area that present navigational hazards include buoys that are used to mark inlet approaches, channels, and shoals (NOAA 2021), dock facilities, meteorological buoys associated with offshore wind lease areas, and other offshore or shoreline-based structures.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore, development activities are anticipated to continue with additional proposed communications towers and onshore commercial, industrial, and residential developments.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Space-use conflicts	Existing stationary facilities within the geographic analysis area that could present a space-use conflict include onshore wind turbines, communication towers, and other onshore commercial, industrial, and residential structures.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore, development activities are anticipated to continue with additional proposed communications towers and onshore commercial, industrial, and residential developments.
Presence of structures: Cable infrastructure	Existing submarine cables cross cumulative lease areas.	Submarine cables would remain in current locations with infrequent maintenance continuing along those cable routes for the foreseeable future.
Traffic: Vessels	Current vessel traffic in the region is described in Final EIS Section 3.16. Vessel activities associated with offshore wind in the cumulative lease areas is currently limited to site assessment surveys.	Continued vessel traffic in the region, as described in Final EIS Section 3.16.
Traffic: Vessels, collisions	Current vessel traffic in the region is described in Final EIS Section 3.16. Vessel activities associated with offshore wind in the cumulative lease areas is currently limited to site assessment surveys.	Continued vessel traffic in the region is described in Final EIS Section 3.16.

FAD = fish aggregating device

Table F1-15 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Aviation and Air Traffic

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Towers	Existing aboveground stationary facilities within the geographic analysis area that present aviation hazards include onshore wind turbines, communication towers, dock facilities, and other onshore structures exceeding 200 feet in height.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore development activities are anticipated to continue with additional proposed communications towers.
Presence of structures: Space-use conflicts	Existing aboveground stationary facilities within the geographic analysis area that could cause space-use conflicts for aircraft include onshore wind turbines, communication towers, and other onshore structures exceeding 200 feet in height.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore, development activities are anticipated to continue with additional proposed communications towers.

Table F1-16 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Cables and Pipelines

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Allisions and navigation hazards	Structures within and near the geographic analysis area that pose potential allision hazards include buoys that are used to mark inlet approaches, channels, and shoals, meteorological buoys associated with offshore wind lease areas, and shoreline developments such as docks, ports, and other commercial, industrial, and residential structures.	Reasonably foreseeable non-offshore wind structures that could affect submarine cables have not been identified in the geographic analysis area.
Presence of structures: Space-use conflicts	Existing submarine cables cross cumulative lease areas and create potential space-use conflicts with marine mineral and sand borrow areas.	Reasonably foreseeable non-offshore wind structures that could create space-use conflicts with submarine cables have not been identified in the geographic analysis area.
Presence of structures: Cable infrastructure	Existing submarine cables cross cumulative lease areas.	Reasonably foreseeable non-offshore wind structures have not been identified in the geographic analysis area.

Table F1-17 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Radar Systems

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Towers	Wind developments in the direct line-of-sight with, or extremely close to, radar systems can cause clutter and interference. Existing wind developments in the area include the Jersey-Atlantic Wind Farm in Atlantic City, New Jersey.	Reasonably foreseeable non-offshore wind structures proposed for construction in the lease areas that could affect radar systems have not been identified.

Table F1-18 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Scientific Research and Surveys

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Navigation hazards	Stationary structures are limited in the open ocean environment of the geographic analysis area, and include met buoys associated with site assessment activities, the five Block Island Wind Farm WTGs, and the two CVOW WTGs.	Reasonably foreseeable non-offshore wind activities would not implement stationary structures within the open ocean environment that would pose navigational hazards and raise the risk of allisions for survey vessels and collisions for survey aircraft.

CVOW = Coastal Virginia Offshore Wind; met = meteorological

Table F1-19 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Recreation and Tourism

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Anchoring	Anchoring occurs due to ongoing military, survey, commercial, and recreational activities.	Impacts from anchoring would continue, and may increase due to offshore military operations, survey activities, commercial vessel traffic, and/or recreational vessel traffic. Modest growth in vessel traffic could increase the temporary, localized impacts of navigational hazards, increased turbidity levels, and potential for direct contact causing mortality of benthic resources.
Light: Vessels	Ocean vessels have an array of lights including navigational lights and deck lights.	Anticipated modest growth in vessel traffic would result in some growth in the nighttime traffic of vessels with lighting.
Light: Structures	Offshore buoys and towers emit low-intensity light. Onshore structures, including houses and ports, emit substantially more light on an ongoing basis.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances would be local and limited to emplacement corridors.	Cable maintenance or replacement of existing cables in the geographic analysis area would occur infrequently and would generate short-term disturbances.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. These disturbances are temporary, local, and extend only a short distance beyond the work area.	No future activities were identified within the recreation and tourism geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: Cable laying/ trenching	Offshore trenching occurs periodically in connection with cable installation or sand and gravel mining.	No future activities were identified within the recreation and tourism geographic analysis area other than ongoing activities.
Noise: Vessels	Vessel noise occurs offshore and more frequently near ports and docks. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Vessel noise is anticipated to continue at or near current levels.	Planned new barge routes and dredging disposal sites would generate vessel noise when implemented. The number and location of such routes are uncertain.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance.	Ports would need to perform maintenance and upgrade facilities over the next 35 years to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Port utilization: Maintenance/ dredging	Periodic maintenance is necessary for harbors within the analysis area.	Ongoing maintenance and dredging of harbors within the geographic analysis area will continue as needed. No specific projects are known.
Presence of structures: Allisions	An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. The likelihood of allisions is expected to continue at or near current levels.	Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures.	No future activities were identified within the recreation and tourism geographic analysis area other than ongoing activities.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented fishes are attracted to these locations. Recreational and commercial fishing can occur near these aggregation locations, although recreational fishing is more popular, because commercial mobile fishing gear is more likely to snag on structures.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Habitat conversion	Structures, including foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented species thus benefit on a constant basis.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions, especially in nearshore areas. This navigation becomes more complex when multiple vessels must navigate around a structure, because vessels need to avoid both the structure and each other.	Vessel traffic, overall, is not expected to meaningfully increase over the next 35 years. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space-use conflicts	Current structures do not result in space-use conflicts.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Viewshed	The only existing offshore structures within the viewshed of the Project are minor features such as buoys.	Non-offshore wind structures that could be viewed in conjunction with the offshore components of the Project would be limited to meteorological towers. Marine activity would also occur within the marine viewshed.
Traffic: Vessels	Geographic analysis area ports and marine traffic related to shipping, fishing, and recreation are important to the region's economy. No substantial changes are anticipated to existing vessel traffic volumes.	New vessel traffic near the geographic analysis area would be generated by proposed barge routes and dredging demolition sites over the next 35 years. Marine commerce and related industries would continue to be important to the geographic analysis area economy.
Traffic: Vessel collisions	The region's substantial marine traffic may result in occasional vessel collisions, which would result in costs to the vessels involved. The likelihood of collisions is expected to continue at or near current rates.	An increased risk of collisions is not anticipated from future activities.

Table F1-20 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Sea Turtles

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-22 for a quantitative analysis of these risks. Ongoing releases are frequent and chronic. Sea turtle exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality (Shigenaka et al. 2010) or sublethal effects on individual fitness, including adrenal effects, dehydration, hematological effects, increased disease incidence, liver effects, poor body condition, skin effects, skeletomuscular effects, and several other health effects that can be attributed to oil exposure (Camacho et al. 2013; Bembenek-Bailey et al. 2019; Mitchelmore et al. 2017; Shigenaka et al. 2010; Vargo et al. 1986). Additionally, accidental releases may result in impacts on sea turtles due to effects on prey species (Table F1-11).	See Table F1-22 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 35 years would increase the risk of accidental releases. Sea turtle exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality (Shigenaka et al. 2010; Wallace et al. 2010) or sublethal effects on individual fitness, including adrenal effects, dehydration, hematological effects, increased disease incidence, liver effects, poor body condition, skin effects, skeletomuscular effects, and several other health effects that can be attributed to oil exposure (Camacho et al. 2013; Bembenek-Bailey et al. 2019; Mitchelmore et al. 2017; Shigenaka et al. 2010; Vargo et al. 1986). Additionally, accidental releases may result in impacts on sea turtles due to effects on prey species (Table F1-11).

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Trash and debris	Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities, cables, lines, and pipeline laying, as well as debris carried in river outflows or windblown from onshore. Accidental releases of trash and debris are expected to be low quantity, local, and low-impact events. Direct ingestion of plastic fragments is well documented and has been observed in all species of sea turtles (Bugoni et al. 2001; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). In addition to plastic debris, ingestion of tar, paper, Styrofoam™, wood, reed, feathers, hooks, lines, and net fragments have also been documented (Thomás et al. 2002). Ingestion can also occur when individuals mistake debris for potential prey items (Gregory 2009; Hoarau et al. 2014; Thomás et al. 2002). Potential ingestion of marine debris varies among species and life history stages due to differing feeding strategies (Nelms et al. 2016). Ingestion of plastics and other marine debris can result in both lethal and sublethal impacts on sea turtles, with sublethal effects more difficult to detect (Gall and Thompson 2015; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). Long-term sublethal effects may include dietary dilution, chemical contamination, depressed immune system function, poor body condition, as well as reduced growth rates, fecundity, and reproductive success. However, these effects are cryptic and clear causal links are difficult to identify (Nelms et al. 2016).	Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying, and debris carried in river outflows or windblown from onshore. Accidental releases of trash and debris are expected to be low quantity, local, and low-impact events. Direct and indirect ingestion of plastic fragments and other marine debris is well documented and has been observed in all species of sea turtles (Bugoni et al. 2001; Gregory 2009; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014; Thomás et al. 2002). Ingestion can result in both lethal and sublethal impacts on sea turtles, with sublethal effects more difficult to detect (Gall and Thompson 2015; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). However, these effects are cryptic and clear causal links are difficult to identify (Nelms et al. 2016).

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
EMF	EMFs emanate constantly from installed telecommunication and electrical power transmission cables. Sea turtles appear to have a detection threshold of magnetosensitivity and behavioral responses to field intensities ranging from 0.0047 to 4000 μT for loggerhead turtles, and 29.3 to 200 μT for green turtles, with other species likely similar due to anatomical, behavioral, and life history similarities (Normandeau et al. 2011). Juvenile or adult sea turtles foraging on benthic organisms may be able to detect magnetic fields while they are foraging on the bottom near the cables and up to potentially 82 feet (25 meters) in the water column above the cable. Juvenile and adult sea turtles may detect the EMF over relatively small areas near cables (e.g., when resting on the bottom or foraging on benthic organisms near cables or concrete mattresses). There are no data on impacts on sea turtles from EMFs generated by underwater cables, although anthropogenic magnetic fields can influence migratory deviations (Luschi et al. 2007; Snoek et al. 2016). However, any potential impacts from AC cables on turtle navigation or orientation would likely be undetectable under natural conditions, and thus would be insignificant (Normandeau et al. 2011).	During operations, future new cables would produce EMF. Submarine power cables in the geographic analysis area for sea turtles are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF to low levels. (Section 5.2.7 of BOEM’s 2007 Final Programmatic EIS for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf.) EMF of any two sources would not overlap. Although the EMF would exist as long as a cable was in operation, impacts, if any, would likely be difficult to detect, if they occur at all. Furthermore, this IPF would be limited to extremely small portions of the areas used by resident or migrating sea turtles. As such, exposure to this IPF would be low, and as a result, impacts on sea turtles would not be expected.
Light: Vessels	Ocean vessels such as ongoing commercial vessel traffic, recreational and fishing activity, scientific and academic research traffic have an array of lights including navigational, deck lights, and interior lights. Such lights have some limited potential to attract sea turtles, although the impacts, if any, are expected to be localized and temporary.	Construction, operations, and decommissioning vessels associated with non-offshore wind activities produce temporary and localized light sources that could result in the attraction or avoidance behavior of sea turtles. These short-term impacts are expected to be of low intensity and occur infrequently.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Light: Structures	Artificial lighting on nesting beaches or in nearshore habitats has the potential to result in disorientation to nesting females and hatchling turtles. Artificial lighting on the OCS does not appear to have the same potential for effects. Decades of oil and gas platform operation in the Gulf of Mexico, that can have considerably more lighting than offshore WTGs, has not resulted in any known impacts on sea turtles (BOEM 2019).	Non-offshore wind activities would not be expected to appreciably contribute to this sub-IPF. As such, no impact on sea turtles would be expected.
New cable emplacement/ maintenance	Cable maintenance activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances will be local and generally limited to the emplacement corridor. Data are not available regarding effects of suspended sediments on adult and juvenile sea turtles, although elevated suspended sediments may cause individuals to alter normal movements and behaviors. However, these changes are expected to be too small to be detected (NOAA 2020). Sea turtles would be expected to swim away from the sediment plume. Elevated turbidity is most likely to affect sea turtles if a plume causes a barrier to normal behaviors, but no impacts would be expected due to swimming through the plume (NOAA 2020). Turbidity associated with increased sedimentation may result in short-term, temporary impacts on sea turtle prey species (Table F1-11).	The impact on water quality from accidental sediment suspension during cable emplacement is short-term and temporary. If elevated turbidity caused any behavioral responses such as avoidance of the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any impacts would be short-term and temporary. Turbidity associated with increased sedimentation may result in short-term, temporary impacts on some sea turtle prey species (Table F1-11).
Noise: Aircraft	Aircraft routinely travel in the geographic analysis area for sea turtles. With the possible exception of rescue operations, no ongoing aircraft flights would occur at altitudes that would elicit a response from sea turtles. If flights are at a sufficiently low altitude, sea turtles may respond with a startle response (diving or swimming away), altered submergence patterns, and a temporary stress response (NSF and USGS 2011; Samuel et al. 2005). These brief responses would be expected to dissipate once the aircraft has left the area.	Future low-altitude aircraft activities such as survey activities and navy training operations could result in short-term responses of sea turtles to aircraft noise. If flights are at a sufficiently low altitude, sea turtles may respond with a startle response (diving or swimming away), altered submergence patterns, and a temporary stress response (NSF and USGS 2011; Samuel et al. 2005). These brief responses would be expected to dissipate once the aircraft has left the area.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: G&G	Infrequent site characterization surveys and scientific surveys produce high-intensity impulsive noise around sites of investigation. These activities have the potential to result in some impacts including potential auditory injuries, short-term disturbance, behavioral responses, and short-term displacement of feeding or migrating sea turtles, if present within the ensonified area (NSF and USGS 2011). The potential for PTS and TTS is considered possible in proximity to G&G surveys utilizing air guns, but impacts are unlikely as turtles would be expected to avoid such exposure and survey vessels would pass quickly (NSF and USGS 2011). No significant impacts would be expected at the population level.	Same as ongoing activities, with the addition of possible future oil and gas exploration surveys.
Noise: Turbines	Available evidence suggests that typical underwater noise levels from operating WTGs would be below current cumulative injury and behavioral effect thresholds for sea turtles. Operating turbines were determined to produce underwater noise on the order of 110 to 125 dB_{RMS}, occasionally reaching as high as 128 dB_{RMS}, in the 10-Hz to 8-kilohertz range (Tougaard et al. 2020). As measured at the Block Island Wind Facility, low frequency operational noise barely exceeds ambient levels at 164 feet (50 meters) from the WTG base (Miller and Potty 2017). Operational noise impacts would be expected to be negligible.	This sub-IPF does not apply to future non-offshore wind development.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can result in high intensity, low exposure levels, and long-term, but localized intermittent risk to sea turtles. Impacts, potentially including behavioral responses, masking, TTS, and PTS, would be localized in nearshore waters. Data regarding threshold levels for impacts on sea turtles from sound exposure during pile driving are very limited, and no regulatory threshold criteria have been established for sea turtles. Based on current literature, the following thresholds are used to assess impacts on turtles: Potential mortal injury: 210 dB cumulative SPL or greater than 207 dB peak SPL (Popper et al. 2014) Potential mortal injury: 204 dB_{SEL}, 232 dB_{PEAK} (PTS), 189 dB_{SEL}, 226 dB_{PEAK} (TTS) (Navy 2017) Behavioral harassment: 175 dB referenced to 1 μPa RMS (Navy 2017)	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Noise: Vessels	The frequency range for vessel noise (10 to 1000 Hz; MMS 2007) overlaps with sea turtles' known hearing range (less than 1,000 Hz with maximum sensitivity between 200 to 700 Hz; Bartol 1994) and would therefore be audible. However, Hazel et al. (Hazel et al. 2007) suggests that sea turtles' ability to detect approaching vessels is primarily vision-dependent, not acoustic. Sea turtles may respond to vessel approach and/or noise with a startle response (diving or swimming away) and a temporary stress response (NSF and USGS 2011). Samuel et al. (Samuel et al. 2005) indicated that vessel noise could have an effect on sea turtle behavior, especially their submergence patterns.	Any offshore projects that require the use of ocean vessels could potentially result in long-term but infrequent impacts on sea turtles, including temporary startle responses, masking of biologically relevant sounds, physiological stress, and behavioral changes, especially their submergence patterns (NSF and USGS 2011; Samuel et al. 2005). However, BOEM expects that these brief responses of individuals to passing vessels would be unlikely given the patchy distribution of sea turtles and no stock or population level effects would be expected.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Port expansion activities are localized to nearshore habitats, and are expected to result in short-term, temporary impacts, if any, on sea turtles. Vessel noise may affect sea turtles, but response would be expected to be short-term and temporary (see the Vessels: Noise sub-IPF above). The impact on water quality from sediment suspension during port expansion activities is short-term, temporary, and would be similar to those described under the New cable emplacement/maintenance IPF above.	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. In addition, the general trend along the coastal region from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require port modifications. Future channel deepening activities are being undertaken to accommodate deeper-draft vessels for the Panama Canal Locks. The additional traffic and larger vessels could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. The increased sediment suspension could be long-term depending on the vessel traffic increase. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future. Additional impacts associated with the increased risk of vessel strikes could also occur (see the Traffic: Vessel collisions sub-IPF below).
Presence of structures: Entanglement or ingestion of lost fishing gear	The Mid-Atlantic region has more than 130 artificial reefs. Currently bridge foundations and the Block Island Wind Facility may be considered artificial reefs and may have higher levels of recreational fishing, which increases the chances of sea turtles encountering lost fishing gear, resulting in possible ingestions, entanglement, injury, or death of individuals (Berreiros and Raykov 2014; Gregory 2009; Vegter et al. 2014) if present where these structures are located. At the scale of the OCS geographic analysis area for sea turtles, there are very few areas that would serve to concentrate recreational fishing and increase the likelihood that sea turtles would encounter lost fishing gear.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Presence of structures: Habitat conversion and prey aggregation	The Mid-Atlantic region has more than 130 artificial reefs. Hard-bottom (scour control and rock mattresses) and vertical structures (bridge foundations, Block Island Wind Facility WTGs, and two WTGs with the CVOW pilot project) in a soft-bottom habitat can create artificial reefs, thus inducing the reef effect (Taormina et al. 2018; NMFS 2015). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans (Taormina et al. 2018), providing a potential increase in available forage items and shelter for sea turtles compared to the surrounding soft-bottoms.	The presence of structures associated with non-offshore wind development in near-shore coastal waters has the potential to provide habitat for sea turtles as well as preferred prey species. This reef effect has the potential to result in long-term, low-intensity beneficial impacts. Bridge foundations will continue to provide foraging opportunities for sea turtles with measurable benefits to some individuals.
Presence of structures: Avoidance/ displacement	No ongoing activities in the geographic analysis area for sea turtles beyond offshore wind facilities are measurably contributing to this sub-IPF. There may be some impacts resulting from the existing Block Island Wind Facility (5 WTGs) and the CVOW pilot project (2 WTGs) but given the limited number of WTGs, no measurable impacts are occurring.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Behavioral disruption - breeding and migration	No ongoing activities in the geographic analysis area for sea turtles beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Displacement into higher risk areas (vessels and fishing)	No ongoing activities in the geographic analysis area for sea turtles beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Traffic: Vessel collisions	Current activities contributing to this sub-IPF include port traffic levels, fairways, TSS, commercial vessel traffic, recreational and fishing activity, and scientific and academic vessel traffic. Propeller and collision injuries from boats and ships are common in sea turtles. Vessel strike is an increasing concern for sea turtles, especially in the southeastern United States, where development along the coasts is likely to result in increased recreational boat traffic. In the United States, the percentage of strandings of loggerhead sea turtles that were attributed to vessel strikes increased from approximately 10% in the 1980s to a record high of 20.5% in 2004 (NMFS and USFWS 2007). Sea turtles are most susceptible to vessel collisions in coastal waters, where they forage from May through November. Vessel speed may exceed 10 knots in such waters, and evidence suggests that they cannot reliably avoid being struck by vessels exceeding 2 knots (Hazel et al. 2007).	Vessel traffic associated with non-offshore wind development has the potential to result in an increased collision risk. While these impacts would be high consequence, the patchy distribution of sea turtles makes stock or population-level effects unlikely (Navy 2018).
Climate change: Warming and sea level rise, storm severity/frequency	Increased storm frequency could lead to long-term, high-consequence impacts on sea turtle onshore beach nesting habitat, including changes to nesting periods, changes in sex ratios of nestlings, drowned nests, as well as loss or degradation of nesting beaches. Offshore impacts, including sedimentation of near-shore hard bottom habitats have the potential to result in long-term, high consequence changes to foraging habitat availability for green turtles.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Ocean acidification	This sub-IPF has the potential to lead to long-term, high-consequence impacts on marine ecosystems by contributing to reduced growth or the decline of invertebrates that have calcareous shells.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	This sub-IPF has the potential to lead to long-term, high-consequence impacts on sea turtles by influencing distributions of sea turtles and/or prey resources. This sub-IPF has the potential to lead to long-term, high-consequence impacts on sea turtle breeding, foraging, and sheltering habitat use.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Climate change: Warming and sea level rise, altered migration patterns	This sub-IPF has the potential to lead to long-term, high-consequence impacts on sea turtle habitat use and migratory patterns.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, disease frequency	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the frequencies of various diseases of sea turtles such as fibropapillomatosis.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, protective measures (barriers, sea walls)	The proliferation of coastline protections have the potential to result in long-term, high-consequence impacts on sea turtle nesting by eliminating or precluding access to potentially suitable nesting habitat or access to potentially suitable habitat.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, storm severity, frequency, sediment erosion, deposition	Sediment erosion and/or deposition in coastal waters have the potential to result in long-term, high-consequence impacts on green sea turtle foraging habitat. Additionally, sediment erosion has the potential to result in the degradation or loss of potentially suitable nesting habitat.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.

μT = microtesla; AC = alternating current; CVOW = Coastal Virginia Offshore Wind; dB_{RMS} = root-mean-square decibels; hazmat = hazardous materials

Table F1-21 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Scenic and Visual Resources

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat, suspended sediments, trash and debris	Ongoing offshore and onshore construction projects involve the use of vehicles, vessels, and equipment that contain fuel, fluids, and hazmat that have the potential for accidental release. Offshore and onshore construction can also result in sedimentation from land and seabed disturbance and accidental releases of trash and debris with associated visual impacts.	Future offshore and onshore construction projects have the potential to result in accidental releases from vehicles, vessels, and equipment that contain fuel, fluids, and hazmat. Future offshore and onshore construction could also result in sedimentation from land and seabed disturbance and accidental releases of trash and debris with associated visual impacts.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Land disturbance: Erosion and sedimentation, onshore construction, onshore land use changes	Onshore human-caused and naturally occurring erosion and sedimentation results from construction, maintenance, and weather events.	Ongoing onshore construction projects could generate noticeable disturbance in the landscape. Intensity and extent would vary depending on the location, type, and duration of activities.
Light: Offshore structures and vessels, onshore vehicles, roads, laydown, parking, facilities, equipment, and structures	Offshore vessels have an array of lights including navigational lights, deck lights, and interior lights. Various ongoing onshore and coastal construction projects have nighttime activities, as well as existing structures, facilities, and vehicles that would require nighttime lighting.	Ongoing onshore construction projects involving nighttime activity could generate nighttime lighting. Intensity and extent would vary depending on the location, type, direction, and duration of nighttime lighting.
Structures: Viewshed	Buoys are the only existing stationary structures within the offshore viewshed of the Project. Typically, buoys are visible only in the immediate foreground (less than 1 mile). Stationary and moving barges, boats, and ships also are visible in the daytime and nighttime viewsheds.	Onshore wind-related structures that could be viewed in conjunction with the offshore project components would be limited to meteorological towers, substations, and electrical transmission towers and conductors.
Traffic: Helicopters, vessels, vehicles	Ongoing activities contribute air, marine, and onshore traffic and visible congestion.	Planned onshore and offshore construction projects involving vessel, vehicle, and helicopter traffic could generate noticeable changes in the characteristic seascape and landscape and viewer experience. Intensity and extent of the changes would vary depending on the location, type, direction, and duration of the traffic.

Table F1-22 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Water Quality

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	Accidental releases of fuels and fluids occur during vessel usage for dredge material ocean disposal, fisheries use, marine transportation, military use, survey activities, and submarine cable lines, and pipeline laying activities. According to the DOE, 31,000 barrels of petroleum are spilled into U.S. waters from vessels and pipelines in a typical year. Approximately 40.5 million barrels of oil were lost as a result of tanker incidents from 1970 to 2009, according to International Tanker Owners Pollution Federation Limited, which collects data on oil spills from tankers and other sources. From 1990 to 1999, the average annual input to the coastal Northeast was 220,000 barrels of petroleum and into the offshore was < 70,000 barrels. Impacts on water quality would be expected to brief and localized from accidental releases.	Future accidental releases from offshore vessel usage, spills, and consumption will likely continue on a similar trend. Impacts are unlikely to affect water quality.
Accidental releases: Trash and debris	Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities, and cables, lines, and pipeline laying. Accidental releases of trash and debris are expected to be low probability events. BOEM assumes operator compliance with federal and international requirements for management of shipboard trash; such events also have a relatively limited spatial impact.	As population and vessel traffic increase gradually over the next 35 years, accidental release of trash and debris may increase. However, there does not appear to be evidence that the volumes and extents anticipated would have any effect on water quality.
Anchoring	Impacts from anchoring occur due to ongoing military use and survey, commercial, and recreational activities.	Impacts from anchoring may occur semi-regularly over the next 35 years due to offshore military operations or survey activities. These impacts would include increased seabed disturbance resulting in increased turbidity levels. All impacts would be localized, short term, and temporary.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
New cable emplacement/ maintenance	Elevated suspended sediment concentrations can occur under natural tidal conditions and increase during storms, trawling, and vessel propulsion. Survey activities, and new cable and pipeline laying activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances would be short-term and either be limited to the emplacement corridor or localized.	Suspension of sediments may continue to occur infrequently over the next 35 years due to survey activities, and submarine cable, lines, and pipeline-laying activities. Future new cables would occasionally disturb the seafloor and cause short-term increases in turbidity and minor alterations in localized currents resulting in local short-term impacts. If the cable routes enter the water quality geographic analysis area, short-term disturbance in the form of increased suspended sediment and turbidity would be expected.
Port utilization: Expansion	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. In addition, the general trend along the coastal region from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require port modifications, which, along with additional vessel traffic, could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. The increased sediment suspension could be long-term depending on the vessel traffic increase. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future.	The general trend along the coastal region from Virginia to Maine is that port activity will increase modestly over the next 35 years. Port modifications and channel deepening activities are being undertaken to accommodate the increase in vessel traffic and deeper-draft vessels that transit the Panama Canal Locks. The additional traffic and larger vessels could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future.
Presence of structures	The installation of onshore and offshore structures leads to alteration of local water currents. These disturbances would be local but, depending on the hydrologic conditions, have the potential to impact water quality through the formation of sediment plumes.	Impacts associated with the presence of structures includes temporary sediment disturbance during maintenance. This sediment suspension would lead to interim and localized impacts.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Discharges	Discharges impact water quality by introducing nutrients, chemicals, and sediments to the water. There are regulatory requirements related to prevention and control of discharges, the prevention and control of accidental spills, and the prevention and control of nonindigenous species.	Increased coastal development is causing increased nutrient pollution in communities. In addition, ocean disposal activity in the North and Mid-Atlantic is expected to gradually decrease or remain stable. Impacts of ocean disposal on water quality are minimized because USEPA has established dredge spoil criteria and regulate the disposal permits issued by USACE. The impact on water quality from sediment suspension during these future activities would be short-term and localized.
Land disturbance: Erosion and sedimentation	Ground disturbance activities may lead to un-vegetated or otherwise unstable soils. Precipitation events could potentially mobilize the soils into nearby surface waters, leading to potential erosion and sedimentation effects and subsequent increased turbidity.	Ground disturbance associated with construction and installation of onshore components could lead to un-vegetated or unstable soils. Precipitation events could mobilize these soils leading to erosion and sedimentation effects and turbidity. The impacts for future offshore wind through this IPF would be staggered in time and localized. The impacts would be short term and localized with an increased likelihood of impacts limited to onshore construction periods.
Land disturbance: Onshore construction	Onshore construction activities may lead to un-vegetated or otherwise unstable soils as well as soil contamination due to leaks or spills from construction equipment. Precipitation events could potentially mobilize the soils into nearby surface waters, leading to increased turbidity and alteration of water quality.	The general trend along coastal regions is that port activity will increase modestly in the future. This increase in activity includes expansion needed to meet commercial, industrial, and recreational demand. Modifications to cargo handling equipment and conversion of some undeveloped land to meet port demand would be required to receive the increase in larger ships.

DOE = U.S. Department of Energy; hazmat = hazardous materials

Table F1-23 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Wetlands

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Land disturbance: Erosion and sedimentation	Ground disturbance activities may lead to unvegetated or otherwise unstable soils. Precipitation events could potentially mobilize the soils into nearby wetlands, leading to potential erosion and sedimentation effects and subsequent increased turbidity.	Ground disturbance associated with construction and installation of onshore components could lead to unvegetated or unstable soils. Precipitation events could mobilize these soils, leading to erosion and sedimentation effects and turbidity. Impacts from future offshore wind activities through this IPF would be staggered in time and localized. The impacts would be short term and localized, with an increased likelihood of impacts limited to onshore construction periods.
Land disturbance: Onshore construction	Onshore construction activities may lead to unvegetated or otherwise unstable soils as well as soil contamination due to leaks or spills from construction equipment. Precipitation events could potentially mobilize the soils into nearby wetlands, leading to increased turbidity and alteration of water quality.	The general trend along coastal regions is that port activity and land development will increase modestly in the future. This increase in activity includes expansion needed to meet commercial, industrial, and recreational demand. Modifications to cargo-handling equipment and conversion of some undeveloped land to meet port demand would be required to receive the increase in larger ships.

References Cited

Bartol, S. M. 1994. Auditory evoked potentials of the loggerhead sea turtle (*Caretta caretta*). Master's Thesis, College of William and Mary – Virginia Institute of Marine Science. 66 pp. Available: https://scholarworks.wm.edu/cgi/viewcontent.cgi?article=2805&context=etd.

Baulch, S., and C. Perry. 2014. Evaluating the Impacts of Marine Debris on Cetaceans. *Marine Pollution Bulletin* 80:210–221.

Bembenek-Bailey, S. A., J. N. Niemuth, P. D. McClellan-Green, M. H. Godfrey, C. A. Harms, H. Gracz, and M. K. Stoskopf. 2019. NMR Metabolomics Analysis of Skeletal Muscle, Heart, and Liver of Hatchling Loggerhead Sea Turtles (*Caretta caretta*) Experimentally Exposed to Crude Oil and/or Corexit. *Metabolites* 2019(9):21. doi:10.3390/metabo9020021.

Berreiros J. P., and V. S. Raykov. 2014. Lethal Lesions and Amputation Caused by Plastic Debris and Fishing Gear on the Loggerhead Turtle *Caretta caretta* (Linnaeus, 1758). Three case reports from Terceira Island, Azores (NE Atlantic). *Marine Pollution Bulletin* 86:518–522.

Briggs, K. T., M. E. Gershwin, and D. W. Anderson. 1997. Consequences of petrochemical ingestion and stress on the immune system of seabirds. *ICES Journal of Marine Science* 54:718–725.

Browne, M. A., A. J. Underwood, M. G. Chapman, R. Williams, R. C. Thompson, and J. A. van Franeker. 2015. Linking Effects of Anthropogenic Debris to Ecological Impacts. *Proceedings of the Royal Society B* 282:20142929. Available: http://dx.doi.org/10.1098/rspb.2014.2929.

Bugoni, L., L. Krause, and M. V. Petry. 2001. Marine Debris and Human Impacts on Sea Turtles in Southern Brazil. *Marine Pollution Bulletin* 42(12):1330–1334.

Bureau of Ocean Energy Management (BOEM). 2019. *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf*. Available: https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/IPFs-in-the-Offshore-Wind-Cumulative-Impacts-Scenario-on-the-N-OCS.pdf. Accessed: December 2020.

Burge. C. A., C. M. Eakin, C. S. Friedman, B. Froelich, P. K. Hershberger, E. E. Hofmann, L. E. Petes, K. C. Prager, E. Weil, B. L. Willis, S. E. Ford, and C. D. Harvell. 2014. Climate Change Influences on Marine Infectious Diseases: Implications for Management and Society. *Annual Review of Marine Science* 6:249–277.

Camacho, M., O. P. Luzardo, L. D. Boada, L. F. L. Jurado, M. Medina, M. Zumbado, and J. Orós. 2013. Potential Adverse Health Effects of Persistent Organic Pollutants on Sea Turtles: Evidence from a Cross-Sectional Study on Cape Verde Loggerhead Sea Turtles. *Science of the Total Environment*.

Causon, Paul D., and Andrew B. Gill. 2018. Linking Ecosystem Services with Epibenthic Biodiversity Change Following Installation of Offshore Wind Farms. *Environmental Science and Policy* 89:340–347.

Claisse, Jeremy T., Daniel J. Pondella II, Milton Love, Laurel A. Zahn, Chelsea M. Williams, Jonathan P. Williams, and Ann S. Bull. 2014. Oil Platforms off California are among the Most Productive Marine Fish Habitats Globally. *Proceedings of the National Academy of Sciences of the United States of America* 111(43):15462–15467. October 28, 2014. First published October 13, 2014. Available: https://doi.org/10.1073/pnas.1411477111. Accessed: March 2020.

Cook, A. S .C. P., and N. H. K. Burton. 2010. *A review of Potential Impacts of Marine Aggregate Extraction on Seabirds*. Marine Environment Protection Fund Project 09/P130. Available: https://www.bto.org/sites/default/files/shared_documents/publications/research-reports/2010/rr563.pdf. Accessed: February 25, 2020.

CSA Ocean Sciences, Inc. and Exponent. 2019. *Evaluation of Potential EMF Effects on Fish Species of Commercial or Recreational Fishing Importance in Southern New England*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2019-049.

Degraer, S., R. Brabant, B. Rumes, and L. Vigin, eds. 2019. *Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea: Marking a Decade of Monitoring, Research and Innovation*. Brussels: Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management, 134 pp.

Dolbeer, R. A., M. J. Begier, P. R. Miller, J. R. Weller, and A. L. Anderson. 2019. *Wildlife Strikes to civil aircraft in the United States, 1990 – 2018*. Federal Aviation Administration National Wildlife Strike Database Serial Report Number 25. 95 pp. + Appendices.

Efroymson, R. A., W. Hodge Rose, S. Nemth, and G. W. Suter II. 2000. *Ecological Risk Assessment Framework for Low Altitude Overflights by Fixed-Wing and Rotary-Wing Military Aircraft*. Research sponsored by Strategic Environmental Research and Development Program of the U.S. Department of Defense under Interagency Agreement 2107-N218-S1. Publication No. 5010, Environmental Sciences Division, ORNL.

Fabrizio, M. C., J. P. Manderson, and J. P. Pessutti. 2014. Home Range and Seasonal Movements of Black Sea Bass (*Centropristis striat*a) during their Inshore Residency at a Reef in the Mid-Atlantic Bight. *Fishery Bulletin* 112:82–97 (2014). doi: 10.7755/FB.112.1.5.

Gall, S. C., and R. C. Thompson. 2015. The Impact of Marine Debris on Marine Life. *Marine Pollution Bulletin* 92:170–179.

Gill, A. B., I. Gloyne-Phillips, K. J. Neal, and J. A. Kimber. 2005. *The Potential Effects of Electromagnetic Fields Generated by Sub-Sea Power Cables Associated with Offshore Wind Farm Developments on Electrically and Magnetically Sensitive Marine Organisms - A Review*. Collaborative Offshore Wind Research into the Environment (COWRIE), Ltd, UK.

Greene, J. K., M. G. Anderson, J. Odell, and N. Steinberg (editors). 2010. *The Northwest Atlantic Marine Ecoregional Assessment: Species, Habitats and Ecosystems. Phase One*. The Nature Conservancy, Eastern U.S. Division, Boston, MA.

Gregory, M. R. 2009. Environmental Implications of Plastic Debris in Marine Settings – Entanglement, Ingestion, Smothering, Hangers-on, Hitch-Hiking, and Alien Invasion. *Philosophical Transactions of the Royal Society* B 364:2013–2025.

Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, and E. Estela-Gomez. 2017. *Habitat Mapping and Assessment of Northeast Wind Energy Areas*. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088.

Haney, J. C., P. G. R. Jodice, W. A. Montevecchi, and D. C. Evers. 2017. Challenges to oil spill assessments for seabirds in the deep ocean. *Archives of Environmental Contamination and Toxicology* 73:33–39.

Hann, Z. A., M. J. Hosler, and P. R. Mooseman, Jr. 2017. Roosting Habits of Two Lasiurus borealis (eastern red bat) in the Blue Ridge Mountains of Virginia. *Northeastern Naturalist* 24 (2):N15–N18.

Hare, J. A., W. E. Morrison, M. W. Nelson, M. M. Stachura, E. J. Teeters, and R. B. Griffis. 2016. A Vulnerability Assessment of Fish and Invertebrates to Climate Change on the Northeast U.S. Continental Shelf. *PLOS ONE* 11(2):e0146756. DOI:10.1371/journal.pone.0146756.

Hawkins, A., and A. Popper. 2017. A Sound Approach to Assessing the Impact of Underwater Noise on Marine Fishes and Invertebrates. *ICES Journal of Marine Science* 74(3):635–651. DOI:10.1093/icesjms/fsw205.

Hazel, J., I. R. Lawler, H. Marsh, and S. Robson. 2007. Vessel Speed Increases Collision Risk for the Green Turtle *Chelonia mydas*. *Endangered Species Research* 3:105–113

Hoarau, L., L. Ainley, C. Jean, S. Ciccione. 2014. Ingestion and Defecation of Marine Debris by Loggerhead Sea Turtles, from By-catches in the South-West Indian Ocean. *Marine Pollution Bulletin* 84:90–96.

Hüppop, O., J. Dierschke, K. Exo, E. Frerich, and R. Hill. 2006. Bird Migration and Potential Collision Risk with Offshore Wind Turbines. *Ibis* 148:90–109.

Hutchison, Zoë, Peter Sigray, Haibo He, Andrew Gill, John King, and Carol Gibson. 2018. *Electromagnetic Field (EMF) Impacts on Elasmobranch (shark, rays, and skates) and American Lobster Movement and Migration from Direct Current Cables*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2018-003.

Jensen, J. H., L. Bejder, M. Wahlberg, N. Aguilar Solo, M. Johnson, and P. T. Madsen. 2009. Vessel Noise Effects on Delphinid Communication. *Marine Ecology Progress Series* 395:161–175.

Karp, M. A., J. O. Peterson, P. D. Lynch, R. B. Griffis, C. F. Adams, W. S. Arnold, L. A. Barnett, Y. deReynier, J. DiCosimo, and K. H. Fenske. 2019. Accounting for shifting distributions and changing productivity in the development of scientific advice for fishery management. *ICES Journal of Marine Science* 76 (5):1305–1315.

Kellar, N. M., T. R. Speakman, C. R. Smith, S. M. Lane, B. C. Balmer, M. L. Trego, K. N. Catelani, M. N. Robbins, C. D. Allen, R. S. Wells, E. S. Zolman, T. K. Rowles, and L. H. Schwacke. 2017. Low Reproductive Success Rates of Common Bottlenose Dolphins *Tursiops truncatus* in the Northern Gulf of Mexico Following the Deepwater Horizon Disaster (2010-2015). *Endangered Species Research* 33:1432–158.

Kirschvink, J. L. 1990. Geomagnetic Sensitivity in Cetaceans an Update with Live Strandings Recorded in the US. In *Sensory Abilities of Cetaceans*, edited by J. Thomas and R. Kastelein. Plenum Press, NY.

Kite-Powell, H. L., A. Knowlton, and M. Brown. 2007. *Modeling the Effect of Vessel Speed on Right Whale Ship Strike Risk*. Unpublished Report for NOAA/NMFS Project NA04NMF47202394. 8 pp.

Kraus, S. D., M. W. Brown, H. Caswell, C. W. Clark, M. Fujiwara, P. H. Hamilton, R. D. Kenney, A. R. Knowlton, S. Landry, C. A. Mayo, W. A. McLellan, M. J. Moore, D. P. Nowacek, D. A. Pabst, A. J. Read, and R. M. Rolland. 2005. North Atlantic Right Whales in Crisis. *Science* 309:561–562.

Kraus, S. D., S. Leiter, K. Stone, B. Wikgren, C. Mayo, P. Hughes, R. D. Kenney, C. W. Clark, A. N. Rice, B. Estabrook, and J. Tielens. 2016. *Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles. Final Report*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Sterling, Virginia. OCS Study BOEM 2016-054.

La Sorte, Frank, K. Horton, C. Nilsson, and A. Dokter. 2018. Projected changes in wind assistance under climate change for nocturnally migrating bird populations. Available: https://par.nsf.gov/servlets/purl/10092560. Accessed: February 10, 2021.

Laist, D. W., A. R. Knowlton, J. G. Mead, A. S. Collet, and M. Podesta. 2001. Collisions between Ships and Whales. *Marine Mammal Science* 17(1):35–75.

Law, K. L., S. Morét-Ferguson, N. A. Maximenko, G. Proskurowski, E. E. Peacock, J. Hafner, and C. M. Reddy. 2010. Plastic Accumulation in the North Atlantic Subtropical Gyre. *Science* 329:1185–1188.

Luschi, P., S. Benhamou, C. Girard, S. Ciccione, D. Roos, J. Sudre, and S. Benvenuti. 2007. Marine Turtles use Geomagnetic Cues during Open Sea Homing. *Current Biology* 17:126–133.

MacLeod, C. D. 2009. Global Climate Change, Range Changes, and Potential Implications for the Conservation of Marine Cetaceans: a Review and Synthesis. *Endangered Species Research* 7:125–136.

Maggini, I., L. V. Kennedy, A. Macmillan, K. H. Elliot, K. Dean, and C. G. Guglielmo. 2017. Light oiling of feathers increases flight energy expenditure in a migratory shorebird. *Journal of Experimental Biology* 220:2372–2379.

Mazet, J. A. K., I. A. Gardner, D. A. Jessup, and L. J. Lowenstine. 2001. Effects of Petroleum on Mink Applied as a Model for Reproductive Success in Sea Otters. *Journal of Wildlife Diseases* 37(4):686–692.

McConnell, B. J., M. A. Fedak, P. Lovell, and P. S. Hammond. 1999. Movements and Foraging Areas of Grey Seals in the North Sea. *Journal of Applied Ecology* 36:573–590.

McCreary, S., and B. Brooks. 2019. Atlantic Large Whale Take Reduction Team Meeting: Key Outcomes Meeting. April 23-26, 2019. Available: https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-mammal-protection/atlantic-large-whale-take-reduction-plan. Accessed: March 17, 2020.

Miller, J. H., and G. R. Potty. 2017. Overview of Underwater Acoustic and Seismic Measurements of the Construction and Operation of the Block Island Wind Farm. *Journal of the Acoustical Society of America* 141(5):3993–3993. doi:10.1121/1.4989144.

Minerals Management Service (MMS). 2007. *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, Final Environmental Impact Statement*. October. OCS EIS/EA MMS 2007-046. Available: https://www.boem.gov/Guide-To-EIS/. Accessed: July 3, 2018.

Mitchelmore, C. L., C. A. Bishop, and T. K. Collier. 2017. Toxicological Estimation of Mortality of Oceanic Sea Turtles Oiled during the Deepwater Horizon Oil Spill. *Endangered Species Research* 33:39–50.

Mohr, F. C., B. Lasely, and S. Bursian. 2008. Chronic Oral Exposure to Bunker C Fuel Oil Causes Adrenal Insufficiency in Ranch Mink. *Archive of Environmental Contamination and Toxicology* 54:337–347.

Moore, M. J., and J. M. van der Hoop. 2012. The Painful Side of Trap and Fixed Net Fisheries: Chronic Entanglement of Large Whales. *Journal of Marine Biology* 2012:Article ID 230653, 4 pp.

Moser, J., and G. R. Shepherd. 2009. Seasonal Distribution and Movement of Black Sea Bass (*Centropristis striata*) in the Northwest Atlantic as Determined from a Mark-Recapture Experiment. *J. Northw. Atl. Fish. Sci.* 40:17–28. doi:10.2960/J.v40.m638.

National Marine Fisheries Service (NMFS). 2015. *Endangered Species Act (ESA) Section 7 Consultation Biological Opinion, Deepwater Wind: Block Island Wind Farm and Transmission System*. June 5.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and USFWS). 2007. *Loggerhead Sea Turtle (*Caretta caretta*) 5-Year Review: Summary and Evaluation*. National Marine Fisheries Service and U.S. Fish and Wildlife Service.

National Oceanic and Atmospheric Administration (NOAA). 2018. *Biological Opinion on the Bureau of Ocean Energy Management's Issuance of Five Oil and Gas Permits for Geological and Geophysical Seismic Surveys off the Atlantic Coast of the United States, and the National Marine Fisheries Services' Issuance of Associated Incidental Harassment Authorizations*. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce. 267 pp. + appendices.

National Oceanic and Atmospheric Administration (NOAA). 2020. *Section 7 Effect Analysis: Turbidity in the Greater Atlantic Region*. NOAA Greater Atlantic Regional Fisheries Office. Available: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effect-analysis-turbidity-greater-atlantic-region.

National Oceanic and Atmospheric Administration (NOAA). 2021. United States Coast Pilot 3. Chapter 4, New Jersey Coast. Available: https://nauticalcharts.noaa.gov/publications/coast-pilot/index.html. Accessed: September 27, 2021.

National Science Foundation (NSF) and U.S. Geological Survey (USGS). 2011. *Final Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for marine seismic research funded by the National Science Foundation or conducted by the U.S. Geological Survey*. 514 pp. Available: https://www.nsf.gov/geo/oce/envcomp/usgs-nsf-marine-seismic-research/nsf-usgs-final-eis-oeis_3june2011.pdf.

Nelms, S. E., E. M. Duncan, A. C. Broderick, T. S. Galloway, M. H. Godfrey, M. Hamann, P. K. Lindeque, and Bendan J. Godley. 2016. Plastic and Marine Turtles: a Review and Call for Research. *ICES Journal of Marine Science* 73(2):165–181.

Normandeau Associates, Inc., Exponent, Inc., T. Tricas, and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species*. Final Report. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09.

Nunny, L., and M. P. Simmonds. 2019. *Climate Change and Cetaceans: an update*. International Whaling Commission. May.

Pace, R. M., and G. K. Silber. 2005. Simple analysis of ship and large whale collisions: Does speed kill? Presentation at the Sixteenth Biennial Conference on the Biology of Marine Mammals, San Diego, CA, December 2005.

Paruk, J. D., E. M. Adams, H. Uher-Koch, K. A. Kovach, D. Long, IV, C. Perkins, N. Schoch, and D. C. Evers. 2016. Polycylic aromatic hydrocarbons in blood related to lower body mass in common loons. *Science of the Total Environment* 565:360–368.

Patenaude, N. J., W. J. Richardson, M. A. Smultea, W. R. Koski, and G. W. Miller. 2002. Aircraft Sound and Disturbance to Bowhead and Beluga Whales During Spring Migration in the Alaskan Beaufort Sea. *Marine Mammal Science* 18(2):309–335.

Popper, Arthur N., Anthony D. Hawkins, Richard R. Fay, David A. Mann, Soraya Bartol, Thomas J. Carlson, Sheryl Coombs, William T. Ellison, Roger L. Gentry, Michele B. Halvorsen, Svein Løkkeborg, Peter H. Rogers, Brandon L. Southall, David G. Zeddies, and William N. Tavolga. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report.* Prepared by ANSI - Accredited Standards Committee S3/SC1 and Registered with ANSI. ASAPress/Springer. ASA S3/SC1.4 TR-2014.

Record, N. R., J. A. Runge, D. E. Pendleton, W. M. Balch, K. T. A. Davies, A. J. Pershing, C. L. Johnson, K. Stamieszkin, Z. Feng, S. D. Kraus, R. D. Kenney, C. A. Hudak, C. A. Mayo, C. Chen, J. E. Salisbury, and C. R. S. Thompson. 2019. Rapid Climate-driven Circulation Changes Threaten Conservation of Endangered North Atlantic Right Whales. *Oceanography* 32(2):162–196.

Roman, L., B. D. Hardesty, M. A. Hindell, and C. Wilcox. 2019. A quantitative analysis linking seabird mortality and marine debris ingestion. *Scientific Reports* 9(1):1–7.

Samuel, Y., S. J. Morreale, C. W. Clark, C. H. Greene, and M. E. Richmond. 2005. Underwater, Low-frequency Noise in a Coastal Sea Turtle Habitat. *Journal of the Acoustical Society of America* 117(3):1465–1472.

Schaub, A., J. Ostwald, and B. M. Siemers. 2008. Foraging bats avoid noise. *Journal of Experimental Biology* 211:3147–3180.

Schuyler, Q. A., C. Wilcox, K. Townsend, B. D. Hardesty, and N. J. Marshall. 2014. Mistaken Identity? Visual Similarities of Marine Debris to Natural Prey Items of Sea Turtles. *BMC Ecology* 14(14). 7 pp.

Secor, D. H., F. Zhang, M. H. P. O'Brien, and M. Li. 2018. Ocean Destratification and Fish Evacuation Caused by a Mid-Atlantic Tropical Storm. *ICES Journal of Marine Science* 76(2):573–584. Available: https://doi.org/10.1093/icesjms/fsx241.

Shigenaka, G., S. Milton, P. Lutz, R. Hoff, R. Yender, and A. Mearns. 2010. *Oil and Sea Turtles: Biology, Planning, and Response*. NOAA Office of Restoration and Response Publication. 116 pp.

Sigourney, D. B. C. D. Orphanides, J. M. Hatch. 2019. *Estimates of Seabird Bycatch in Commercial Fisheries off the East Coast of the United States from 2015-2016*. NOAA Technical Memorandum NMFS-NE-252. Woods Hole, Massachusetts. 27 pp.

Simmons, A. M., K. N. Horn, M. Warnecke, and J. A. Simmons. 2016. Broadband Noise Exposure Does Not Affect Hearing Sensitivity in Big Brown Bats (Eptesicus fuscus). *Journal of Experimental Biology* 219:1031–1040.

Smith, C. R., T. K. Rowles, L. B. Hart, F. I. Townsend, R. S. Wells, E. S. Zolman, B. C. Balmer, B. Quigley, M. Ivnacic, W. McKercher, M. C. Tumlin, K. D. Mullin, J. D. Adams, Q. Wu, W. McFee, T. K. Collier, and L. H. Schwacke. 2017. Slow Recovery of Barataria Bay Dolphin Health Following the Deepwater Horizon Oil Spill (2013-2014) with Evidence of Persistent Lung Disease and Impaired Stress Response. *Endangered Species Research* 33:127–142.

Smith, James, Michael Lowry, Curtis Champion, and Iain Suthers. 2016. A Designed Artificial Reef is among the Most Productive Marine Fish Habitats: New Metrics to Address Production Versus Attraction. *Marine Biology* 163:188.

Snoek, R., R. de Swart, K. Didderen, W. Lengkeek, and M. Teunis. 2016. *Potential Effects of Electromagnetic Fields in the Dutch North Sea.* Final Report submitted to Rijkswaterstaat Water, Verkeer en Leefmgeving.

Southall, B., A. Bowles, W. Ellison, J. Finneran, R. Gentry, C. Greene Jr., D. Kastak, D. Ketten, J. Miller, P. Nachtigall, W. Richardson, J. Thomas, and P. Tyack. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals* 33(4):411–509.

Sullivan, L., T. Brosnan, T. K. Rowles, L. Schwacke, C. Simeone, and T. K. Collier. 2019. *Guidelines for Assessing Exposure and Impacts of Oil Spills on Marine Mammals*. NOAA Tech. Memo. NMFS-OPR-62, 82 pp.

Takeshita, R., L. Sullivan, C. Smith, T. Collier, A. Hall, T. Brosnan, T. Rowles, and L. Schwacke. 2017. The Deepwater Horizon Oil Spill Marine Mammal Injury Assessment. *Endangered Species Research* 33:96–106.

Taormina, B, J. Bald, A. Want, G. D. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. A Review of Potential Impacts of Submarine Power Cables on the Marine Environment: Knowledge Gaps, Recommendations and Future Directions. *Renewable and Sustainable Energy Reviews* 96(2018):380–391.

Thomás, J., R. Guitart, R. Mateo, and J. A. Raga. 2002. Marine Debris Ingestion in Loggerhead Turtles, *Caretta caretta*, from the Western Mediterranean. *Marine Pollution Bulletin* 44:211–216.

Thomsen, Frank, A. B. Gill, Monika Kosecka, Mathias Andersson, Michel André, Seven Degraer, Thomas Folegot, Joachim Gabriel, Adrian Judd, Thomas Neumann, Alain Norro, Denise Risch, Peter Sigray, Daniel Wood, and Ben Wilson. 2015. *MaRVEN – Environmental Impacts of Noise, Vibrations and Electromagnetic Emissions from Marine Renewable Energy*. 10.2777/272281.

Todd, V. L. G., I. B. Todd, J. C. Gardiner, E. C. N. Morrin, N. A. MacPherson, N. A. DiMarzio, and F. Thomsen. 2015. A Review of Impacts on Marine Dredging on Marine Mammals. *ICES Journal of Marine Science* 72(2):328–340.

Tougaard, J., L. Hermannsen, and P. T. Madsen. 2020. How loud is the underwater noise from operating offshore wind turbines? *Journal of the Acoustical Society of America* 148(5):2885–2893.

Tournadre, J. 2014. Anthropogenic Pressure on the Open Ocean: The Growth of Ship Traffic Revealed by Altimeter Data Analysis. *Geophysical Research Letters* 41:7924–7932. doi:10.1002/2014GL061786.

U.S. Department of the Navy (Navy). 2017. C*riteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*. Technical report. Available: https://nwtteis.com/portals/nwtteis/files/technical_reports/Criteria_and_Thresholds_for_U.S._Navy_Acoustic_and_Explosive_Effects_Analysis_June2017.pdf.

U.S. Department of the Navy (Navy). 2018. *Hawaii-Southern California Training and Testing EIS/OEIS*. Available: https://www.hstteis.com/Documents/2018-Hawaii-Southern-California-Training-and-Testing-Final-EIS-OEIS/Final-EIS-OEIS.

U.S. Energy Information Administration. 2020. New Jersey State Energy Profile. Last Updated: September 17, 2020. Available: https://www.eia.gov/state/print.php?sid=NJ.

Vanderlaan, A. S. M., and C. T. Taggart. 2007. Vessel Collisions with Whales: The Probability of Lethal Injury Based on Vessel Speed. *Marine Mammal Science* 23(1):144–156.

Vargo, S., P. Lutz, D. Odell, E. Van Vleet, and G. Bossart. 1986. *Effects of Oil on Marine Turtles. Final Report prepared for the Minerals Management Service (MMS).* 12 pp. Available: http://www.seaturtle.org/PDF/VargoS_1986a_MMSTechReport.pdf.

Vegter, A. C., M. Barletta, C. Beck, J. Borrero, H. Burton, M. L. Campbell, M. F. Costa, M. Eriksen, C. Eriksson, A. Estrades, K. V. K. Gilardi, B. D. Hardesty, J. A. Ivar do Sul, J. L. Lavers, B. Lazar, L. Lebreton, W. J. Nichols, C. A. Ribic, P. G. Ryan, Q. A. Schuyler, S. D. A. Smith, H. Takada, K. A. Townsend, C. C. C. Wabnitz, C. Wilcox, L. C. Young, and M. Hamann. 2014. Global Research Priorities to Mitigate Plastic Pollution Impacts on Marine Wildlife. *Endangered Species Research* 25:225–247.

Walker, M. M., C. E. Diebel, and J. L. Kirschvink. 2003. Detection and Use of the Earth's Magnetic Field by Aquatic Vertebrates. In *Sensory Processing in Aquatic Environments*, edited by S. P. Collin and N. J. Marshall, pp. 53–74. Spriner-Verlag, New York.

Wallace, B. P., B. A. Stacey, E. Cuevas, C. Holyake, P. H. Lara, A. C. J. Marcondes, J. D. Miller, H. Nijkamp, N. J. Pilcher, I. Robinson, N. Rutherford, and G. Shigenaka. 2010. Oil Spills and Sea Turtles: Documented Effects and Considerations for Response and Assessment Efforts. *Endangered Species Research* 41:17–37.

Weilgart, Lindy. 2018. The Impact of Ocean Noise Pollution on Fish and Invertebrates. Report for OceanCare. Switzerland. Available: https://www.oceancare.org/wp-content/uploads/2017/10/OceanNoise_FishInvertebrates_May2018.pdf. Accessed: April 21, 2020.

Werner, S., A. Budziak, J. van Franeker, F. Galgani, G. Hanke, T. Maes, M. Matiddi, P. Nilsson, L. Oosterbaan, E. Priestland, R. Thompson, J. Veiga, and T. Vlachogianni. 2016. *Harm Caused by Marine Litter*. *MSFD GES TG Marine Litter - Thematic Report*. JRC Technical report; EUR 28317 EN; doi:10.2788/690366.

Whitaker, J. O., Jr. 1998. Life History and Roost Switching in Six Summer Colonies of Eastern Pipistrelles in Buildings. *Journal of Mammalogy* 79(2):651–659.

ATTACHMENT 2
MAXIMUM-CASE SCENARIO ESTIMATES FOR OFFSHORE WIND PROJECTS

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LIST OF TABLES

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The following tables provide maximum-case scenario estimates of potential offshore wind project impacts assuming maximum buildout within the Ocean Wind 1 EIS geographic analysis areas. BOEM developed these estimates based on offshore wind demand, as discussed in its 2019 study *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf* (BOEM 2019). Estimates disclosed in this EIS's Chapter 3, No Action analyses were developed by summing acreage or number calculations across all lease areas noted as occurring within, or overlapping, a given geographic analysis area. This likely overestimates some impacts in cases where lease areas only partially overlap analysis areas. However, this approach was used to provide the most conservative estimate of future offshore wind development.

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Table F2-1 Offshore Wind Development Activities on the U.S. East Coast: Projects and Assumptions (Part 1, Turbine and Cable Design Parameters)

Region	Lease, Project, Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps geographic analysis area)[3]						Estimated Construction Schedule[4]	Turbine Number[5]	Generating Capacity (MW)	Offshore Export Cable Length (statute miles)[6]	Offshore Export Cable Installation Tool Disturbance Width (feet)	Inter-Array Cable Length (statute miles)[7]	Hub Height (feet)[8]	Rotor Diameter (feet)[8]	Height of Turbine (feet)[8]
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism									
NE	*Aqua ventus (state waters)*	*State Project*					*X*		*2023*	*2*	*11*					*450*	*520*
	Total State Waters Projects									**2**	11					450	520
Existing and Ongoing Projects																	
MA/RI	*Block Island (state waters)*	*Built*					*X*		*Built*	*5*	*30*	*28*	*5*	*2*	*328*	*541*	*659*
MA/RI	*Vineyard Wind 1 part of OCS-A 0501*	*COP Approved (ROD issued 2021), PPA, SAP*					*X*		*2023*	*62*	*800*	*98*	*6.5*	*171*	*451*	*721*	*812*
MA/RI	*South Fork, OCS-A 0517*	*COP Approved (ROD issued 2021), PPA, SAP*					*X*		*2023*	*12*	*130*	*139*	*6.5*	*24*	*472*	*735*	*840*
VA/NC	*CVOW, OCS-A 0497*	*RAP, FDR/FIR*					*X*		*Built*	*2*	*12*	*27*	*3*	*9*	*364*	*506*	*620*
	Total Existing and Ongoing Projects									81	972	292		206			
Planned Projects																	
Massachusetts/Rhode Island Region																	
MA/RI	Sunrise, OCS-A 0487	COP, PPA, SAP					X		2024	94	1,034	105	6.5	180	459	656	787
MA/RI	Revolution, part of OCS-A 0486	COP, PPA, SAP					X		2023–2024	100	880	100	131	155	512	722	873
MA/RI	New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 1 [i.e., Park City Wind])	COP, PPA, SAP					X		2024–2026	62	804	125	10	139	630	837	1,047
MA/RI	New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 2 [i.e., Commonwealth Wind])	COP, PPA, SAP							2024–2026	79	1,500	225	10	201	702	935	1,171
MA/RI	Mayflower OCS-A 0521	COP, PPA, SAP					X		2024–2028	147	804	744	6.5	497	605	919	1,066
MA/RI	Beacon Wind 1, part of OCS-A 0520	PPA, SAP							2024–2025	78	1,230	233	6.5	186	591	984	853
MA/RI	Beacon Wind 2, part of OCS-A 0520	SAP					X		2025–2026	77	1,200	233	6.5	186	591	984	853
MA/RI	Bay State Wind, part of OCS-A 0500	SAP, COP (unpublished); the MW is included in the description below in the 5,148 MW.					X		By 2030, spread over 2025–2030	110	4,200	120	6.5	172	492	722	853
MA/RI	Liberty Wind, part of OCS-A 0522	This group is exposed to 5,800 MW of demand—for MA (4,000 MW remaining), CT (900 MW remaining), and RI (900 MW expected). Collectively the remaining technical capacity is 5,148 MW.					X			227		480	6.5	398	492	722	853
MA/RI	OCS-A 0500 remainder						X					120			492	722	853
MA/RI	OCS-A 0487 remainder						X					120			492	722	853
MA/RI	Remaining MA/RI Lease Area Total[2]	73%								337	4,400	480	6.5	540	492	722	853

Region	Lease, Project, Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps geographic analysis area)[3]						Estimated Construction Schedule[4]	Turbine Number[5]	Generating Capacity (MW)	Offshore Export Cable Length (statute miles)[6]	Offshore Export Cable Installation Tool Disturbance Width (feet)	Inter-Array Cable Length (statute miles)[7]	Hub Height (feet)[8]	Rotor Diameter (feet)[8]	Height of Turbine (feet)[8]
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Inverterbrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism									
	Total MA/RI Leases[2]									**974**	**13,248**	**2,852**		**2,654**			
New York/New Jersey Region																	
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA, SAP	X	X	X	X	X	X	2023–2025	98	1,100	194[11]	98	190	512	788	906
NY/NJ	Atlantic Shores South (OCS-A 0499)	COP, PPA, SAP	X	X	X		X	X	2024–2027	200	1,510	441	58	584	576	919	1,049
NY/NJ	Ocean Wind 2, OCS-A 0532	PPA	X	X	X	X	X	X	By 2030, spread over 2026–2030	111	1,554	120	5	173	512	788	906
NY/NJ	Empire Wind 1, part of OCS-A 0512	COP, PPA, SAP					X		2023–2026	57	816	46	5	133	525	853	951
NY/NJ	Empire Wind 2, part of OCS-A 0512	COP, PPA, SAP					X		2023–2027	90	1,260	30	5	166	525	853	951
NY/NJ	Atlantic Shores North, OCS-A 0549	SAP	X		X		X	X	By 2030, spread over 2026–2030	157	2,198	99	58	249	576	919	1,049
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537[12]						X		By 2030, spread over 2026–2030	100	1,200	120	5	157	492	722	853
NY/NJ	Attentive Energy LLC, OCS-A 0538[12]						X		By 2030, spread over 2026–2030	102	1,224	120	5	130	492	722	853
NY/NJ	Bight Wind Holdings LLC, OCS-A 0539[12]						X		By 2030, spread over 2026–2030	145	1,740	120	5	205	492	722	853
NY/NJ	Atlantic Shores Offshore Wind Bight LLC, OCS-A 0541[12]						X	X	By 2030, spread over 2026–2030	93	1,116	120	5	133	492	722	853
NY/NJ	Invenergy Wind Offshore LLC, OCS-A 0542[12]						X	X	By 2030, spread over 2026–2030	97	1,164	120	5	147	492	722	853
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544[12]						X		By 2030, spread over 2026–2030	102	1,224	120	5	95	492	722	853
	Total NY/NJ Leases									**1,352**	**16,106**	**1,650**		**2,362**			
Maryland/Delaware Region																	
DE/MD	Skipjack, part of OCS-A 0519	COP, PPA, SAP					X	X	2024	16	120	40	10	30	492	722	853
DE/MD	US Wind, part of OCS-A 0490	COP, PPA, SAP					X		2024–2027	125	1,500	190	6.5	151	440	722	801
DE/MD	GSOE I, OCS-A 0482	Collectively the technical capacity of this is group is 1,080 MW (90 turbines). The remaining capacity may be utilized by demand from NJ or MD.					X	X	By 2030, spread over 2023–2030	90	1,080	-	-	-	492	722	853
DE/MD	OCS-A 0519 remainder						X	X				-	-	-			
DE/MD	Remaining DE/MD Lease Area Total									90	1,080	240	5	139			
	Total DE/MD Leases									**231**	**2,700**	**470**		**320**			
Virginia/North Carolina Region																	
VA/NC	CVOW-C, OCS-A 0483	COP, SAP					X		2025–2027	205	3,000	417	5	301	489	761	869

Region	Lease, Project, Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps geographic analysis area)[3]						Estimated Construction Schedule[4]	Turbine Number[5]	Generating Capacity (MW)	Offshore Export Cable Length (statute miles)[6]	Offshore Export Cable Installation Tool Disturbance Width (feet)	Inter-Array Cable Length (statute miles)[7]	Hub Height (feet)[8]	Rotor Diameter (feet)[8]	Height of Turbine (feet)[8]
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism									
VA/NC	Kitty Hawk North, OCS-A 0508	COP, SAP					X		2024–2030	69	1,242	200	29.5	149	574	935	1,042
VA/NC	Kitty Hawk South, OCS-A 0508	COP					X		2024–2027	121	1,242	353	29.5	149	472	728	837
	Total VA/NC Leases									**395**	**5,484**	**970**		**599**			
	OCS Total (Planned)[9,10]									**2,952**	**38,038**	**5,942**		**5,395**			

Projects in *italics* are projects that have already been constructed or that are ongoing projects. Completed and ongoing projects are not included in project totals.
[1] The spacing/layout for projects are as follows: NE State water projects include a single strand of WTGs and no OSS. For projects in the RI, MA, NY, NJ, DE, MD lease areas, a 1×1–nm grid spacing is assumed. For the CVOW Project, the spacing is 0.7 nm; and the Dominion commercial lease area off the coast of Virginia would utilize 0.5 nm average spacing, which is less than the 1×1–nm spacing due to the need to attain the state's goals.
[2] Because development could occur anywhere within the RI and MA lease areas and assumes a continuous 1x1–nm grid, the actual development for these projects is expected to be approximately 73% of the collective technical capacity. Under the scenario described in this appendix, the total area in the RI and MA lease areas is greater than the area needed to meet state demand. Therefore, if a project is not constructed, BOEM assumes that another future project would be constructed to fulfill the unmet demand.
[3] This column identifies lease areas that are applicable to each resource based on the geographic analysis areas.
[4] The estimated construction schedule is based on information known at the time of this analysis and could be different when an applicant submits a COP.
[5] The number of turbines for those lease areas without an announced number of turbines has been calculated based on lease size, a 1×1-nm grid spacing, and/or the generating capacity.
[6] BOEM assumes that each offshore wind development would have its own cable (both onshore and offshore) and that future projects would not utilize a regional transmission line. The length of offshore export cable for those lease areas without a known project size is assumed to include two offshore cables totaling 120 miles (193 kilometers). The offshore export cable would be buried a minimum of 4 feet (1.8 meters) but not more than 10 feet (3.1 meters).
[7] If information for a future project could not be obtained from a COP, the length of inter-array cabling is assumed to be the average amount per foundation based on the COPs submitted to date, which is 1.48 miles (2.4 kilometers). In addition, for those lease areas that require more than one OSS, it is assumed that an additional 6.2 miles (9.9 kilometers) of inter-link cable would be required to link the two OSSs. Inter-array cable is assumed to be buried between 4 and 6 feet.
[8] The hub height, rotor diameter, and turbine height for lease areas is based on worst-case scenario for the resource area. Presentation of heights vary by COP and may be presented relative to MLLW, mean sea level, or height above highest astronomical tide.
[9] BOEM recognizes that the estimates presented within this analysis are likely high, conservative estimates; however, BOEM believes that this analysis is appropriately capturing the potential cumulative impacts and errs on the side of maximum impacts. Totals by lease area and by OCS may not fully sum due to rounding errors.
[10] New York's demand is not double-counted, this total comes from looking at New York's state demand, not adding up the potential of the areas because that would double-count New York.
CT = Connecticut; CVOW = Coastal Virginia Offshore Wind; DE = Delaware; FDR = Facility Design Report; FIR = Fabrication and Installation Report; MA = Massachusetts; MD = Maryland; NE = New England; NJ = New Jersey; NY = New York; PPA = Power Purchase Agreement; RAP = research activities plan; RI = Rhode Island
[11] Includes cable length from offshore export cables and substation interconnector cables.
[12] Parameters for the New York Bight leases represent a build-out based on current technology and expectations for each lease prior to receiving plans, and may differ from what is analyzed in total in the upcoming New York Bight Draft Programmatic EIS.

Table F2-2 Offshore Wind Development Activities on the U.S. East Coast: Projects and Assumptions (Part 2, Seabed/Anchoring Disturbance and Scour Protection)

Region	Lease/Project/Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[3]						Estimated Foundation Number[2]	Foundation Footprint[3] (acres)	WTG Seabed Disturbance (Foundation + Scour Protection) (acres)[4]	Offshore Export Cable Seabed Disturbance (acres)[5]	Offshore Export Cable Operating Seabed Footprint (acres)[6]	Offshore Export Cable Hard Protection (acres)[7]	Anchoring Disturbance (acres)[8]	Inter-Array Construction Footprint/Seabed Disturbance (acres)[9]	Inter-Array Operating Footprint/ Seabed Disturbance (acres)[10]	Inter-Array Cable Hard Protection (acres)[11]
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism										
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA, SAP	X	X	X	X	X	X	101	4	84	1,935[12]	+78	94	19	1,850[13]	144	77
NY/NJ	Atlantic Shores South, OCS-A 0499	COP, PPA, SAP	X	X	X		X	X	211	9	135	1,606	137	12	262	2,035	317	307
NY/NJ	Ocean Wind 2, OCS-A 0532, and remainder	PPA	X	X	X	X	X	X	113	5	96	727	48	43	12	271	162	0
NY/NJ	Empire Wind 1, part of OCS-A 0512	COP, PPA, SAP					X		58	1	52	368	37	33	9	534	82	26
NY/NJ	Empire Wind 2, part of OCS-A 0512	COP, PPA, SAP					X		91	2	82	360	24	32	9	633	129	32
NY/NJ	Atlantic Shores North, OCS-A 0549	SAP, COP (unpublished)	X		X		X	X	160	7	135	600	40	35	10	382	239	0
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537[14]						X		102	4	87	727	48	43	12	952	146	0
NY/NJ	Attentive Energy LLC, OCS-A 0538[14]						X		104	4	88	727	48	43	12	970	149	0
NY/NJ	Bight Wind Holdings LLC, OCS-A 0539[14]						X		148	6	126	727	48	43	12	1,403	212	0
NY/NJ	Atlantic Shores Offshore Wind Bight LLC[14]						X	X	95	4	81	727	48	43	12	890	136	0
NY/NJ	Invenergy Wind Offshore LLC, OCS-A 0542[14]						X	X	99	4	84	727	48	43	12	925	142	0
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544[14]						X		104	4	88	727	48	43	12	970	149	0
	Total NY/NJ Leases								**1,386**	**54**	**1,138**	**9,959**	**652**	**506**	**393**	**11,815**	**2,006**	**442**
	MA, RI, DE, MD, NC, VA Leases								**1,630**	**206**	**3,466**	**140,321**	**1,814**	**1,017**	**2,009**	**22,484**	**2,529**	**697**
	OCS Total								**3,016**	**260**	**4,604**	**150,280**	**2,465**	**1,523**	**2,402**	**34,299**	**4,534**	**1,139**

[1] This column identifies lease areas that are applicable to each resource based on the geographic analysis areas.
[2] The estimated number of foundations is the total number of turbines plus OSS. If information for a future project could not be obtained from a publicly available COP, it is assumed that for every 50 turbines there would be one OSS installed.
[3] If information for a future project could not be obtained from a publicly available COP, the foundation footprint is assumed to be 0.04 acre, which is based on the largest monopile reported (12 MW) for all lease areas.
[4] The seabed disturbance with the addition of scour protection was calculated based on scour protection expected in submitted COPs. If information for a future project could not be obtained from a publicly available COP, it is assumed that for all lease areas that a 12-MW foundation with addition of scour protection would be 0.85 acre per foundation.
[5] Offshore export cable seabed bottom disturbance is assumed to be due to installation of the export cable, the use of jack-up vessels, and the need to perform dredging. If information for a future project could not be obtained from a publicly available COP, export cable seabed disturbance assumed to be 6.06 acres per mile.
[6] If information for a future project could not be obtained from a publicly available COP, the offshore export cable operating seabed footprint assumed to be 0.4 acre per mile.
[7] If information for a future project could not be obtained from a publicly available COP, the offshore export cable hard protection is assumed to be similar to Vineyard Wind 1 Project, which is 0.357 acre per mile of offshore export cable.
[8] If information for a future project could not be obtained from a publicly available COP, anchoring disturbance for other lease areas is assumed to be a rate equal to 0.10 acre per mile of offshore export cable.
[9] If information for a future project could not be obtained from a publicly available COP, inter-array construction seabed disturbance is assumed to be 6.06 acres per mile.
[10] If information for a future project could not be obtained from a publicly available COP, the inter-array operating footprint is assumed to be a rate equal to the average amount per foundation of 1.43 acres per foundation.
[11] If information for a future project could not be obtained from a publicly available COP, the inter-array cable hard protection is assumed to be zero.
[12] Includes disturbance from offshore export cables and substation interconnector cables. Assumes an 82-foot-wide corridor would be disturbed per cable, based on the Ocean Wind 1 COP.
[13] Assumes an 82-foot-wide corridor would be disturbed, based on the Ocean Wind 1 COP.
[14] Parameters for the New York Bight leases represent a build-out based on current technology and expectations for each lease prior to receiving plans, and may differ from what is analyzed in total in the upcoming New York Bight Draft Programmatic EIS.
nd = not defined; NJ = New Jersey; NY = New York; PPA = Power Purchase Agreement

Table F2-3 Offshore Wind Development Activities on the U.S. East Coast: Projects and Assumptions (Part 3, Gallons of Coolant, Oils, Lubricants, and Diesel Fuel)

Region	Lease/Project/Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[1]						Total Coolant Fluids in WTGs (gallons)	Total Coolant Fluids in OSS or ESP (gallons)	Total Oils and Lubricants in WTGs (gallons)	Total Oils and Lubricants in OSS or ESP (gallons)	Total Diesel Fuel in WTGs (gallons)	Total Diesel Fuel in OSS or ESP (gallons)
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism						
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA, SAP	X	X	X	X	X	X	39,690	-	187,964	238,707	77,714	158,502
NY/NJ	Atlantic Shores South, OCS-A 0499	COP, PPA, SAP	X	X	X		X	X	820,000	10,300	606,200	370,050	80,000	75,000
NY/NJ	Ocean Wind 2, part of OCS-A 0532[2], and remainder	PPA	X	X	X	X	X	X	44,953	-	212,888	160,732	88,019	105,673
NY/NJ	Empire Wind 1, part of OCS-A 0512	COP, PPA, SAP					X		49,704		285,684	158,503	-	7,925
NY/NJ	Empire Wind 2, part of OCS-A 0512	COP, PPA, SAP					X		78,480		451,080	158,503	-	7,925
NY/NJ	Atlantic Shores North, OCS-A 0549[3]	SAP, COP (unpublished)	X		X		X	X	643,700	8,240	475,867	296,040	62,800	60,000
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537[2,4]						X		40,500	-	191,800	243,579	79,300	161,737
NY/NJ	Attentive Energy LLC, OCS-A 0538[2,4]						X		41,310	-	195,636	248,450	80,886	164,971
NY/NJ	Bight Wind Holdings LLC, OCS-A 0539[2,4]						X		58,725	-	278,110	353,189	114,985	234,518
NY/NJ	Atlantic Shores Offshore Wind Bight LLC ,OCS-A 0541[2,4]						X	X	37,665	-	178,374	226,528	73,749	150,415
NY/NJ	Invenergy Wind Offshore LLC, OCS-A 0542[2,4]						X	X	39,285		186,046	236,271	76,921	156,885
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544[2,4]						X		41,310	-	195,636	248,450	80,886	164,971
	Total NY/NJ Leases								**1,935,322**	**18,540**	**3,445,285**	**2,939,003**	**815,260**	**1,448,523**
	MA, RI, DE, MD, NC, VA Leases								**2,156,654**	**21,063**	**5,430,591**	**5,688,507**	**1,397,165**	**1,048,288**
	OCS Total								**4,091,976**	**39,603**	**8,875,876**	**8,627,510**	**2,212,425**	**2,496,811**

[1] This column identifies lease areas that are applicable to each resource based on the geographic analysis areas.
[2] Quantities of coolant, oil and lubricants, and diesel fuel are scaled to Ocean Wind 1 based on number turbines and OSS.
[3] Quantities of coolant, oil and lubricants, and diesel fuel are scaled to Atlantic Shores South based on number turbines and OSS.
[4] Parameters for the New York Bight leases represent a build-out based on current technology and expectations for each lease prior to receiving plans, and may differ from what is analyzed in total in the upcoming New York Bight Draft Programmatic EIS.
ESP = electrical service platform; NJ = New Jersey; NY = New York; PPA = Power Purchase Agreement

Table F2-4 Offshore Wind Development Activities on the U.S. East Coast: Projects and Assumptions (Part 4, OCS Construction and Operation Emissions)

Region	Lease/Project/Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[1]						2023	2024	2025	2026	2027	2028	2029	2030	Beyond 2030
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism									
Nitrogen oxides (tons)																	
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA	X	X	X	X	X	X	5	11,168	159	159	159	159	159	159	159
NY/NY	Atlantic Shores South, OCS-A 0499	COP, PPA, SAP	X	X	X		X	X	--	2,089	2,089	2,089	2,089	519	519	519	519
NY/NJ	Ocean Wind 2, OCS-A 0532, and remainder	PPA	X	X	X	X	X	X	--	--	--	2,531	2,531	2,531	2,531	2,531	180
NY/NJ	Atlantic Shores North, OCS-A 0549	SAP, COP (unpublished)	X		X		X	X	--	--	--	1,312	1,312	1,312	1,312	1,312	407
	Total Air Quality Analysis Area								5	13,257	2,248	6,091	6,091	4,521	4,521	4,521	1,265
Volatile organic compounds (tons)																	
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA	X	X	X	X	X	X	<1	293	4	4	4	4	4	4	4
NY/NY	Atlantic Shores South, OCS-A 0499	COP, PPA, SAP	X	X	X		X	X	--	40	40	40	40	9	9	9	9
NY/NJ	Ocean Wind 2, OCS-A 0532, and remainder	PPA	X	X	X	X	X	X	--	--	--	66	66	66	66	66	4
NY/NJ	Atlantic Shores North, OCS-A 0549	SAP, COP (unpublished)	X		X		X	X	--	--	--	25	25	25	25	25	7
	Total Air Quality Analysis Area								<1	333	44	136	136	104	104	104	24
Carbon monoxide (tons)																	
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA	X	X	X	X	X	X	3	2,154	40	40	40	40	40	40	40
NY/NY	Atlantic Shores South, OCS-A 0499	COP, PPA, SAP	X	X	X		X	X	--	503	503	503	503	121	121	121	121
NY/NJ	Ocean Wind 2, OCS-A 0532, and remainder	PPA	X	X	X	X	X	X	--	--	--	489	489	489	489	489	45
NY/NJ	Atlantic Shores North, OCS-A 0549	SAP, COP (unpublished)	X		X		X	X	--	--	--	316	316	316	316	316	95
	Total Air Quality Analysis Area								3	2,657	543	1,348	1,348	966	966	966	302
Particulate matter, 10 microns or less (tons)																	
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA	X	X	X	X	X	X	<1	365	6	6	6	6	6	6	6
NY/NY	Atlantic Shores South, OCS-A 0499	COP, PPA, SAP	X	X	X		X	X	--	70	70	70	70	17	17	17	17
NY/NJ	Ocean Wind 2, OCS-A 0532, and remainder	PPA	X	X	X	X	X	X	--	--	--	83	83	83	83	83	6

Region	Lease/Project/Lease Remainder[1]	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area)[1]						2023	2024	2025	2026	2027	2028	2029	2030	Beyond 2030
			Air Quality, Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism									
NY/NJ	Atlantic Shores North, OCS-A 0549	SAP, COP (unpublished)	X		X		X	X	--	--	--	44	44	44	44	44	13
	Total Air Quality Analysis Area								<1	435	76	202	202	149	149	149	42
Particulate matter, 2.5 microns or less (tons)																	
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA	X	X	X	X	X	X	<1	349	5	5	5	5	5	5	5
NY/NY	Atlantic Shores South, OCS-A 0499	COP, PPA, SAP	X	X	X		X	X	--	68	68	68	68	16	16	16	16
NY/NJ	Ocean Wind 2, OCS-A 0532, and remainder	PPA	X	X	X	X	X	X	--	--	--	79	79	79	79	79	6
NY/NJ	Atlantic Shores North, OCS-A 0549	SAP, COP (unpublished)	X		X		X	X	--	--	--	43	43	43	43	43	13
	Total Air Quality Analysis Area								<1	417	73	195	195	143	143	143	40
Sulfur dioxide (tons)																	
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA	X	X	X	X	X	X	<1	115	1	1	1	1	1	1	1
NY/NY	Atlantic Shores South, OCS-A 0499	COP, PPA, SAP	X	X	X		X	X	--	7	7	7	7	1	1	1	1
NY/NJ	Ocean Wind 2, OCS-A 0532, and remainder	PPA	X	X	X	X	X	X	--	--	--	26	26	26	26	26	1
NY/NJ	Atlantic Shores North, OCS-A 0549	SAP, COP (unpublished)	X		X		X	X	--	--	--	4	4	4	4	4	1
	Total Air Quality Analysis Area								<1	122	8	39	39	33	33	33	4
Carbon dioxide (tons)																	
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA	X	X	X	X	X	X	3,539	652,774	11,752	11,752	11,752	11,752	11,752	11,752	11,752
NY/NY	Atlantic Shores South, OCS-A 0499	COP, PPA, SAP	X	X	X		X	X	--	139,357	139,357	139,357	139,357	33,566	33,566	33,566	33,566
NY/NJ	Ocean Wind 2, OCS-A 0532, and remainder	PPA	X	X	X	X	X	X	--	--	--	148,675	148,675	148,675	148,675	148,675	13,311
NY/NJ	Atlantic Shores North, OCS-A 0549	SAP, COP (unpublished)	X		X		X	X	--	--	--	87,516	87,516	87,516	87,516	87,516	26,349
	Total Air Quality Analysis Area								3,539	792,131	151,109	387,301	387,301	281,510	281,510	281,510	84,978

[1] This column identifies lease areas that are applicable to each resource based on the geographic analysis areas.
Note: Emissions for Ocean Wind 2 and Atlantic Shores North are scaled from Ocean Wind 1 and Atlantic Shores South, respectively, based on number of turbines and estimated construction schedule.
NJ = New Jersey; NY = New York; PPA = Power Purchase Agreement

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References Cited

Bureau of Ocean Energy Management (BOEM). 2019. *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf*. Available: https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/IPFs-in-the-Offshore-Wind-Cumulative-Impacts-Scenario-on-the-N-OCS.pdf. Accessed: December 2020.

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Appendix G. Assessment of Resources with Minor (or Lower) Adverse Impacts in the Draft Environmental Impact Statement

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G.1. Introduction

To focus on the impacts of most concern in the main body of the EIS, BOEM included the analysis of resources with no greater than **minor** adverse impacts in Appendix G in the Draft EIS. This included air quality; bats; birds; coastal habitat and fauna; demographics, employment, and economics; land use and coastal infrastructure, sea turtles; and water quality. After further review, and with consideration of public comments on the Draft EIS, impact levels for air quality, coastal habitat and fauna, and water quality were increased to up to **moderate** in the Final EIS. For easier comparison, the Draft EIS structure is retained in the Final EIS and the resource sections for air quality, coastal habitat and fauna, and water quality are still included in Appendix G of the Final EIS even though the impacts for these resources have been reassessed as up to **moderate**.

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3.4. Air Quality

This section discusses potential impacts on air quality from the proposed Project, alternatives, and ongoing and planned activities in the air quality geographic analysis area. The air quality geographic analysis area, as shown on Figure 3.4-1, includes the airshed within 25 miles (40 kilometers) of the Wind Farm Area (corresponding to the OCS permit area) and the airshed within 15.5 miles (25 kilometers) of onshore construction areas and ports that may be used for the Project. The geographic analysis area encompasses the geographic region subject to USEPA review as part of an OCS permit for the Project under the CAA. The geographic analysis area also considers potential air quality impacts associated with the onshore construction areas and the mustering port(s) outside of the OCS permit area. The dispersion characteristics of emissions from marine vessels, equipment, and similar emission sources that would be used during proposed construction and O&M activities would likely have maximum potential air quality impacts occurring within a few miles of the source, as would decommissioning activities if emissions are similar to those during construction. BOEM selected the 15.5-mile (25-kilometer) distance to ensure that the locations of maximum potential air quality impact would be considered.

3.4.1 Description of the Affected Environment for Air Quality

The overall geographic analysis area for air quality covers much of southern New Jersey and the adjacent portions of Delaware Bay and the Atlantic Ocean. This includes the air above the Wind Farm Area and adjacent OCS area, the offshore and onshore export cable routes, the onshore substations, the construction staging areas, the onshore construction and proposed Project-related sites, and the ports used to support proposed Project activities. COP Volume II, Section 2.1.3 (Ocean Wind 2023), provides further description of the air quality geographic analysis area. Appendix I provides information on climate and meteorological conditions in the Project region.

Air quality within a region is measured in comparison to the National Ambient Air Quality Standards (NAAQS), which are standards established by USEPA) pursuant to the CAA (42 USC 7409) for several common pollutants, known as criteria pollutants, to protect human health and welfare. The criteria pollutants are CO, lead, nitrogen dioxide (NO_2), ozone, PM_{10}, $PM_{2.5}$, and SO_2. New Jersey has established ambient air quality standards (AAQS) that are similar to the NAAQS. Table 2.1.3-1 in COP Volume II (Ocean Wind 2023) shows the NAAQS and the New Jersey AAQS. Emissions of lead from Project-associated sources would be negligible because lead is not a component of liquid or gaseous fuels; accordingly, lead is not analyzed in this EIS. Ozone is not emitted directly but is formed in the atmosphere from precursor chemicals, primarily NO_X and VOCs, in the presence of sunlight. Potential impacts of a project on ozone levels are evaluated in terms of NO_X and VOC emissions.

USEPA designates all areas of the country as attainment, nonattainment, or unclassified for each criteria pollutant. An attainment area is an area where all criteria pollutant concentrations are within all NAAQS. A nonattainment area does not meet the NAAQS for one or more pollutants. Unclassified areas are those where attainment status cannot be determined based on available information and are regulated as attainment areas. An area can be in attainment for some pollutants and nonattainment for others. If an area was nonattainment at any point in the last 20 years but is currently attainment or is unclassified, then the area is designated a maintenance area. Nonattainment and maintenance areas are required to prepare a State Implementation Plan, which describes the region's program to attain and maintain compliance with the NAAQS. The attainment status of an area can be found at 40 CFR 81 and in the USEPA Green Book, which the agency revises from time to time (USEPA 2021). Attainment status is determined through evaluation of air quality data from a network of monitors.

The nearest onshore designated areas to the proposed Wind Farm Area are Ocean, Atlantic, and Cape May Counties in New Jersey. Parts of these counties are in a designated nonattainment area for ozone (Philadelphia-Wilmington-Atlantic City Pennsylvania-New Jersey-Maryland-Delaware), which also includes Cumberland, Gloucester, and Salem Counties. Also, Gloucester County is in the maintenance area for the 2006 $PM_{2.5}$ NAAQS. The nonattainment areas include facilities that the Project could use in Atlantic City, BL England, Oyster Creek, Hope Creek, Port Elizabeth, and Repauno/Paulsboro. More distant ports that may be used include Norfolk, Virginia, which is in an ozone maintenance area, and Charleston, South Carolina, which is in an area designated in attainment for all pollutants. Figure 3.4-2 displays the nonattainment and maintenance areas[1] that intersect the geographic analysis area.

The CAA prohibits federal agencies from approving any activity that does not conform to a State Implementation Plan. This prohibition applies only with respect to nonattainment or maintenance areas (i.e., areas that were previously nonattainment and for which a maintenance plan is required). Conformity to a State Implementation Plan means conformity to a State Implementation Plan’s purpose of reducing the severity and number of violations of the NAAQS to achieve attainment of such standards. The activities for which BOEM has authority are outside of any nonattainment or maintenance area and therefore not subject to the requirement to show conformity.

The CAA defines Class I areas as certain national parks and wilderness areas where very little degradation of air quality is allowed. Class I areas consist of national parks larger than 6,000 acres and wilderness areas larger than 5,000 acres that were in existence before August 1977. In order to begin an analysis of whether projects will have an adverse impact on Class I areas, projects subject to federal permits are required to notify the federal land manager responsible for designated Class I areas within 62 miles (100 kilometers) of the Project.[2] The federal land manager identifies appropriate air quality–related values for the Class I area and evaluates the impact of the Project on air quality–related values. The Brigantine Wilderness Area, within the geographic analysis area approximately 25 miles north-northwest of the geographic center of the Project, is the only Class I area within 62 miles (100 kilometers) of the Project. Air quality–related values identified by USFWS for Brigantine Wilderness include aquatic resources, fauna/wildlife, soils, vegetation, and visibility.

The CAA amendments directed USEPA to establish requirements to control air pollution from OCS oil- and gas-related activities along the Pacific, Arctic, and Atlantic Coasts and along the U.S. Gulf Coast off Florida, east of 87° 30′ west longitude. The OCS Air Regulations (40 CFR 55) establish the applicable air pollution control requirements, including provisions related to permitting, monitoring, reporting, fees, compliance, and enforcement for facilities subject to the CAA. These regulations apply to OCS sources that are beyond state seaward boundaries. Projects within 25 nm of a state seaward boundary are required to comply with the air quality requirements of the nearest or corresponding onshore area, including applicable permitting requirements.

In addition to the CAA, the National Wildlife Refuge Administration Act directs USFWS to manage Refuge System lands to “ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans.” Furthermore, the Wilderness Act directs USFWS to manage and preserve a Wilderness Area’s “natural conditions and retain its primeval character and influence.” Maintaining air quality as a natural condition is necessary for a wilderness area to retain these characteristics.

[1] Figure 3.4-2 also indicates the nonattainment area for the 1979 1-hour ozone NAAQS, which USEPA has revoked; however, this area still must meet the provisions of the former State Implementation Plan for the 1-hour ozone standard.

[2] The 100-kilometer distance applies to notification and is not a threshold for use in evaluating impacts. Impacts at Class I areas at distances greater than 100 kilometers may need to be considered for larger emission sources if there is reason to believe that such sources could affect the air quality in the Class I area (USEPA 1992).

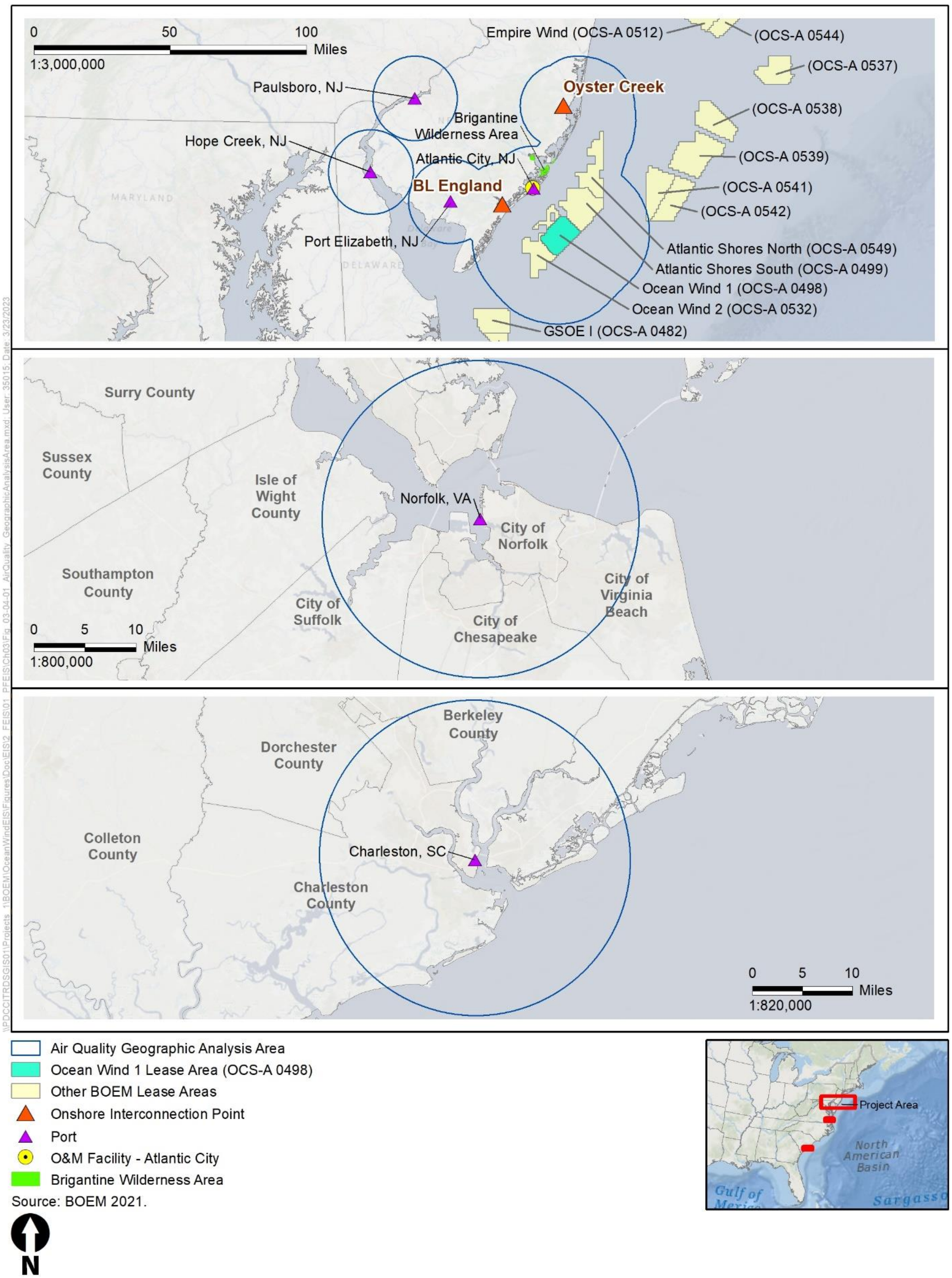


Figure 3.4-1 Air Quality Geographic Analysis Area

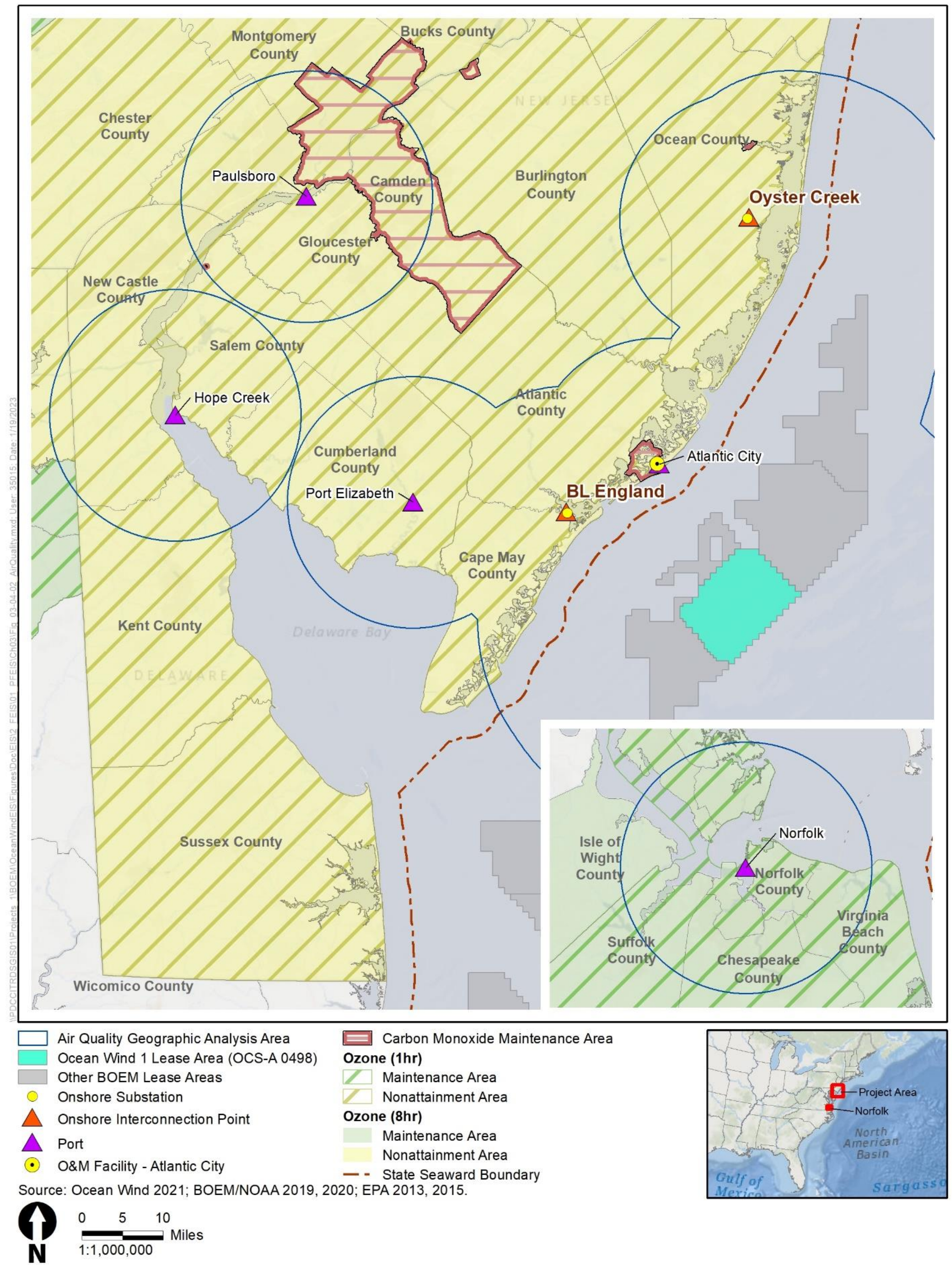


Figure 3.4-2 Air Quality Nonattainment and Maintenance Areas in the Geographic Analysis Area

3.4.2 Environmental Consequences

3.4.2.1. Impact Level Definitions for Air Quality

Definitions of impact levels are provided in Table 3.4-1. Impact levels are intended to serve NEPA purposes only, and are not intended to establish thresholds or other requirements with respect to permitting under the CAA.

Table 3.4-1 Impact Level Definitions for Air Quality

Impact Level	Type of Impact	Definition
Negligible	Adverse	Increases in ambient pollutant concentrations due to Project emissions would not be detectable.
	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would not be detectable.
Minor to Moderate	Adverse	Increases in ambient pollutant concentrations due to Project emissions would be detectable but would not lead to exceedance of the NAAQS.
	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would be detectable.
Major	Adverse	Changes in ambient pollutant concentrations due to Project emissions would lead to exceedance of the NAAQS.
	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would be larger than for minor to moderate impacts.

3.4.3 Impacts of the No Action Alternative on Air Quality

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on air quality, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for air quality. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.4.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for air quality described in Section 3.4.1, *Description of the Affected Environment for Air Quality*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-shore offshore wind activities within the geographic analysis area that contribute to impacts on air quality are generally associated with existing onshore land uses, including residential, commercial, industrial, and transportation activities as well as onshore construction activities. Other ongoing activities that could contribute to air quality impacts include construction of undersea transmission lines, gas pipelines, and other submarine cables; marine minerals use and ocean-dredged material disposal; military use; marine transportation; and oil and gas activities. See Appendix F, Table F1-1 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for air quality. There are no ongoing offshore wind activities within the geographic analysis area for air quality.

NJDEP has projected that under a scenario of continuation of current regulations and policies, emissions from electricity generation would decline slowly through 2050 due to improvements in efficiency and switching to cleaner fuels (NJDEP 2019). Under the No Action Alternative, without implementation of other offshore wind projects, the electricity that would have been generated by offshore wind would likely be provided by fossil fuel-fired facilities.[3] As a result, a continuation of ongoing activities under the No Action Alternative could lead to less decline in emissions than would occur with offshore wind development. An overall mix of natural gas, solar, wind, and energy storage would likely occur in the future due to market forces and state energy policies. New Jersey Executive Order 92 (November 19, 2019) sets a goal of developing 7,500 MW of offshore wind energy off the coast of New Jersey by 2035. The New Jersey Energy Master Plan (BPU 2019) sets a goal of transitioning New Jersey to 100 percent renewable electricity by 2050. In addition to electricity generation, emissions from other ongoing activities including vessel and vehicle emissions and accidental releases of fuel or other hazardous material would continue to contribute to ongoing regional air quality impacts.

3.4.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities within the geographic analysis area that contribute to cumulative impacts on air quality are generally associated with existing onshore land uses, including residential, commercial, industrial, and transportation activities as well as onshore construction activities. Other planned non-offshore activities that could contribute to air quality impacts include construction of undersea transmission lines, gas pipelines, and other submarine cables; marine minerals use and ocean-dredged material disposal; military use; marine transportation; oil and gas activities; and onshore development activities (Appendix F). These planned non-offshore wind activities have the potential to affect air quality through their emissions. Impacts associated with climate change could affect ambient air quality through increased formation of ozone and particulate matter associated with increasing air temperatures.

Other planned offshore wind activities within the geographic analysis area that could contribute to impacts on air quality include:

- Construction of the Atlantic Shores South project (200 WTGs), expected 2024–2027
- Construction of the Ocean Wind 2 project (111 WTGs), expected 2026–2030
- Construction of the Atlantic Shores North project (157 WTCs), expected 2026–2030

BOEM expects planned offshore wind activities to affect air quality through the following primary IPFs.

Air emissions: Most air pollutant emissions and air quality impacts from planned offshore wind projects would occur during construction, potentially from multiple projects occurring simultaneously. All projects would be required to comply with the CAA and NAAQS. Primary emission sources would include increased public and commercial vehicular traffic, air traffic, combustion emissions from construction equipment, and fugitive emissions from construction-generated dust. As wind energy projects come online, power generation emissions overall could decrease and the region as a whole could realize a net benefit to air quality.

[3] In 2020, the generation mix of the PJM Interconnection, the regional grid that serves New Jersey, was approximately 40 percent natural gas, 34 percent nuclear, 19 percent coal, 3 percent wind, 2 percent hydroelectric, and 2 percent other sources, on an annual average basis (Monitoring Analytics 2021).

The planned offshore wind projects other than the Proposed Action that may result in air pollutant emissions and air quality impacts within the air quality geographic analysis area include projects within all or portions of the following lease areas: OCS-A-0499, OCS-A-0532, and OCS A-0549 (Table F2-4). Projects currently proposed in these lease areas include Atlantic Shores South, Ocean Wind 2, and Atlantic Shores North, respectively. These projects would produce 5,262 MW of renewable power from the installation of 468 WTGs (Table F2-1). Based on the assumed offshore construction schedule in Table F2-1, those projects within the geographic analysis area would have overlapping construction periods beginning in 2024 and continuing through 2030.

During the construction phase, the total emissions of criteria pollutants and ozone precursors from offshore wind projects other than Ocean Wind 1 proposed within the air quality geographic analysis area, summed over all construction years, are estimated to be 6,034 tons of CO, 27,571 tons of NO_X, 913 tons of PM_{10}, 880 tons of $PM_{2.5}$, 181 tons of SO_2, 618 tons of VOCs, and 1,738,387 tons of CO_2 (Table F2-4). Most emissions would occur from diesel-fueled construction equipment, vessels, and commercial vehicles. The magnitude of the emissions and the resulting air quality impacts would vary spatially and temporally during the construction phases. Construction activity would occur at different locations and could overlap temporally with activities at other locations, including operational activities at previously constructed projects. As a result, air quality impacts would be minor, shifting spatially and temporally across the air quality geographic analysis area during the proposed construction period (2024–2030).

During operations, emissions from planned offshore wind projects within the air quality geographic analysis area would overlap temporally, but operations would contribute few criteria pollutant emissions compared to construction and decommissioning. Operational emissions would come largely from commercial vessel traffic and emergency diesel generators. The aggregate operational emissions for all projects within the air quality analysis area would vary by year as successive projects begin operation. Estimated operational emissions would be 121–261 tons per year of CO, 519–1,106 tons per year of NO_X, 17–36 tons per year of PM_{10}, 16–35 tons per year of $PM_{2.5}$, 1–3 tons per year of SO_2, 9–20 tons per year of VOCs, and 33,566–73,226 tons per year of CO_2 (Table F2-4). Cumulatively, operational emissions would result in negligible air quality impacts because emissions would be intermittent, localized, and dispersed throughout the 342,733-acre combined lease areas and vessel routes from the onshore O&M facility and be indistinguishable from background concentrations.

Offshore wind energy development could help offset emissions from fossil fuels, potentially improving regional air quality and reducing GHGs. An analysis by Katzenstein and Apt (2009), for example, estimates that CO_2 emissions can be reduced by up to 80 percent and NO_X emissions can be reduced up to 50 percent by implementing wind energy projects.[4] An analysis by Barthelmie and Pryor (2021) calculated that, depending on global trends in GHG emissions and the amount of wind energy expansion, development of wind energy could reduce predicted increases in global surface temperature by 0.3–0.8 °C (0.5–1.4 °F) by 2100.

Estimations and evaluations of potential health and climate benefits from offshore wind activities for specific regions and project sizes rely on information about the air pollutant emission contributions of the existing and projected mixes of power generation sources, and generally estimate the annual health

[4] Katzenstein and Apt (2009) modeled a system of two types of natural gas generators, four wind farms, and one solar farm. The power output of wind and solar facilities can vary relatively rapidly, and the natural gas generators change their power output accordingly to meet electrical demand. When gas generators change their power output their emission rates may increase above their steady-state levels. As a result, the net emissions reductions realized from gas generators reducing their output in response to wind and solar power can be less than the reduction that would be expected based on the amount of wind and solar power. The study found that reductions in CO_2 emissions would be about 80 percent, and in NO_X emissions about 30–50 percent, of the emissions reductions expected if the power fluctuations caused no additional emissions.

benefits of an individual commercial scale offshore wind project to be valued in the hundreds of millions of dollars (Kempton et al. 2005; Buonocoure et al. 2016).

The potential health benefits of avoided emissions can be evaluated using USEPA's CO-Benefits Risk Assessment (COBRA) health impacts screening and mapping tool (USEPA 2020a). COBRA is a tool that estimates the health and economic benefits of clean energy policies. COBRA was used to analyze the avoided emissions that were calculated for development of 36 GW of reasonably foreseeable wind power on the OCS (Appendix F, Table F2-1). Table 3.4-2 presents the estimated monetized health benefits and avoided mortality for this example scenario.

Table 3.4-2 COBRA Estimate of Annual Avoided Health Effects with 36 GW Reasonably Foreseeable Offshore Wind Power

Discount Rate[1] (2023)	Monetized Total Health Benefits (Million U.S. dollars/year)		Avoided Mortality (cases/year)	
	Low Estimate[2]	High Estimate[2]	Low Estimate[2]	High Estimate[2]
3%	7,765	17,516	698	1,580
7%	6,929	15,619	698	1,580

[1] The discount rate is used to express future economic values in present terms. Not all health effects and associated economic values occur in the year of analysis. Therefore, COBRA accounts for the "time value of money" preference (i.e., a general preference for receiving economic benefits now rather than later) by discounting benefits received later (USEPA 2020b).
[2] The low and high estimates are derived using two sets of assumptions about the sensitivity of adult mortality and non-fatal heart attacks to changes in ambient $PM_{2.5}$ levels. Specifically, the high estimates are based on studies that estimated a larger effect of changes in ambient $PM_{2.5}$ levels on the incidence of these health effects (USEPA 2020b).

BOEM anticipates that the air quality impacts associated with planned offshore wind activities other than the Proposed Action in the geographic analysis area would result in minor adverse impacts due to emissions of criteria pollutants, VOCs, hazardous air pollutants (HAP), and GHGs, mostly released during construction and decommissioning. Impacts would be minor because these emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a violation of the NAAQS or New Jersey AAQS. Offshore wind projects likely would lead to reduced emissions from fossil-fueled power generating facilities and consequently minor to moderate beneficial impacts on air quality.

Construction and operation of planned offshore wind projects would produce GHG emissions that would contribute incrementally to climate change. CO_2 is relatively stable in the atmosphere and, for the most part, mixed uniformly throughout the troposphere and stratosphere. As such, the impact of GHG emissions does not depend upon the source location. Increasing energy production from offshore wind projects could reduce regional GHG emissions by displacing energy from fossil fuels. This reduction could more than offset the relatively small GHG emissions from offshore wind projects. This reduction in regional GHG emissions would be noticeable in the regional context, would contribute incrementally to reducing climate change, and would represent a moderate beneficial impact in the regional context but a negligible beneficial impact in the global context.

Accidental releases: Planned offshore wind activities could release air toxics or HAPs because of accidental chemical spills within the air quality geographic analysis area. Section 3.21, *Water Quality*, includes a discussion of the nature of releases anticipated. Based on Table F2-3, up to about 1,527,193 gallons (5.8 million liters) of coolants, 2,121,777 gallons (8.0 million liters) of oils and lubricants, and 471,492 gallons (1.8 million liters) of diesel fuel would be contained in the 482 wind turbine and substation structures for the wind energy projects within the air quality geographic analysis area. If accidental releases occur, they would be most likely during construction but could occur during operations and decommissioning of offshore wind facilities. These may lead to short-term periods (hours to days)[5] of HAP emissions through surface evaporation. HAP emissions would consist of VOCs, which may be important for ozone formation. By comparison, the smallest tanker vessel operating in these waters (a general-purpose tanker) has a capacity of between 3.2 and 8 million gallons (12.1 million and 30.3 million liters). Tankers are relatively common in these waters, and the total WTG chemical storage capacity within the geographic analysis area for air quality is much less than the volume of hazardous liquids transported by ongoing activities (U.S. Energy Information Administration 2014). BOEM expects air quality impacts from accidental releases would be negligible because impacts would be short term and limited to the area near the accidental release location. Accidental spills would occur infrequently over a 30-year period with a higher probability of spills during future project construction, but they would not be expected to contribute appreciably to cumulative impacts on air quality.

3.4.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, air quality would continue to be affected by existing environmental trends and ongoing activities. Additional, higher-emitting, fossil-fuel energy facilities would be kept in service to meet future power demand, fired by natural gas, oil, or coal. Although the proposed Project would not be built under the No Action Alternative, BOEM expects ongoing non-offshore wind activities would continue to have regional air quality impacts primarily through air pollutant emissions, accidental releases, and climate change.

BOEM anticipates that ongoing non-offshore wind activities would result in **moderate** impacts on air quality because of air pollutant and GHG emissions resulting from the No Action Alternative. Although there are no such energy generation facilities planned within the air quality geographic analysis area, continuation of current regional trends in energy development could include new power plants that could contribute to air quality and GHG impacts in New Jersey and the Mid-Atlantic states. BOEM anticipates that the impacts of planned non-offshore wind activities would be moderate. BOEM expects the combination of ongoing and planned activities other than offshore wind to result in moderate impacts on air quality, primarily driven by recent market and permitting trends indicating future electric generating units would most likely include natural-gas-fired facilities.

Offshore wind activities in the geographic analysis area would contribute to the emissions of criteria pollutants, VOCs, HAPs, and GHGs, mostly released during construction and decommissioning. Impacts would be minor because these emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a violation of the NAAQS or New Jersey AAQS. Pollutant emissions during operations would be generally lower and more transient. Most air pollutant emissions and air quality impacts would occur during multiple overlapping project construction phases from 2024 through 2030 (Table F2-4). Overall, adverse air quality impacts from offshore wind projects are expected to be relatively small and transient. Offshore wind projects likely would lead to reduced emissions from fossil-fueled power generating facilities and consequently minor to moderate beneficial impacts on regional air quality after offshore wind projects are operational.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and activities would continue, and air quality would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **moderate** impacts on air quality. BOEM anticipates that the No Action Alternative combined with all other planned activities (including other offshore wind activities) would result in **moderate** adverse impacts due to emissions of criteria pollutants, VOCs, HAPs, and GHGs, mostly released during construction and decommissioning,

[5] For example, small diesel fuel spills (500–5,000 gallons) usually will evaporate and disperse within a day or less (NOAA 2006).

and **minor** to **moderate beneficial** impacts on regional air quality after offshore wind projects are operational.

3.4.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within range of the PDE to result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix E) would influence the magnitude of the impacts on air quality:

- Emission ratings of construction equipment and vehicle engines;
- Location of construction laydown areas;
- Choice of cable-laying locations and pathways;
- Choice of marine traffic routes to and from the Wind Farm Area and offshore export cable routes;
- Soil characteristics at excavation areas, which may affect fugitive emissions; and
- Emission control strategy for fugitive emissions due to excavation and hauling operations.

Changes to the design capacity of the WTGs would not alter the maximum potential air quality impacts for the Proposed Action and other action alternatives because the maximum-case scenario involved the maximum number of WTGs (98) allowed in the PDE.

Ocean Wind has committed to the following measures to reduce impacts on air quality. Low-sulfur fuels would be used to the extent practicable (AQ-01) and specific engines designed to reduce air pollution would be used when practicable (AQ-02), in addition to limiting engine idling times (AQ-03), complying with international air emission standards for marine vessels (AQ-04), and implementing a dust control plan (AQ-05) (COP Volume II, Table 1.1-2; Ocean Wind 2023). Ocean Wind has committed to measures to minimize fugitive emissions of sulfur hexafluoride contained in WTGs and OSS switchgear, because the use of sulfur hexafluoride-free switchgear for WTGs and OSS is not feasible. Ocean Wind would follow manufacturer recommendations for service and repair of the affected breakers and switches; conduct visual inspections of the switchgear and monitoring equipment according to manufacturer recommendations; create alarms based on the pressure readings in the breakers/switches, so leaks can be detected when substantial sulfur hexafluoride leakage occurs; upon a detectable pressure drop that is greater than 10 percent of the original pressure (accounting for ambient air conditions), perform maintenance to fix seals as soon as feasible; if an event requires removal of sulfur hexafluoride, the affected major component(s) will be replaced with new component(s); keep a log of all detected leaks and maintenance procedures potentially affecting sulfur hexafluoride emissions from circuit breakers/ switches; and capture and recycle sulfur hexafluoride removed from breakers and switches during maintenance (AQ-06) (COP Volume II, Table 1.1-2; Ocean Wind 2023).

3.4.5 Impacts of the Proposed Action on Air Quality

3.4.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.4.6, *Impacts of Alternatives B, C, D, and E on Air Quality*.

The Project may generate emissions and affect air quality in the New Jersey region and nearby coastal waters during construction, O&M, and decommissioning activities. Onshore emissions would occur in the onshore export cable corridors and at points of interconnection, potentially including BL England and Oyster Creek, in Ocean, Atlantic, and Cape May Counties in New Jersey. Offshore emissions would be within the OCS, including state offshore waters. Offshore emissions would occur in the Lease Area and the offshore export cable corridors. COP Volume I, Section 4 (Ocean Wind 2023), provides additional information on land use and proposed ports.

As discussed elsewhere in this section, Ocean Wind is required to obtain a permit from USEPA for air emissions resulting from the construction and operation of a new OCS source, as defined in USEPA's regulations (40 CFR 55.6). USEPA's regulations set forth the federal and state requirements that an OCS source must satisfy in order to obtain a permit (40 CFR 55.13 and 55.14). Generally, these requirements include demonstrating, as applicable, that emissions from construction and operation of the OCS source will not cause or contribute to violations of any NAAQS or exceed the allowable consumption of any ambient air increment. In addition, the OCS air permit may contain requirements for offsetting certain emissions, as well as complying with any additional applicable requirements specific to New Jersey, which is the corresponding onshore area under 40 CFR 55.14. Ocean Wind is in the process of applying to USEPA for a permit under 40 CFR 55.

Air quality in the geographic analysis area may be affected by emissions of criteria pollutants from sources involved in the construction or maintenance of the proposed Project and, potentially, during operations. These impacts, while generally localized to the areas near the emission sources, may occur at any location associated with the proposed Project, be it offshore in the Wind Farm Area or at any of the onshore construction or support sites. Ozone levels in the region also could be affected.

The proposed Project's WTGs, substations, and offshore and onshore cable corridors would not themselves generate air pollutant emissions during normal operations. However, air pollutant emissions from equipment used in the construction, O&M, and decommissioning phases could affect air quality in the geographic analysis area and nearby coastal waters and shore areas. Most emissions would occur temporarily during construction, offshore in the Wind Farm Area, onshore at the landfall sites, along the offshore and onshore export cable routes, at the onshore substations, and at the construction staging areas. Additional emissions related to the Project could also occur at nearby ports used to transport material and personnel to and from the Project site.

The emissions estimates in this section do not include emissions from raw material extraction, materials processing, and manufacturing of components, i.e., full life-cycle analysis. However, recently published studies have analyzed the life-cycle impacts of offshore wind (Ferraz de Paula and Carmo 2022; Rueda-Bayona et al. 2022; Shoaib 2022). These studies concluded that the materials that have the greatest impact on life-cycle emissions generally are steel and concrete and that materials recycling rates have a large influence on life cycle emissions. The National Renewable Energy Laboratory harmonized approximately 3,000 life cycle assessment studies with around 240 published life-cycle analyses of land-based and offshore wind technologies (NREL 2021). Although wind has higher upstream emissions than many other generation methods, its life-cycle GHG emissions are orders of magnitude lower. NREL (2021) estimated that the central 50 percent of GHG estimates reviewed were in the range of 9.4–14 grams of CO_2 equivalent per kilowatt-hour while life-cycle GHG estimates for coal and natural gas are on the scale of 1,000 grams of CO_2 equivalent per kilowatt-hour (Dolan and Heath 2012) and 480 grams of CO_2 equivalent per kilowatt-hour (O'Donoughue et al. 2013), respectively.

The Project would provide beneficial impacts on the air quality near the proposed Project location and the surrounding region to the extent that energy produced by the Project would displace energy produced by fossil-fueled power plants.

Air emissions – construction: Fuel combustion and solvent use would cause construction-related emissions. The air pollutants would include criteria pollutants, VOCs, and HAPs, as well as GHGs. During the construction phase, the activities of additional workers, increased traffic congestion, additional commuting miles for construction personnel, and increased air-polluting activities of supporting businesses also could have impacts on air quality. Construction equipment would comply with all applicable emissions and fuel-efficiency standards to minimize combustion emissions and associated air quality impacts. The total estimated construction emissions of each pollutant are summarized in Table 3.4-3.

Table 3.4-3 Ocean Wind 1 Total Construction Emissions (U.S. tons)

Period	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2	CH_4	N_2O	CO_2e
Year 1	2.5	5.1	0.3	0.3	0.02	0.4	3,539	0.0	0.0	3,539
Year 2	2,154	11,168	365.3	349.3	115.3	292.6	652,774	4.1	32	662,421
Total	2,156	11,173	365.6	349.5	115.3	293.0	656,313	4.1	32	665,960

Source: COP Volume II, Table 2.1.3-3 (Ocean Wind 2023)
Sum of individual values may not equal total due to rounding.
CH_4 = methane; CO_2e = carbon dioxide equivalent; N_2O = nitrous oxide

Offshore Construction

Emissions from potential sources or construction activities would vary throughout the construction and installation of offshore components. Emissions from offshore activities would occur during pile and scour protection installation, offshore cable laying, turbine installation, and substation installation. Offshore construction-related emissions also would come from diesel-fueled generators used to temporarily supply power to the WTGs and substations so that workers could operate lights, controls, and other equipment before cabling is in place. There also would be emissions from engines used to power pile-driving hammers and air compressors used to supply compressed air to noise-mitigation devices during pile driving (if used). Emissions from vessels used to transport workers, supplies, and equipment to and from the construction areas would result in additional air quality impacts. The Project may need emergency generators at times, potentially resulting in increased emissions for limited periods. Ocean Wind's APMs include compliance with applicable fuel-efficiency and emissions standards (AQ-02, AQ-04; see COP Volume II, Table 1.1-2; Ocean Wind 2023).

Table 3.4-4 presents an initial summary of the Project's estimated offshore construction emissions in the OCS permit area and a comparison of the total OCS permit area emissions in relation to the total emission inventories of the potentially affected counties. The OCS permit area, measured as 25 nm from the center of the Wind Farm Area, extends into Atlantic County, Cape May County, and Ocean County, New Jersey. This summary is a conservative analysis because it assumes all emissions would directly affect the nearest county's air; however, depending on the wind conditions at the time of emissions, it is likely that not all emissions generated offshore would reach land.

Table 3.4-4 Estimated Ocean Wind 1 Construction Emissions (U.S. tons) in OCS Permit Area

Period	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2	CH_4	N_2O	CO_2e
OCS Permit Area Year 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OCS Permit Area Year 2	1,342	7,486	244	233	95	217	417,894	2.7	21	424,114
Total	1,342	7,486	244	233	95	217	417,894	2.7	21	424,114

Period	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2	CH_4	N_2O	CO_2e
Atlantic County, New Jersey 2017 Inventory	29,820	4,493	1,828	839	267	15,084	NA	NA	NA	1,598,849
Project percentage of Atlantic County, New Jersey 2017 Inventory	4.5	166.6	13.4	27.7	35.4	1.4	NA	NA	NA	26.5
Cape May County, New Jersey 2017 Inventory	18,831	2,883	959	475	64	9,015	NA	NA	NA	833,592
Project percentage of Cape May County, New Jersey 2017 Inventory	7.1	259.6	25.5	49.0	148.8	2.4	NA	NA	NA	50.9
Ocean County, New Jersey 2017 Inventory	63,398	7,738	3,238	2,064	187	20,866	NA	NA	NA	3,702,977
Project percentage of Ocean County, New Jersey 2017 Inventory	2.1	96.7	7.5	11.3	50.5	1.0	NA	NA	NA	11.5

Source: COP Volume III, Appendix N, Table 3-1 and COP Volume II, Table 2.1.3-4 (Ocean Wind 2023); USEPA 2022
Sum of individual values may not equal total due to rounding.
Global Warming Potentials (GWP) used for conversion to CO_2e as defined in 40 CFR 98, Table A-1: CH_4 GWP = 25, N_2O GWP = 298
CH_4 = methane; CO_2e = carbon dioxide equivalent; N_2O = nitrous oxide; NA = not available

The largest air quality impacts are anticipated during construction, with smaller and more infrequent impacts anticipated during decommissioning. During the construction phase, the total emissions of criteria pollutants and ozone precursors from all offshore wind projects, including the Proposed Action, proposed within the air quality geographic analysis area, summed over all construction years, are estimated to be 8,190 tons of CO, 38,744 tons of NO_X, 1,279 tons of PM_{10}, 1,229 tons of $PM_{2.5}$, 297 tons of SO_2, 911 tons of VOCs, and 2,394,700 tons of CO_2 (Table F2-4). Most emissions would occur from diesel-fueled construction equipment, vessels, and commercial vehicles. The magnitude of the emissions and the resulting air quality impacts would vary spatially and temporally during the construction phases.

BOEM anticipates that air quality impacts from construction and decommissioning of the Proposed Action would be minor (i.e., less than the NAAQS as discussed below). The Proposed Action would contribute an average of approximately 34 percent of the total offshore wind project emissions that may generate impacts, depending on the pollutant, due to construction and decommissioning activities within the air quality geographic analysis area. This suggests that about two-thirds of the air quality impacts resulting from offshore wind development, depending on the pollutant, would be due to other offshore wind projects in total and the addition of the Proposed Action would yield a noticeable contribution to the total air quality impacts.

Construction activity would occur at different locations and could overlap temporally with activities at other locations, including operational activities at previously constructed projects. As a result, air quality impacts would shift spatially and temporally across the air quality geographic analysis area. The largest combined air quality impacts from offshore wind would occur during overlapping construction and decommissioning of multiple offshore wind projects. The Proposed Action is anticipated to overlap with Atlantic Shores South for 2 years of construction in 2024 and 2025. Construction of other wind projects within the air quality geographic analysis area would overlap with the proposed Project's operations

(Table F2-4). The highest emissions would occur in the offshore region and the westerly prevailing winds would result in most emission plumes remaining offshore. Although OCS sources in the Atlantic are subject to CAA requirements including requirements not to violate any NAAQS both onshore and offshore, the amount of human exposure offshore is typically very low. Ozone and some particulate matter are formed in the atmosphere from precursor emissions and can be transported longer distances, potentially over land.

The majority of air pollutant and GHG emissions from the Proposed Action alone would come from the main engines, auxiliary engines, and auxiliary equipment on marine vessels used during offshore construction activities. Fugitive dust emissions would occur as a result of excavation and hauling of soil during onshore construction activities. Emissions from the OCS source, as defined in the CAA, would be permitted as part of the OCS permit for which Ocean Wind is currently in the application process. The Project must demonstrate compliance with the NAAQS. The OCS air permitting process includes air dispersion modeling of emissions to demonstrate compliance with the NAAQS. The CAA also provides protection of air quality in Class I wilderness areas by means of the NAAQS and the Prevention of Significant Deterioration program and gives federal land managers a responsibility to protect the air quality–related values of Class I areas from the adverse impacts of air pollution. If emissions from the Project would cause or contribute to adverse impacts on the air quality–related values of a Class I area, the permitting authority (i.e., USEPA) can deny the permit. As part of the air quality–related values analysis, the Project must demonstrate that significant visibility degradation would not occur as a result of increased haze or plumes.

As part of its OCS air permit application (Ocean Wind 2022), Ocean Wind conducted dispersion modeling to estimate pollutant concentrations and air quality–related values. The regulatory definition of an OCS emission source for air permitting purposes does not include all emissions associated with the Project. However, the modeling analysis included all Project-associated emissions to ensure that impacts would not be underestimated.

The USEPA Offshore and Coastal Dispersion model (USEPA 1997) was used to estimate criteria pollutant concentrations for comparison to the NAAQS and Prevention of Significant Deterioration increments. Prevention of Significant Deterioration increments represent allowable concentration increases in attainment areas. Impacts of secondary pollutants (particulate matter and ozone formed in the atmosphere from reactions of precursor chemicals) were estimated using USEPA guidance for Modeled Emissions Rates for Precursors (USEPA 2019). Table 3.4-5 and Table 3.4-6 present the estimated concentrations for construction of the Proposed Action compared to the Prevention of Significant Deterioration increments and the NAAQS, respectively. Table 3.4-5 and Table 3.4-6 show that all predicted concentrations during construction of the Project would be within the respective Prevention of Significant Deterioration increments and NAAQS. Concentrations during O&M would be much lower than shown in Table 3.4-5 and Table 3.4-6 because emissions during O&M would be much lower than during construction. Consequently, concentrations during O&M would also be within the respective Prevention of Significant Deterioration increments and NAAQS.

Table 3.4-5 Estimated Pollutant Concentrations During Construction Compared to Prevention of Significant Deterioration Increments

Pollutant	Period	Increment Consumption ($\mu g/m^3$)			
		Modeled	MERP	Modeled + MERP	Allowable Increment Consumption
Class I Area Increments					
NO_2	Annual	0.68	NA	NA	2.5
$PM_{2.5}$	24-hour	0.69	0.52	1.21	2

Pollutant	Period	Increment Consumption (µg/m³)			
		Modeled	MERP	Modeled + MERP	Allowable Increment Consumption
$PM_{2.5}$	Annual	0.02	0.04	0.06	1
PM_{10}	24-hour	0.71	0.52	1.23	8
PM_{10}	Annual	0.02	0.04	0.06	4
Class II Area Increments					
NO_2	Annual	16.18	NA	16.18	25
$PM_{2.5}$	24-hour	8.22	0.53	8.75	9
$PM_{2.5}$	Annual	1.35	0.04	1.39	4
PM_{10}	24-hour	10.24	0.53	10.77	30

Source: Ocean Wind 2022
µg/m³ = microgram per cubic meter; MERP = Modeled Emissions Rates for Precursors; NA = not applicable

Table 3.4-6 Estimated Pollutant Concentrations During Construction Compared to NAAQS

Pollutant	Period	Modeled	Concentration (µg/m³)			
			MERP	Background	Modeled + MERP	NAAQS
NO_2	1-hour	Hourly[1]	NA	Hourly[1]	179.37	188
NO_2	Annual	Hourly[1]	NA	Hourly[1]	49.46	100
$PM_{2.5}$	24-hour	5.16	0.53	16.7	22.39	35
$PM_{2.5}$	Annual	1.35	0.04	6.6	7.99	12
PM_{10}	24-hour	10.24	0.53	44.7	55.47	150

Source: Ocean Wind 2022
[1] Background values were varied by hour of the day and season of the year and added to the modeled values hour-by-hour of each year at each receptor location to generate the estimates of total NO_2 impact for the 1-hour and annual periods (based on 3-year averages).
µg/m³ = microgram per cubic meter; MERP = Modeled Emissions Rates for Precursors; NA = not applicable

The OCS air permit is subject to Prevention of Significant Deterioration requirements for analysis of impacts on soils, vegetation, and economic growth and associated emissions. Based on the modeled concentrations the permit application (Ocean Wind 2022), it was determined that impacts on soils and vegetation would be lower than applicable thresholds. The permit application (Ocean Wind 2022) also determined and that the Project would lead to only limited growth and emissions. For further discussion of economic impacts see Section 3.11, *Demographics, Employment, and Economics*.

The air quality–related values analysis assessed visibility and acidic deposition impacts at the Brigantine Wilderness Area. Projects that affect Class I areas should apply the Federal Land Managers' Air Quality–Related Values Work Group guidance from 2010, as referenced in USEPA Regulations at 40 CFR 51, Appendix W. The Applicant is currently revising air quality modeling to assess impacts on air quality–related values per the Federal Land Managers' Air Quality–Related Values Work Group guidance. Initial modeling has shown potential visibility impacts from visible plumes ("plume blight") using the USEPA VISCREEN screening model. The VISCREEN model is a pass/fail test that showed plume blight would occur for some duration during the construction period.

Acidic deposition impacts were assessed using the USEPA CALPUFF model. The CALPUFF deposition results for total sulfur (as elemental sulfur) and total nitrogen (as elemental nitrogen) were 0.00025 kilogram per hectare per year and 0.00694 kilogram per hectare per year, respectively. These values are lower than the applicable screening levels of 0.005 kilogram per hectare per year for sulfur and 0.010 kilogram per hectare per year for nitrogen (FLAG 2010). Based on these results, the Project is not expected to have adverse effects on soils, vegetation, or biota in the Brigantine Class I area due to deposition of sulfur and nitrogen compounds.

Potential visibility impacts from regional haze were assessed using the USEPA CALPUFF model (Exponent 2000). The metric used to assess the potential for discernible visibility reduction is the deciview. A change in visibility of approximately 1.0 deciview is assumed to be detectable to a human observer looking at a distant scene or object. While USEPA Regional Haze rules (40 CFR 51, Appendix Y) do not apply to the impact analysis for air quality–related values for Class I areas, they do provide a screening level of 0.5 deciview that may be used as a screening benchmark for whether the proposed Project would potentially cause or contribute to visibility impairment at the Brigantine Class I area. The modeled visibility impacts exceeded the screening level. Given these circumstances, Ocean Wind has requested that USFWS discuss the potential for impacts in accordance with applicable FLAG guidance, and provide appropriate feedback to USEPA.

Analysis conducted by USFWS, summarized in USFWS's April 4, 2023, comment letter to USEPA on the Ocean Wind 1 OCS Air Permit application, concludes that Ocean Wind's construction as outlined in the application would result in 40 days of visibility impacts for the evaluation year of 2018, which exceeds the Federal Land Managers' Air Quality Related Values Workgroup threshold. The Federal Land Managers' Air Quality Related Values Workgroup guidance targets no more than 7 days over the threshold per year. In the current OCS Air Permit application, the eighth highest impact day was estimated at 18.4 percent change, which exceeds the threshold of a 5 percent change in visibility when compared to an annual estimate of natural visibility conditions. According to USEPA definitions and scientific research, this would be a noticeable change in visibility to visitors and would affect USFWS management goals within the refuge.

Onshore Construction

Onshore activities of the Proposed Action would consist primarily of HDD, duct bank construction, cable-pulling operations, and substation construction. Emissions would primarily be from operation of diesel-powered equipment and vehicle activity such as bulldozers, excavators, and diesel trucks, and fugitive particulate emissions from excavation and hauling of soil. Ocean Wind's APMs include complying with applicable fuel-efficiency and emissions standards, implementing anti-idling practices, and developing and implementing a fugitive dust control plan (AQ-01, AQ-02, AQ-03, AQ-04, AQ-05; see COP Volume II, Table 1.1-2; Ocean Wind 2023).

These emissions would be highly variable and limited in spatial extent at any given period and would result in minor impacts (less than the NAAQS as shown in Table 3.4-6), as they would be temporary in nature. Fugitive particulate emissions would vary depending on the spatial extent of the excavated areas, soil type, soil moisture content, and magnitude and direction of ground-level winds.

Air emissions – O&M: During O&M, air quality impacts are anticipated to be smaller in magnitude compared to construction and decommissioning. Offshore O&M activities would consist of WTG operations, planned maintenance, and unplanned emergency maintenance and repairs. The WTGs operating under the Proposed Action would have no pollutant emissions. The WTGs would not include permanently installed emergency generators; however, a temporary backup diesel generator may be installed at the turbine during the commissioning phase until the grid connection is made. Emergency generators on the substations would operate only during emergencies or testing, so emissions from these sources would be small and transient. Pollutant emissions from O&M would be mostly the result of operations of ocean vessels for maintenance activities. Crew transfer vessels would transport crews to the Wind Farm Area for inspections, routine maintenance, and repairs. Jack-up vessels, multipurpose offshore support vessels, and rock-dumping vessels would travel infrequently to the Wind Farm Area for significant maintenance and repairs. The proposed Project's contribution would be additive with the impact(s) of any and all other operational activities, including offshore wind activities, that occur within the air quality geographic analysis area. COP Volume I, Sections 6.1.3 and 6.2.3 (Ocean Wind 2023), provide a more detailed description of offshore and onshore O&M activities, and COP Volume II, Table 2.1.3-4, summarizes emissions during O&M. The annual estimated emissions for O&M are summarized in Table 3.4-7.

Table 3.4-7 Ocean Wind 1 Operations and Maintenance Emissions (U.S. tons)

Period	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2	CH_4	N_2O	CO_2e
Annual	40	159	5.6	5.4	0.9	4.1	11,753	0.09	0.5	11,912
Lifetime (35 years)	1,411	5,576	196	191	31	144	411,347	3.3	18.4	416,907

Source: COP Volume II, Table 2.1.3-5 (Ocean Wind 2023)
CH_4 = methane; CO_2e = carbon dioxide equivalent; N_2O = nitrous oxide

Table 3.4-8 presents a summary of the Project's estimated offshore O&M emissions in the OCS permit area and a comparison of the total OCS permit area emissions in relation to the total emission inventories of the potentially affected counties. This summary is a conservative analysis because it assumes all emissions would directly affect the nearest county's air; however, depending on the wind conditions at the time of emissions, it is likely that not all emissions generated offshore would reach land.

Table 3.4-8 Estimated Ocean Wind 1 O&M Emissions (U.S. tons) in OCS Permit Area

Period	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO_2	CH_4	N_2O	CO_2e
OCS Permit Area Annual	**40**	**159**	**5.6**	**5.4**	**0.8**	**3.9**	**11,587**	**0.1**	**0.5**	**11,744**
Atlantic County, New Jersey 2017 Inventory	29,820	4,493	1,828	839	267	15,084	NA	NA	NA	1,598,849
Project percentage of Atlantic County, New Jersey 2017 Inventory	0.1	3.5	0.3	0.6	0.3	0.0	NA	NA	NA	0.7
Cape May County, New Jersey 2017 Inventory	18,831	2,883	959	475	64	9,015	NA	NA	NA	833,591
Project percentage of Cape May County, New Jersey 2017 Inventory	0.2	5.5	0.6	1.1	1.3	0.0	NA	NA	NA	1.4
Ocean County, New Jersey 2017 Inventory	63,398	7,738	3,238	2,064	187	20,866	NA	NA	NA	3,702,978
Project percentage of Ocean County, New Jersey 2017 Inventory	0.1	2.1	0.2	0.3	0.4	0.0	NA	NA	NA	0.3

Source: COP Volume III, Appendix N, Table 3-2 and COP Volume II, Table 2.1.3-6 (Ocean Wind 2023); USEPA 2022 Global Warming Potentials (GWP) used for conversion to CO_2e as defined in 40 CFR 98 Table A-1: CH_4 GWP = 25, N_2O GWP = 298
CH_4 = methane; CO_2e = carbon dioxide equivalent; N_2O = nitrous oxide; NA = not available

BOEM anticipates that air quality impacts from O&M of the Proposed Action would be minor (less than the NAAQS), occurring for short periods of time several times per year during the proposed 35 years.

Emissions from onshore O&M activities would be limited to periodic use of construction vehicles and equipment. Onshore O&M activities would include occasional inspections and repairs to the onshore substation and splice vaults, which would require minimal use of worker vehicles and construction equipment. Ocean Wind intends to use port facilities at Atlantic City, New Jersey to support O&M activities. BOEM anticipates that air quality impacts due to onshore O&M from the Proposed Action alone would be minor, intermittent, and occurring for short periods.

Increases in renewable energy could lead to reductions in emissions from fossil-fueled power plants. BOEM used its Wind Tool (BOEM 2017) to estimate the emissions avoided as a result of the Proposed Action. Once operational, the Proposed Action would result in annual avoided emissions of 2,362 tons of NO_X, 114 tons of $PM_{2.5}$, and 5,705 tons of SO_2 (COP Volume II, Table 2.1.3-5). It is important to note that the estimated annual avoided emissions are relative to today's energy grid. Accounting for construction emissions and assuming decommissioning emissions would be the same, and including emissions from future operations, operation of the Proposed Action would offset emissions related to its construction and eventual decommissioning within different time periods of operation depending on the pollutant: NO_X would be offset in approximately 10 years of operation, $PM_{2.5}$ in 6 years, and SO_2 in 1 month. If emissions from future operations and decommissioning were not included, the times required for emissions to "break even" would be shorter. From that point, the Project would be offsetting emissions that would otherwise be generated from another source. The potential health benefits of avoided emissions can be evaluated using USEPA's COBRA health impacts screening and mapping tool as discussed in Section 3.4.3.2. COBRA was used to analyze the avoided emissions that were calculated for the Proposed Action (COP Volume II, Table 2.1.3-5; Ocean Wind 2023). Table 3.4-9 presents the results.

Table 3.4-9 COBRA Estimate of Annual Avoided Health Effects with Proposed Action

Discount Rate[2] (2023)	Monetized Total Health Benefits[1] (U.S. dollars/year)		Avoided Mortality[1] (cases/year)	
	Low Estimate[3]	High Estimate[3]	Low Estimate[3]	High Estimate[3]
3%	239,354,740	539,958,646	21.511	48.694
7%	213,599,259	481,487,641	21.511	48.694

[1] Estimates are gross benefits, i.e., they do not account for emissions from Project O&M.
[2] The discount rate is used to express future economic values in present terms. Not all health effects and associated economic values occur in the year of analysis. Therefore, COBRA accounts for the "time value of money" preference (i.e., a general preference for receiving economic benefits now rather than later) by discounting benefits received later (USEPA 2020b).
[3] The low and high estimates are derived using two sets of assumptions about the sensitivity of adult mortality and non-fatal heart attacks to changes in ambient $PM_{2.5}$ levels. Specifically, the high estimates are based on studies that estimated a larger effect of changes in ambient $PM_{2.5}$ levels on the incidence of these health effects (USEPA 2020b).

The overall impacts of GHG emissions can be assessed using "social costs." The "social cost of carbon," "social cost of nitrous oxide," and "social cost of methane"—together, the "social cost of greenhouse gases" (SC-GHG)—are estimates of the monetized damages associated with incremental increases in GHG emissions in a given year. NEPA does not require monetizing costs and benefits but allows the use of the social cost of carbon, SC-GHG, or other monetized costs and benefits of GHGs in weighing the merits and drawbacks of alternative actions. In January 2023, CEQ issued interim guidance (CEQ 2023) that updates its 2016 guidance document (CEQ 2016) on consideration of GHGs and climate change under NEPA. The interim guidance recommends that agencies provide context for GHG emissions, including through the use of SC-GHG estimates, to translate climate impacts into the more accessible metric of dollars.

For federal agencies, the best currently available estimates of SC-GHG are the interim estimates of the social costs of CO_2, methane, and nitrous oxide developed by the Interagency Working Group (IWG) on SC-GHG and published in its Technical Support Document (IWG 2021). IWG's SC-GHG estimates are based on complex models describing how GHG emissions affect global temperatures, sea level rise, and other biophysical processes; how these changes affect society through, for example, agricultural, health, or other effects; and monetary estimates of the market and nonmarket values of these effects. One key parameter in the models is the discount rate, which is used to estimate the present value of the stream of future damages associated with emissions in a particular year. The discount rate accounts for the "time value of money," i.e., a general preference for receiving economic benefits now rather than later, by discounting benefits received later. A higher discount rate assumes that future benefits or costs are more heavily discounted than benefits or costs occurring in the present (i.e., future benefits or costs are less valuable or are a less significant factor in present-day decisions). IWG developed the current set of interim estimates of SC-GHG using three different annual discount rates: 2.5 percent, 3 percent, and 5 percent (IWG 2021).

There are multiple sources of uncertainty inherent in the SC-GHG estimates. Some sources of uncertainty relate to physical effects of GHG emissions, human behavior, future population growth and economic changes, and potential adaptation (IWG 2021). To better understand and communicate the quantifiable uncertainty, the IWG method generates several thousand estimates of the social cost for a specific gas, emitted in a specific year, with a specific discount rate. These estimates create a frequency distribution based on different values for key uncertain climate model parameters. The shape and characteristics of that frequency distribution demonstrate the magnitude of uncertainty relative to the average or expected outcome.

To further address uncertainty, IWG recommends reporting four SC-GHG estimates in any analysis. Three of the SC-GHG estimates reflect the average damages from the multiple simulations at each of the three discount rates. The fourth value represents higher-than-expected economic impacts from climate change. Specifically, it represents the 95th percentile of damages estimated, applying a 3-percent annual discount rate for future economic effects. This is a low-probability but high-damage scenario and represents an upper bound of damages within the 3-percent discount rate model. The estimates below follow the IWG recommendations.

Table 3.4-10 presents the SC-GHG associated with estimated emissions from the Proposed Action. These estimates represent the present value of future market and nonmarket costs associated with CO_2, methane, and nitrous oxide emissions. In accordance with IWG's recommendation, four estimates were calculated based on IWG estimates of social cost per metric ton of emissions for a given emissions year and Ocean Wind's estimates of emissions in each year. In Table 3.4-10, negative values represent social benefits of avoided GHG emissions. The negative values for net SC-GHG indicate that the impact of the Proposed Action on GHG emissions and climate would be a net benefit in terms of SC-GHG.

Table 3.4-10 Estimated Social Cost of GHGs associated with the Proposed Action

Description	Social Cost of GHGs (2020$)[1]			
	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
Social Cost of CO_2				
Construction, Operation, and Decommissioning	$16,640,000	$67,296,000	$103,780,000	$203,870,000
Avoided	-$962,528,000	-$3,967,307,000	-$6,120,384,000	-$12,108,979,000

Description	Social Cost of GHGs (2020$)[1]			
	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
Emissions[2]				
Net SC-CO_2	-$945,888,000	-$3,900,011,000	-$6,016,604,000	-$11,905,109,000
Social Cost of CH_4				
Construction, Operation, and Decommissioning	$5,000	$14,000	$20,000	$38,000
Avoided Emissions	-$3,946,000	-$11,017,000	-$15,164,000	-$29,357,000
Net SC-CH_4	-$3,941,000	-$11,003,000	-$15,144,000	-$29,319,000
Social Cost of N_2O				
Construction, Operation, and Decommissioning	$314,000	$1,169,000	$1,791,000	$3,103,000
Avoided Emissions	-$4,638,000	-$17,748,000	-$27,245,000	-$47,262,000
Net SC-N_2O	-$4,324,000	-$16,579,000	-$25,454,000	-$44,159,000
Social Cost of GHG				
Construction, Operation, and Decommissioning	$39,956,000	$156,121,000	$239,719,000	$445,688,000
Avoided Emissions	-$3,580,863,000	-$14,268,309,000	-$21,953,268,000	-$40,889,501,000
Net SC-GHG	-$3,540,907,000	-$14,112,189,000	-$21,713,548,000	-$40,443,813,000

Estimates are the sum of the social costs for CO_2, CH_4, and N_2O over the Project lifetime.
Estimates are rounded to the nearest $1,000.
[1] The following calendar years were used in calculating SC-GHG: construction 2023–2024, operation (35 years) 2025–2059, and decommissioning 2060–2061.
[2] Negative cost values indicate benefits.
CH_4 = methane; N_2O = nitrous oxide; SC = social cost

The Proposed Action would produce GHG emissions that contribute to climate change; however, its contribution would be less than the emissions reductions from fossil-fueled sources during operation of the Project. Because GHG emissions disperse and mix within the troposphere, the climatic impact of GHG emissions does not depend upon the source location. Therefore, regional climate impacts are largely a function of global emissions. Nevertheless, the Proposed Action per se would have negligible impacts on climate change during these activities and an overall net beneficial impact on criteria pollutant and ozone precursor emissions as well as GHGs, compared to a similarly sized fossil-fueled power plant or to the generation of the same amount of energy by the existing grid.

Climate change can make ecosystems, resources, and communities more susceptible as well as lessen resilience to other environmental impacts apart from climate change. In some instances, this may exacerbate the environmental effects of a project. Although the Project would produce criteria pollutant emissions, the predicted impacts would be within applicable standards (see Table 3.4-5 and Table 3.4-6) and would be unlikely to contribute substantially to increasing susceptibility or decreasing resilience of ecosystems. Similarly, foreseeable climate change would be unlikely to contribute substantially to increasing the impacts of criteria pollutant emissions from the Project.

Overall, it is anticipated that there would be a net reduction in GHG emissions, and no collective adverse impact on climate change as a result of offshore wind projects. Additional offshore wind projects would likely contribute a relatively small emissions increase of CO_2. Development of offshore wind projects including the Proposed Action and construction, O&M, and eventual decommissioning activities would cause some GHG emissions to increase, primarily through emissions of CO_2. The additional GHG emissions anticipated from the planned activities including the Proposed Action over the next 35-year period would have a negligible incremental contribution to existing GHG emissions.

Air emissions – decommissioning: At the end of the operational lifetime of the Project, Ocean Wind would decommission the Project. Ocean Wind anticipates that all structures above the seabed level or aboveground would be completely removed. The decommissioning sequence would generally be the reverse of the construction sequence, involve similar types and numbers of vessels, and use similar equipment.

The dismantling and removal of the turbine components (blades, nacelle, and tower) and other offshore components would largely be a “reverse installation” process subject to the same constraints as the original construction phase. Onshore decommissioning activities would include removal of facilities and equipment and restoration of the sites to pre-Project conditions where warranted. Emissions from Project decommissioning were not quantified but are expected to be less than for construction. The Project anticipates pursuing a separate OCS Air Permit for those activities because it is assumed that marine vessels, equipment, and construction technology will change substantially in the next 35 years and in the future will have lower emissions than current vessels and equipment. Ocean Wind anticipates minor and temporary air quality impacts from the Proposed Action due to decommissioning.

Accidental releases: The proposed Project could release VOCs or HAPs because of accidental chemical spills. Based on Table F2-3, the Proposed Action would have up to about 39,690 gallons (150,243 liters) of coolants, 426,671 gallons (1.6 million liters) of oils and lubricants, and 236,216 gallons (894,174 liters) of diesel fuel in its 101 wind turbine and substation structures. Accidental releases including spills from vessel collisions and allisions may lead to short-term periods of VOC and HAP emissions through evaporation. VOC emissions also would be a precursor to ozone formation. Air quality impacts would be short term and limited to the local area at and around the accidental release location. BOEM anticipates that a major spill is very unlikely due to vessel and offshore wind energy industry safety measures, as discussed in Section 3.21.3.2, as well as the distributed nature of the material. BOEM anticipates that these activities would have a negligible air quality impact as a result of the Proposed Action alone.

Collectively, based on Table F2-3, there would be up to about 1,566,883 gallons (5.9 million liters) of coolants, 2,548,448 gallons (9.6 million liters) of oils and lubricants, and 707,708 gallons (2.7 million liters) of diesel fuel contained in the 583 structures among the Proposed Action and planned activities in the air quality geographic analysis area.

3.4.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities.

Air emissions – construction: The cumulative impacts of the Proposed Action would be moderate during construction. The Proposed Action would contribute a noticeable increment to the cumulative impacts on air quality associated with offshore construction. Impacts would be greatest during overlapping construction activities, but these effects would be short term in nature, as the overlap in the air quality geographic analysis area would be limited in time. The Proposed Action would contribute a noticeable increment to cumulative air quality impacts associated with onshore construction, which would be minor. Emissions from ongoing and planned activities, including the Proposed Action, would be highly variable and limited in spatial extent at any given period. Fugitive particulate emissions would vary depending on the spatial extent of the excavated areas, soil type, soil moisture content, and magnitude and direction of ground-level winds.

Air emissions – O&M: The Proposed Action would contribute a noticeable increment to cumulative impacts, which would be moderate. O&M emissions from ongoing and planned activities, including the Proposed Action, could begin in 2024. Emissions would largely be due to the same source types as for the Proposed Action, including commercial vessel traffic, air traffic, and operation of emergency diesel generators. Planned activities, including the Proposed Action, are estimated to emit 302 tons per year of CO, 1,265 tons per year of NO_X, 42 tons per year of PM_{10}, 40 tons per year of $PM_{2.5}$, 4 tons per year of SO_2, 24 tons per year of VOCs, and 84,978 tons per year of CO_2 when all projects are operating (Table F2-4). Cumulative O&M activity across the air quality geographic analysis area would result in short-term, intermittent, and widely dispersed emissions. Anticipated impacts on air quality from O&M emissions would be transient, small in magnitude, and localized. Additionally, some emissions associated with O&M activities could overlap with other projects' construction-related emissions. Comparison of the combined emissions from all offshore wind projects as noted above to the emissions contributions from the Proposed Action alone shown in Table 3.4-3 and Table 3.4-4 shows that the increases in air quality impacts from the Proposed Action could be greater or lesser than the impacts of any other single project depending on project size, but would be small relative to those of the combined total of the other planned offshore wind projects. In summary, the largest magnitude air quality impacts and largest spatial extent would result from the overlapping operations activities from the multiple offshore wind projects within the air quality geographic analysis area. A net improvement in air quality is expected on a regional scale as wind projects begin operation and offset emissions from fossil-fueled sources. The Proposed Action would also contribute a noticeable increment to the cumulative GHG impacts on air quality, which would be beneficial from the net decrease in GHG emissions to the extent that fossil-fueled generating facilities would reduce operations as a result of increased energy generation from offshore wind projects.

Air emissions – decommissioning: The Proposed Action would contribute a noticeable increment to the cumulative air quality impacts, which would represent a moderate impact. The decommissioning process for all offshore wind projects is expected to be similar to that for Ocean Wind 1, and impacts would be similar to those of Ocean Wind 1 decommissioning. Because the emissions related to onshore activities would be widely dispersed and transient, BOEM expects all air quality impacts to occur close to the emitting sources. If decommissioning activities for projects overlap in time, then impacts could be greater for the duration of the overlap.

Accidental releases: The Proposed Action would contribute an undetectable increment to the cumulative accidental release impacts on air quality, which would be negligible due to the short-term nature and localized potential effects. Accidental spills would occur infrequently over the 35-year period with a higher probability of spills during construction of projects, but they would not be expected to contribute appreciably to overall impacts on air quality, as the total storage capacity within the air quality geographic analysis area is considerably less than the existing volumes of hazardous liquids being transported by ongoing activities and is distributed among many different locations and containers.

3.4.5.3. Conclusions

Impacts of the Proposed Action. The Proposed Action would result in a net decrease in overall emissions over the region compared to the installation of a traditional fossil-fueled power plant. Although there would be some short-term air quality impacts due to various activities associated with construction, maintenance, and eventual decommissioning, these emissions would be relatively small and limited in duration. The Proposed Action would result in air quality–related health effects avoided in the region due to the reduction in emissions associated with fossil-fueled energy generation (Table 3.4-2). As described above, the impact from air pollutant emissions is anticipated to be minor to moderate, and the impact from accidental releases would be negligible. Considering all IPFs together, **minor** to **moderate** air quality impacts would be anticipated for a limited time during construction, maintenance, and decommissioning, but there would be a **minor beneficial** impact on air quality near the Wind Farm Area and the surrounding region overall to the extent that energy produced by the Project would displace energy produced by fossil-fueled power plants. Ocean Wind has committed to APMs that would reduce potential impacts through complying with applicable emissions and fuel standards (AQ-01, AQ-02, and AQ-04), limiting engine idling time (AQ-03), and requiring dust control plans for onshore construction areas (AQ-05). Because of the amounts of emissions, the fact that emissions would be spread out in time (2 years for construction and then lesser emissions annually during operation), and the large geographic area over which they would be dispersed (throughout the 75,525-acre Lease Area and the vessel routes from the onshore facilities), air pollutant concentrations associated with the Proposed Action are not expected to exceed the NAAQS and New Jersey AAQS.

Cumulative Impacts of the Proposed Action. The incremental impacts contributed by the Proposed Action to the cumulative impacts on air quality would range from undetectable to noticeable, with noticeable beneficial impacts. BOEM anticipates that the cumulative impacts associated with the Proposed Action would result in **moderate** adverse impacts and **moderate beneficial** impacts. The main driver for this impact rating is emissions related to construction activities increasing commercial vessel traffic, air traffic, and truck and worker vehicle traffic. Combustion emissions from construction equipment, and fugitive emissions, would be higher during overlapping construction activities but short term in nature, as the overlap would be limited in time. Therefore, the adverse impact on air quality would likely be **moderate** because while emissions would incrementally increase ambient pollutant concentrations, they are not expected to exceed the NAAQS and New Jersey AAQS. The Proposed Action and other offshore wind projects would benefit air quality in the region surrounding the projects to the extent that energy produced by the projects would displace energy produced by fossil-fueled power plants. While the benefit is regional, BOEM anticipates a **moderate beneficial** impact because the magnitude of the potential reduction in emissions from displacing fossil-fueled generated power would be small relative to total energy generation emissions in the area.

3.4.6 Impacts of Alternatives B, C, D, and E on Air Quality

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternatives B, C, D, and E. Air quality and climate impacts associated with all action alternatives would be similar to those of the Proposed Action. Alternatives B-1, B-2, and D could have slightly lower emissions from offshore construction and operation compared to the Proposed Action, to the extent that these alternatives would reduce the number of WTGs. To the extent that total annual MW-hours generated were diminished due to differing wind cut-in speeds of higher-capacity turbine generators, benefits would be diminished. Alternatives C-1 and C-2 would have the same number of WTGs as the Proposed Action and, therefore, the same anticipated emissions. Although under Alternative E, the offshore and onshore cable lengths would be slightly (2,000 feet) longer, the anticipated emissions from offshore and onshore cable construction and installation would not be discernably different from those of the Proposed Action. Overall, the differences in emissions among the action alternatives and the Proposed Action would be small, and the air quality and climate impacts from all action alternatives would be substantively the same as described for the Proposed Action. Similarly, the quantities of coolants, oils and lubricants, and diesel fuel under the other action alternatives would be similar to those of the Proposed Action and therefore the impacts on air quality from accidental releases are expected to be about the same as those of the Proposed Action.

BOEM used the USEPA AVERT v4.0 model to calculate the avoided CO_2 emissions for the operational lifespan[6] of the Project with a capacity factor of 45 percent (Ocean Wind 2023) and with a generation capacity of 1,100 MW for each alternative. Table 3.4-11 presents the associated annual emissions and avoided emissions of CO_2 for each alternative. The Proposed Action would result in an annual reduction of 3,177,897 U.S. tons of CO_2, which is the equivalent of the removal of 621,185 gasoline-powered passenger vehicles driven per year (USEPA 2020c) with a lifetime reduction of 111,226,395 tons of CO_2.

Alternative B-1 would exclude up to nine WTGs, resulting in a 14.0-percent reduction in expected annual energy production and a 9-percent reduction in annual construction and O&M emissions. By reducing the number of WTGs constructed, the emissions related to construction and O&M would be lower; however, by reducing the energy produced, the avoided emissions would be reduced, equivalent to 534,104 vehicles removed annually. Alternative B-2 would exclude up to 19 WTGs, resulting in a 29.6-percent[7] reduction in expected annual energy production and a 19-percent reduction in annual construction and O&M emissions, equivalent to the removal of 440,811 vehicles per year.

Alternative C-1 would exclude or relocate up to eight WTGs, resulting in a 12.5-percent reduction in expected annual energy production and an 8-percent reduction in annual construction and O&M emissions, equivalent to the removal of 543,433 vehicles per year. Alternative D would exclude up to 15 WTGs, resulting in a 19.0-percent reduction in expected annual energy production and a 15-percent reduction in annual construction and O&M emissions, equivalent to the removal of 503,068 vehicles per year.

The No Action Alternative would result in no emissions during construction and O&M, as the Project would not be built, but would also offer no avoided emissions, resulting in higher GHG emissions over the Project duration by not displacing fossil-fueled power generation via offshore wind and resulting in emissions equivalent to 687,271 additional vehicles per year. These figures are relative to the existing grid configuration, but the actual annual quantity of avoided emissions attributable to this proposed facility is expected to diminish over time if the electric grid becomes lower-emitting due to the addition of other renewable energy facilities and retirement of high-emitting generators.

Table 3.4-11 Net Emissions of CO_2 for Each Alternative

Alternative	CO_2 Emissions (U.S. tons)					
	Construction		Operation			Operational Lifetime Net Emissions
	Year 1	Year 2	Years 3–37	Years 3–37 Avoided Emissions	Years 3–37 Net Emissions	
A (Proposed Action)	3,539	656,313	11,753	-3,189,650	-3,177,897	-111,226,395
B-1	3,220	597,245	10,695	-2,743,099	-2,732,404	-95,634,132
B-2	2,867	531,614	9,520	-2,264,652	-2,255,132	-78,929,605
C-1	3,256	603,808	10,813	-2,790,944	-2,780,131	-97,304,585
D	3,008	557,866	9,990	-2,583,617	-2,573,626	-90,076,926

[6] The assumed operational lifetime of the Project is 35 years, while Lease OCS-A 0498 has an operation term of 25 years. Ocean Wind would need to request and be granted an extension of its operations terms from BOEM.
[7] Calculation for Alternative B-2 assumed a linear reduction of 1.56 percent in energy produced per turbine removed based on the ratio in Alternative B-1 that the removal of eight WTGs results in a reduction in expected annual energy production of 12.5 percent.

Alternative	CO_2 Emissions (U.S. tons)					
	Construction		Operation			Operational Lifetime Net Emissions
	Year 1	Year 2	Years 3–37	Years 3–37 Avoided Emissions	Years 3–37 Net Emissions	
No Action	0	0	0	0	+3,189,650	+111,637,750

Cumulative Impacts of Alternatives B, C, D, and E. The incremental impacts contributed by the action alternatives to the overall impacts on air quality would be similar to those of the Proposed Action.

3.4.6.1. Conclusions

Impacts of Alternatives B, C, D, and E. Expected **minor** to **moderate** impacts associated with the Proposed Action would not change under the other action alternatives. The same construction, O&M, and decommissioning activities would still occur, albeit at slightly differing scales as identified. Alternatives B-1, B-2, and D could have slightly less, but not materially different, impacts on air quality compared to the Proposed Action due to a reduced number of WTGs. Alternatives C-1 and C-2 would have the same number of WTGs and therefore the same impacts on air quality as the Proposed Action. Alternative E would have similar impacts on air quality compared to the Proposed Action. As under the Proposed Action, the action alternatives would result in **minor beneficial** impacts on air quality and climate overall due to reduced emissions from fossil-fueled power plants.

Cumulative Impacts of Alternatives B, C, D, and E. The incremental impacts contributed by the action alternatives to the overall impacts on air quality would be the same as those of the Proposed Action, ranging from undetectable to noticeable with noticeable beneficial impacts. Considering all the IPFs together, BOEM anticipates that the impacts on air quality associated with each of the action alternatives when combined with the impacts from ongoing and planned activities including offshore wind would likely be **moderate** adverse and **moderate beneficial** overall due to reduced emissions from fossil-fueled power plants.

3.4.7 Proposed Mitigation Measures

Measures are proposed to minimize impacts on air quality (Appendix H, Table H-3). If the measures analyzed below is adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced. Furthermore, BOEM anticipates that some necessary authorizations for the proposed Project, including the OCS Air Permit, may be issued after BOEM issues a ROD or reaches a decision on the COP. Measures or offsets to mitigate potential impacts on the Brigantine Wilderness Area may be included as conditions of the OCS Air Permit. Ocean Wind would be required to adhere to all conditions of the consultations, authorizations, and permits regardless of whether they are issued prior to or after BOEM’s decision on the COP.

Table 3.4-12 Additional Proposed Measures (Also Identified in Appendix H, Table H-3): Air Quality

Measure	Description	Effect
Brigantine Wilderness Area air quality related values	BOEM, BSEE, USFWS, and Ocean Wind would develop a framework for the mitigation of AQRV impacts at Brigantine Wilderness Area. The framework would include a description of existing conditions and	Development of a mitigation framework and the subsequent implementation of preventative and compensatory mitigation measures would offset incremental increases in

Measure	Description	Effect
(AQRV) mitigation framework	monitoring objectives; description of preventative and compensatory mitigation measures; identification of the avoidance or offset value for each measure; cost estimates for each measure; schedule for USFWS implementation of each measure; the mechanism for the transfer of funding from Ocean Wind to USFWS; and, reporting to demonstrate completion of implementation.	nitrogen deposition and visibility reducing particles (e.g., plume blight) in the Brigantine Wilderness Area.
SF_6 leak rate monitoring and detection	Leak detection and monitoring requirements of less than 1% would be required in line with IEC and USEPA guidance.	Monitoring leaks at a higher detection threshold would allow for the maintenance to fix seals as soon as possible at an earlier stage.

IEC = International Electrotechnical Commission; SF_6 = sulfur hexafluoride

3.4.7.1. Measures Incorporated in the Preferred Alternative

BOEM has identified the additional measures in Table 3.4-12, Brigantine Wilderness Area air-quality related values mitigation framework, to be incorporated in the Preferred Alternative. This measure, if adopted, would result in the coordinated development and implementation of preventative and compensatory mitigation measures intended to offset air quality impacts. Adoption of this measure would not reduce the minor to moderate impacts of the Preferred Alternative or other action alternatives because increases in ambient pollutant concentrations due to Project emissions would still be detectable.

3.5. Bats

This section discusses potential impacts on bat populations from the proposed Project, alternatives, and ongoing and planned activities in the bat geographic analysis area. The bat geographic analysis area, as shown on Figure 3.5-1, includes the United States coastline from Maine to Florida, and extends 100 miles (161 kilometers) offshore and 5 miles (8 kilometers) inland to capture the movement range for species in this group. The geographic analysis area for bats was established to capture most of the movement range for migratory species. The offshore limit was established to capture the migratory movements of most species in this group, while the onshore limits cover onshore habitats used by species that may be affected by onshore and offshore components of the proposed Project.

3.5.1 Description of the Affected Environment for Bats

The number of bat species in the geographic analysis area varies by state, ranging from eight species (Rhode Island, New Hampshire, and Maine) to 17 (Virginia and North Carolina) (Rhode Island Department of Environmental Management n.d.; Maine Department of Inland Fisheries and Wildlife 2021; New Hampshire Fish and Game n.d.; Virginia Department of Wildlife Resources 2021; North Carolina Wildlife Resources Commission 2017).

There are nine species of bats present in the state of New Jersey, eight of which may be present in the Project area and six that are year-round residents (Table 3.5-1).

Table 3.5-1 Bats Present in New Jersey and their Conservation Status

Common Name	Scientific Name	State Status	Federal Status
Cave-Hibernating Bats			
Eastern small-footed bat[1]	*Myotis leibii*	-	-
Little brown bat[1]	*Myotis lucifugus*	-	Under Review[2]
Northern long-eared bat[1,3]	*Myotis septentrionalis*	-	Endangered
Indiana bat[4]	*Myotis sodalist*	Endangered	Endangered
Tri-colored bat[1]	*Perimyotis subflavus*	-	Proposed
Big brown bat[5]	*Eptesicus fuscus*	-	-
Migratory Tree Bats			
Eastern red bat[5]	*Lasiurus borealis*	-	-
Hoary bat[5]	*Lasiurus cinereus*	-	-
Silver-haired bat[5]	*Lasionycteris noctivagans*	-	-

Source: Ocean Wind 2023; USFWS 2021a, 2021b.
[1] Currently a candidate for state listing as endangered pending rule promulgation (NJDEP 2013).
[2] Currently under a USFWS discretionary status review. Results of the review may be to propose listing, make a species a candidate for listing, provide notice of a not warranted candidate assessment, or other action as appropriate. USFWS anticipates a decision in Fiscal Year 2022.
[3] USFWS reclassified the northern long-eared bat as endangered on January 30, 2023 (87 *Federal Register* 73488).
[4] Range does not indicate species presence in Project area.
[5] Currently a candidate for state listing as special concern pending rule promulgation (NJDEP 2013).

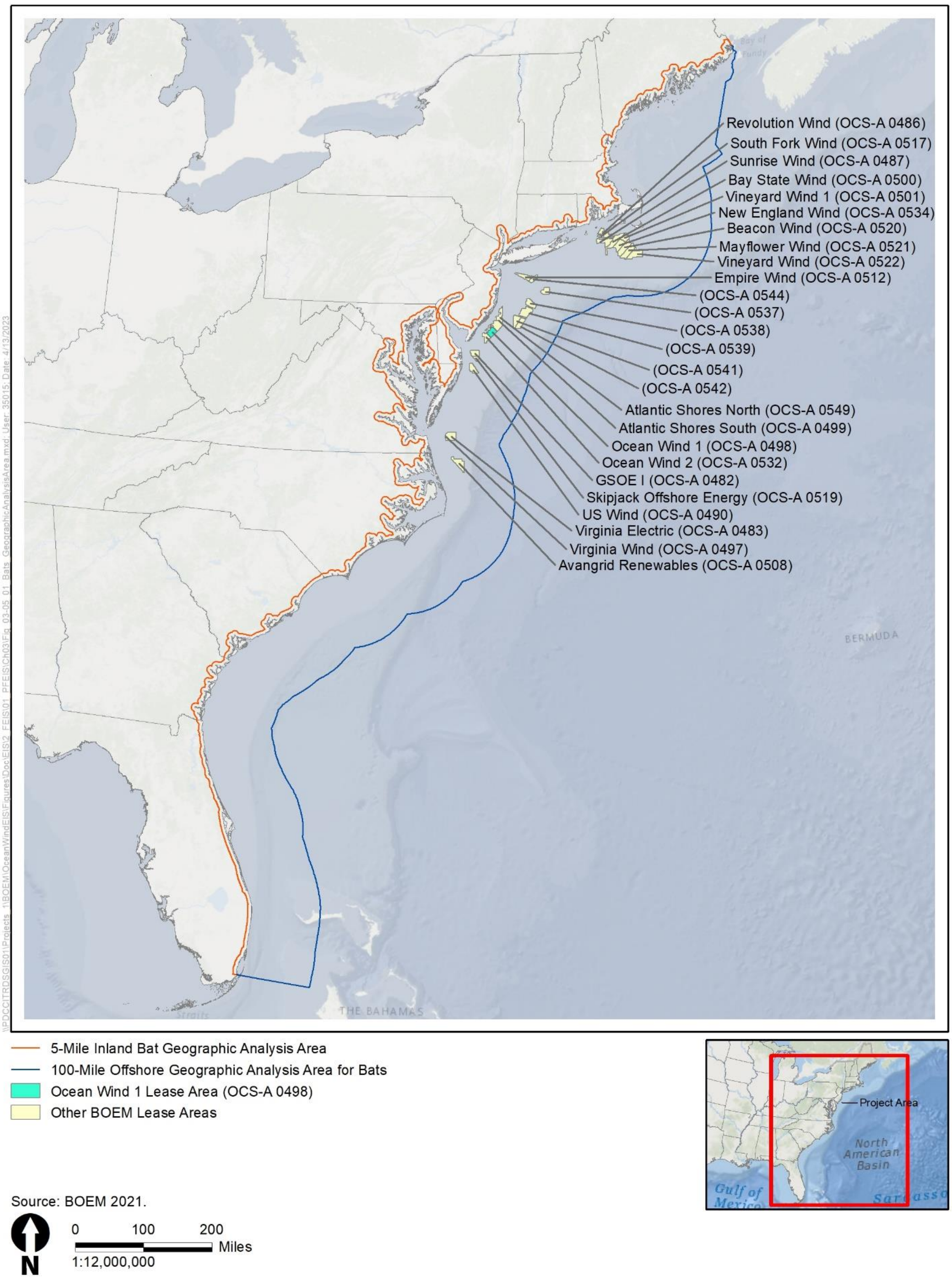


Figure 3.5-1 Bats Geographic Analysis Area

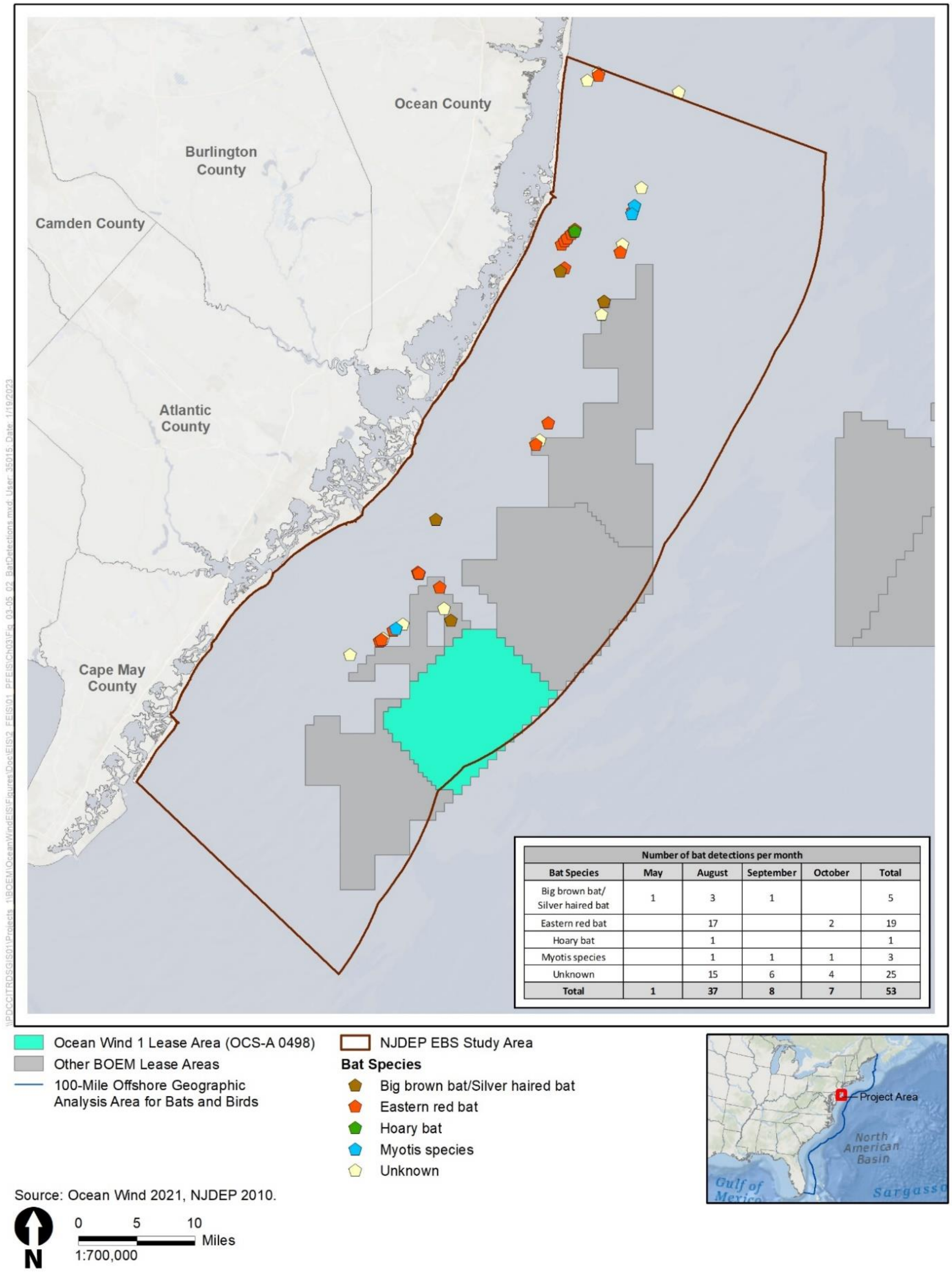
These species can be broken down into cave-hibernating bats and migratory tree bats based on their wintering strategy. Bats are terrestrial species that spend almost their entire lives on or over land. On occasion, tree bats may potentially occur offshore during spring and fall migration and under very specific conditions like low wind and high temperatures. Recent studies, combined with historical anecdotal accounts, indicate that migratory tree bats sporadically travel offshore during spring and fall migration, with 80 percent of acoustic detections occurring in August and September (Dowling et al. 2017; Hatch et al. 2013; Pelletier et al. 2013; Stantec 2016). However, unlike tree bats, the likelihood of detecting a Myotis species or other cave bat is substantially less in offshore areas (Pelletier et al. 2013).

The presence of bats has been documented in the offshore marine environment in the United States (Cryan and Brown 2007; Dowling et al. 2017; Hatch et al. 2013; Pelletier et al. 2013; Ocean Wind 2023). Bats have been documented temporarily roosting on structures (i.e., lighthouses) on nearshore islands and there is evidence of eastern red bats migrating offshore in the Atlantic. In a mid-Atlantic bat acoustic study conducted during the spring and fall of 2009 and 2010, the maximum distance that bats were detected from shore was 13.6 miles (21.9 kilometers) and the mean distance was 5.2 miles (8.4 kilometers). In Maine, bats were detected on islands up to 25.8 miles (41.6 kilometers) from the mainland. In the mid-Atlantic acoustic study, eastern red bat represented 78 percent of all bat detections offshore and bat activity decreased as wind increased. In addition, eastern red bats were detected in the mid-Atlantic up to 27.3 miles (44 kilometers) offshore by high-definition video aerial surveys (Ocean Wind 2023). At this time, there is some uncertainty regarding the level of bat use of the OCS. However, available data indicates that bat activity levels are generally lower offshore compared to onshore (Hein et al. 2021). A bat migration study in the North Sea off Belgium found that the number of bat detections was up to 24 times higher at onshore locations compared to the offshore locations (Brabant et al. 2021).

Cave-hibernating bats hibernate regionally in caves, mines, and other structures (e.g., buildings) and feed primarily on insects in terrestrial and fresh-water habitats. These species generally exhibit lower activity in the offshore environment than the migratory tree bats (Ocean Wind 2023), with movements primarily during the fall. In the mid-Atlantic, the maximum distance *Myotis* bats were detected offshore was 7.2 miles (11.5 kilometers). A recent nano-tracking study on Martha’s Vineyard recorded little brown bat movements off the island in late August and early September, with one individual flying from Martha’s Vineyard to Cape Cod. Big brown bats were also detected migrating from the island later in the year (October–November). These findings are supported by an acoustic study conducted on islands and buoys off the Gulf of Maine that indicated the greatest percentage of activity in July–October. Given that the use of the coastline as a migratory pathway by cave-hibernating bats is likely limited to their fall migration period, that acoustic studies indicate lower use of the offshore environment by cave-hibernating bats, and that cave-hibernating bats do not regularly feed on insects over the ocean, exposure to the Wind Farm Area is unlikely for this group (Ocean Wind 2023).

Tree bats migrate south to overwinter and have been documented in the offshore environment (Ocean Wind 2023). Eastern red bats have been detected migrating from Martha’s Vineyard late in the fall, with one bat tracked as far south as Maryland. These results are supported by historical observations of eastern red bats offshore and recent acoustic and survey results (Ocean Wind 2023). While little local data are available for the Project area, the NJDEP EBS surveys recorded several observations of bats flying over the ocean, with observations of migratory tree bats in the near-shore portion of the Wind Farm Area. Given that tree-bats were detected in the offshore environment, they may pass through the Project area during the migration period (Figure 3.5-2). Offshore acoustic bat surveys were conducted in Lease Area OCS-A 0499 in 2020 and 2021, which is directly adjacent to and north of the Wind Farm Area (Atlantic Shores 2021); species detected in this area during the 2020/2021 survey period may presumably occur in the Wind Farm Area given Lease Area OCS-A 0499’s proximity to the Wind Farm Area. Eastern red bat represented the most detections (495) followed by big brown/silver-haired bat group (478), silver-haired bat (80), hoary bat (37), big brown bat (26), tri-colored bat (5), and *Myotis* spp. (3). Detections occurred from July to October, with peak activity in August and September, and the latest detection occurring on November 1. Overall, there were 1,124 total bat detections identified to species or species group across the 180 survey nights in Lease Area OCS-A 0499. This averages to 6.2 bat detections per detector-night, which is a small fraction of bat passage rates typically found onshore during migration in eastern North America. For a nearby onshore comparison, Johnson et al. (2011) found bat activity along the coast of Maryland to average 25 passes per detector-night over the span of an entire year. During fall migration, the number of bat passes there commonly exceeded 500 per detector-night and peaked around 1,000 (Johnson et al. 2011), compared to an average of only 6.2 bat passes per night in Lease Area OCS-A 0499 during a similar time of year. As another comparison, a recent study farther inland, along Lake Erie, reported an average of 155 bat passes per detector-night during the fall migration period of 2020 (Haddaway and McGuire 2022). As such, while some bats undoubtedly take offshore routes during migration and can be present offshore, they appear to represent a very small percentage of their species' total population onshore.

Onshore coastal areas throughout the geographic analysis area provide a variety of habitats that support a diversity of bat species. The onshore export cable route corridors to BL England and Oyster Creek contain a diverse set of habitats including coastal wetlands, forested wetlands, forested uplands, forested lowlands, barrier beaches, and bay island habitats that support a diversity of bat species. Forested habitats, such as the area adjacent to the proposed onshore export cables at BL England and Oyster Creek, can provide roosting areas for both migratory and non-migratory species. All bat species present in New Jersey (migratory and non-migratory) are known to utilize forested areas (of varying types) during summer for roosting and foraging. Some of these species roost solely in the foliage of trees, while others select dead and dying trees where they roost in peeling bark or inside crevices. Some species may select forest interior sites, while others prefer edge habitats (Ocean Wind 2023). Ocean Wind conducted acoustic bat surveys in eight locations of potential suitable bat habitat in the Onshore Project area, including two locations at the Oyster Creek Substation, three locations along a segment of the Oyster Creek onshore export cable route, and three locations around the BL England substation (Johnson and Ostroski 2022). Over the course of the survey, which took place on various nights between July 13 and August 15, 2022, 3,874 total bat calls were recorded (note that number of bat calls does not equal number of bat individuals). The quantitative analysis of the recorded data indicates the presence of big brown bat, eastern red bat, and little brown bat. A manual review of each call file indicated the presence of big brown bat (3), eastern red bat (388), hoary bat (8), evening bat (1), and tricolored bat (2). Biodiversity Research Institute completed field work in 2011 in the area at Edwin B. Forsythe National Wildlife Refuge (6 miles [10 kilometers] south of Oyster Creek and 30 miles [48 kilometers] north of BL England) where northern long-eared bat, eastern red bat, big brown bat, and little brown bat were captured. No telemetry was conducted, so it is unknown if they used the refuge or surrounding areas for roosting. Caves and mines provide key habitat for non-migratory bats. These locations serve as winter hibernacula, fall swarm locations (areas where mating takes place in the fall months), and summer roosting locations for some individuals. Hibernacula are documented in New Jersey, but the numbers of individuals at the sites have declined dramatically because of the fungal disease white-nose syndrome (WNS) (Ocean Wind 2023). Overall, while both cave-hibernating and migratory tree bats may occur in the area around BL England and Oyster Creek, the onshore export cable route corridors are not likely to provide suitable habitat because they are anticipated to be mostly co-located with existing disturbed areas (e.g., roads, transmission lines). In addition, there are generally fewer bats along the coast of New Jersey (see Figure 2-4 in COP Volume III, Appendix H, Ocean Wind 2023).



Number of bat detections per month					
Bat Species	May	August	September	October	Total
Big brown bat/ Silver haired bat	1	3	1		5
Eastern red bat		17		2	19
Hoary bat		1			1
Myotis species		1	1	1	3
Unknown		15	6	4	25
Total	1	37	8	7	53

Figure 3.5-2 Bat Occurrences in the New Jersey Department of Environmental Protection Ecological Baseline Studies

One bat species protected under the ESA may occur in the Project area: the northern long-eared bat (USFWS 2021a; Ocean Wind 2023). However, the 2022 acoustic bat surveys did not detect any northern long-eared bats (Johnson and Ostroski 2022). The 2022 acoustic survey did detect two calls from tricolored bat, which was recently proposed for listing under the federal ESA. The two calls occurred on one night at one survey location along the Oyster Creek onshore cable route. It is not expected that northern long-eared bats will be exposed to the offshore Wind Farm Area. A recent tracking study on Martha’s Vineyard (July–October 2016) did not record any offshore movements (Ocean Wind 2023). If northern long-eared bat were to migrate over water, movements would likely be in close proximity to the mainland. The related little brown bat has been documented to migrate from Martha’s Vineyard to Cape Cod, and northern long-eared bat may likewise migrate to mainland hibernacula from these islands in August–September (Ocean Wind 2023). Given that there is little evidence of use of the offshore environment by northern long-eared bat, exposure to the proposed Wind Farm Area, if it occurs, is anticipated to be minimal. The Ocean Wind BA provides a detailed discussion of ESA-listed species and potential impacts on these species as a result of the Project (BOEM 2022).

Cave bat species, including the northern long-eared bat, are experiencing drastic declines due to WNS. WNS has been confirmed present in every state in the geographic analysis area, except Florida (Whitenosesyndrome.org 2021). WNS was confirmed present in New Jersey in 2009 and has killed large numbers of cave bats during hibernation—more than 90 percent at many sites (Whitenosesyndrome.org 2021; New Jersey Division of Fish and Wildlife 2019). However, New Jersey’s bat population appears to be stabilizing (New Jersey Division of Fish and Wildlife 2019). Proposed Project-related impacts have the potential to affect cave bat populations already affected by WNS. The unprecedented mortality of more than 5.5 million bats in northeastern North America as of 2015 reduces the likelihood of many individuals being present within the onshore portions of the proposed Project area (USFWS 2015). However, given the drastic reduction in cave bat populations in the region, the biological significance of mortality resulting from the proposed Project, if any, may be increased.

3.5.2 Environmental Consequences

3.5.2.1. Impact Level Definitions for Bats

Definitions of impact levels are provided in Table 3.5-2. There are no beneficial impacts on bats.

Table 3.5-2 Impact Level Definitions for Bats

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
Minor	Adverse	Most impacts would be avoided; if impacts occur, the loss of one or few individuals or temporary alteration of habitat could represent a minor impact, depending on the time of year and number of individuals involved.
Moderate	Adverse	Impacts are unavoidable but would not result in population-level effects or threaten overall habitat function.
Major	Adverse	Impacts would result in severe, long-term habitat or population-level effects on species.

3.5.3 Impacts of the No Action Alternative on Bats

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on bats, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for bats. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.5.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for bats described in Section 3.5.1, *Description of the Affected Environment for Bats,* would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on bats are generally associated with onshore construction and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect bat species through temporary and permanent habitat removal and temporary noise impacts, which could cause avoidance behavior and displacement. Mortality of individual bats could occur, but population-level effects would not be anticipated. Impacts associated with climate change have the potential to reduce reproductive output and increase individual mortality and disease occurrence.

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on bats include:

- Continued O&M of the Block Island project (five WTGs) installed in state waters;
- Continued O&M of the Coastal Virginia Offshore Wind project (two WTGs) installed in OCS-A 0497; and
- Ongoing construction of two offshore wind projects, the Vineyard Wind 1 project (62 WTGs and 1 OSS) in OCS-A 0501 and the South Fork project (12 WTGs and 1 OSS) in OCS-A 0517.

The effects of approved projects have been evaluated through previous NEPA review and are incorporated by reference. Ongoing O&M of the Block Island and Coastal Virginia Offshore Wind projects and ongoing construction of the Vineyard Wind 1 and South Fork projects would affect bats through the primary IPFs of noise, presence of structures, and land disturbance. Ongoing offshore wind activities would have the same type of impacts from noise, presence of structures, and land disturbance that are described in detail in Section 3.5.3.2 for planned offshore wind activities but the impacts would be of lower intensity.

3.5.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Other planned non-offshore wind activities that may affect bats include new submarine cables and pipelines, oil and gas activities, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS (see Section F.2 in Appendix F for a complete description of planned activities). These activities may result in temporary and permanent onshore habitat impacts and temporary or permanent displacement and injury of or mortality to individual bats, but population-level effects would not be expected. See Table F1-2 for a summary of potential impacts associated with planned non-offshore wind activities by IPF for bats.

The sections below summarize the potential impacts of planned offshore wind activities on bats during construction, O&M, and decommissioning of the projects. The federally listed northern long-eared bat is the only bat species listed under the ESA that may be affected by other offshore wind activities. Impacts on the northern long-eared bat would most likely be limited to onshore impacts, and generally during onshore facility construction.

Offshore wind activities may affect bats through the following primary IPFs.

Noise: Anthropogenic noise associated with offshore wind development, including noise from pile-driving and construction activities, has the potential to affect bats on the OCS. Additionally, onshore construction noise has the potential to affect bats. BOEM anticipates that these impacts would be temporary and highly localized.

In the planned activities scenario (Appendix F, *Planned Activities Scenario*), the construction of 3,000 offshore structures (other than the Proposed Action) would create noise and may temporarily affect some migrating tree bats, if conducted at night during spring or fall migration. The greatest impact of noise is likely to be caused by pile-driving activities during construction. Noise from pile driving would occur during installation of foundations for offshore structures at a frequency of 4 to 6 hours at a time over an 8-year period. Construction activity would be temporary and highly localized. Auditory impacts are not expected to occur, as recent research has shown that bats may be less sensitive to TTS than other terrestrial mammals (Simmons et al. 2016). Habitat-related impacts (i.e., displacement from potentially suitable habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior by individual migrating tree bats (Schaub et al. 2008). These impacts would likely be limited to behavioral avoidance of pile-driving or construction activity, and no temporary or permanent hearing loss would be expected (Simmons et al. 2016). However, these impacts are highly unlikely to occur, as little use of the OCS is expected, and only during spring and fall migration.

Potential for temporary and localized habitat impacts arising from onshore construction noise exists; however, no auditory impacts on bats would be expected to occur. Recent literature suggests that bats are less susceptible to temporary or permanent hearing loss from exposure to intense sounds (Simmons et al. 2016). Nighttime work may be required on an as-needed basis. Some temporary displacement or avoidance of potentially suitable foraging habitat could occur, but these impacts would not be expected to be biologically significant. Some bats roosting in the vicinity of construction activities may be disturbed during construction but would be expected to move to a different roost farther from construction noise. This would not be expected to result in any impacts, as frequent roost switching is common among bats (Hann et al. 2017; Whitaker 1998).

Non-routine activities associated with the offshore wind facilities would generally require intense, temporary activity to address emergency conditions. The noise made by onshore construction equipment or offshore repair vessels could temporarily deter bats from approaching the site of a given non-routine event. Impacts on bats, if any, would be temporary and last only as long as repair or remediation activities were necessary to address these non-routine events.

Given the temporary and localized nature of potential impacts and the expected biologically insignificant response to those impacts, no individual fitness or population-level impacts would be expected to occur as a result of onshore or offshore noise associated with offshore wind development, so impacts would be negligible.

Presence of structures: Offshore wind-related activities would add up to 3,000 WTGs and OSS on the OCS that could result in potential impacts on bats. Cave bats (including the federally listed as threatened northern long-eared bat) do not tend to fly offshore (even during fall migration) and, therefore, exposure to construction vessels during construction or maintenance activities, or the rotor-swept zone (RSZ) of operating WTGs in the wind lease areas (e.g., collisions, barotrauma), is expected to be negligible to minor, if exposure occurs at all (BOEM 2015; Pelletier et al. 2013).

Tree bats, however, may pass through the offshore wind lease areas during the fall migration, with limited potential for migrating bats to encounter vessels during construction and decommissioning of WTGs, OSS, and offshore export cable corridors, although structure and vessel lights may attract bats due to increased prey abundance. As discussed above, while bats have been documented on offshore islands, relatively little bat activity has been documented over open water habitat similar to the conditions in the Project Wind Farm Area. Several authors, such as Cryan and Barclay (Barclay 2009), Cryan et al. (Cryan et al. 2014), and Kunz et al. (Kunz et al. 2007), discuss several hypotheses as to why bats may be attracted to WTGs. Many of these, including the creation of linear corridors, altered habitat conditions, or thermal inversions, would not apply to WTGs on the Atlantic OCS (Cryan and Barclay 2009; Cryan et al. 2014; Kunz et al. 2007). Other hypotheses associated with the Atlantic OCS regarding bat attraction to WTGs include bats perceiving the WTGs as potential roosts, potentially increased prey base, visual attraction, disorientation due to EMFs or decompression, or attraction due to mating strategies (Arnett et al. 2008; Cryan 2007; Kunz et al. 2007). However, no definitive answer as to why, if at all, bats are attracted to WTGs has been postulated, despite intensive studies at onshore wind facilities. As such, it is possible that some bats may encounter, or perhaps be attracted to, OSS and non-operational WTG towers to opportunistically roost or forage. However, bats' echolocation abilities and agility make it unlikely that these stationary objects (OSS and non-operational WTGs) or moving vessels would pose a collision risk to migrating individuals; this assumption is supported by the evidence that bat carcasses are rarely found at the bases of onshore turbine towers (Choi et al. 2020).

Tree bat species that may encounter the operating WTGs in the offshore wind lease areas include the eastern red bat, hoary bat, and silver-haired bat. Offshore O&M would present a seasonal risk factor to migratory tree bats that may utilize the offshore habitats during fall migration. While some potential exists for migrating tree bats to encounter operating WTGs during fall migration, the overall occurrence of bats on the OCS is relatively very low (Stantec 2016). Furthermore, unlike with terrestrial migration routes, there are no landscape features that would concentrate bats and thereby increase exposure to the offshore wind lease areas. Given the expected infrequent and limited use of the OCS by migrating tree bats, very few individuals would be expected to encounter operating WTGs or other structures associated with offshore wind development. With the proposed up to 1-nm (1.9-kilometer) spacing between structures associated with offshore wind development and the distribution of anticipated projects, individual bats migrating over the OCS within the RSZ of project WTGs would likely pass through projects with only slight course corrections, if any, to avoid operating WTGs because, unlike with terrestrial migration routes, there are no landscape features that would concentrate migrating tree bats and increase exposure to offshore wind lease areas on the OCS (Baerwald and Barclay 2009; Cryan and Barclay 2009; Fiedler 2004; Hamilton 2012; Smith and McWilliams 2016). Additionally, the potential collision risk to migrating tree bats varies with climatic conditions; for example, bat activity is associated with relatively low wind speeds and warm temperatures (Arnett et al. 2008; Cryan and Brown 2007; Fiedler 2004; Kerns et al. 2005). Given the relatively low numbers of tree bats in the offshore environment, the WTGs being widely spaced, and the patchiness of projects, the likelihood of collisions is expected to be low, so impacts on bats would be negligible to minor. Additionally, the likelihood of a migrating individual encountering one or more operating WTGs during adverse weather conditions is extremely low, as bats have been shown to suppress activity during periods of strong winds, low temperatures, and rain in the onshore environment (Arnett et al. 2008; Erickson et al. 2002), as well as the offshore environment where strong winds, low temperatures, and inclement weather correlate with lower bat activity in the offshore environment (Sjollema et al. 2014; Ahlen et al. 2007; Stantec 2016; True et al. 2021). In addition, bats avoid flying in rain due to the increased energy expenditure (Voigt et al. 2011).

Land disturbance: A small amount of infrequent construction impacts associated with onshore power infrastructure would be required over the next 8 years to tie offshore wind energy projects to the electrical grid. Typically, this would require only small amounts of habitat removal, if any, and would occur in previously disturbed areas. Short-term, negligible to minor impacts associated with habitat loss or avoidance during construction may occur, and injury or mortality of individuals would be unlikely. As such, onshore construction activities associated with offshore wind development would not be expected to appreciably contribute to impacts on bats.

In addition to electrical infrastructure, some amount of habitat conversion may result from port expansion activities required to meet the demands for fabrication, construction, transportation, and installation of wind energy structures. The general trend along the coastal region from Virginia to Maine is that port activity will increase modestly and require some conversion of undeveloped land to meet port demand. This conversion will result in permanent habitat loss for local bat populations. However, the incremental increase from offshore wind development would be a minimal contribution in the port expansion required to meet increased commercial, industrial, and recreational demand (BOEM 2019).

3.5.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, bats would continue to be affected by existing environmental trends and ongoing activities. Ongoing activities are expected to have continuing temporary and permanent impacts (disturbance, displacement, injury, mortality, and habitat conversion) on bats. These effects are primarily driven by onshore construction impacts, the presence of structures, and climate change. Given the infrequent and limited anticipated use of the OCS by migrating tree bats during spring and fall migration, and given that cave bats do not typically occur on the OCS, ongoing offshore wind activities would not appreciably contribute to impacts on bats. Temporary disturbance and permanent loss of onshore habitat may occur as a result of offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the geographic analysis area. The No Action Alternative would result in **negligible** to **minor** impacts on bats.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and bats would continue to be affected by natural and human-caused IPFs. Planned activities would contribute to impacts on bats due to habitat loss from increased onshore construction. BOEM anticipates that the cumulative impacts of the No Action Alternative would likely be **negligible** to **minor** because bat presence on the OCS is anticipated to be limited and onshore bat habitat impacts are expected to be minimal.

3.5.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on bats:

- The onshore export cable routes, including routing variants, and extent of ground disturbance for new onshore substations, which could require the removal of trees suitable for roosting and foraging;
- The number, size, and location of WTGs; and
- The time of year during which construction occurs.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- WTG number, size, and location: The level of hazard related to WTGs is proportional to the number of WTGs installed; fewer WTGs would present less hazard to bats.
- Onshore export cable routes and substation footprints: The route chosen (including variants within the general route) and substation footprints would determine the amount of habitat affected.
- Season of construction: The active season for bats in this area is from April through October. Construction outside of this window would have a lesser impact on bats than construction during the active season.

Ocean Wind has committed to measures to minimize impacts on bats. Trees would be cleared during winter months to the extent practicable (BAT-01), and if tree clearing is required in areas with trees suitable for bat roosting habitat when northern long-eared bats may be present, avoidance and minimization measures would be developed in coordination with USFWS and NJDEP (BAT-02). Also, Ocean Wind would use lighting technology that minimizes impacts on bat species (BIRD-04) (COP Volume II, Table 1.1-2; Ocean Wind 2023) and has committed to implementing an *Avian and Bat Post-Construction Monitoring Framework* (COP Appendix AB; Ocean Wind 2023) that outlines an approach to post-construction bat monitoring that supports advancement of the understanding of bat interactions with offshore wind farms.

3.5.5 Impacts of the Proposed Action on Bats

3.5.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.5.7, *Impacts of Alternative E on Bats*.

The sections below summarize the potential impacts of the Proposed Action on bats during the various phases of the proposed Project. Routine activities would include construction, O&M, and decommissioning of the proposed Project, as described in Chapter 2, *Alternatives*. BOEM prepared a BA for the potential effects on USFWS federally listed species, which found that the Proposed Action was *not likely to adversely affect*, or had *no effect*, on listed species (BOEM 2022). BOEM requested concurrence on its conclusion that the impacts of the proposed activities are expected to be discountable and insignificant, and thus *may affect but are not likely to adversely affect* northern long-eared bat. There is no critical habitat designated for this species. The results of consultation with USFWS pursuant to Section 7 of the ESA will be included in the Final EIS.

Noise: Pile-driving noise and onshore and offshore construction noise associated with the Proposed Action is expected to result in temporary, highly localized, and negligible impacts. Auditory impacts are not expected to occur, as recent research has shown that bats may be less sensitive to TTS than other terrestrial mammals (Simmons et al. 2016). Impacts, if any, are expected to be limited to behavioral avoidance of pile-driving or construction activity, and no temporary or permanent hearing loss would be expected (Simmons et al. 2016).

Presence of Structures: The various types of impacts on bats that could result from the presence of structures, such as migration disturbance and turbine strikes, are described in detail in Section 3.5.3.2. Up to 98 WTGs on the OCS would result from the proposed Project where few currently exist. The structures, and related bat impacts, associated with Proposed Action would remain at least until decommissioning of the proposed Project is complete. At this time, there is some uncertainty regarding the level of bat use of the OCS and the ultimate consequences of mortality, if any, associated with operating WTGs. Three years of post-construction bat monitoring around the Block Island Wind Farm found bats present and at wind speeds at or above the cut-in speeds for Ocean Wind 1's proposed WTGs (Stantec 2020), which could indicate vulnerability for bats. The cut-in speed for the proposed WTGs is 3.5 m/s and, based on the wind speeds that bats were observed at the Block Island Wind Farm, bats could be exposed to the turbine blades when they are turning. However, as previously mentioned, available data indicate that bat activity levels are generally lower offshore compared to onshore (Hein et al. 2021). A bat migration study in the North Sea off Belgium found that the number of bat detections was up to 24 times higher at onshore locations compared to offshore locations (Brabant et al. 2021). In addition, the proposed WTGs are very large and spin much slower (7.8 rotations per minute) compared to onshore wind turbines.

Existing data from meteorological buoys provide the best opportunity to further define bat use of open-water habitat far from shore where Ocean Wind would site the proposed Project WTGs. Relatively few (372) bat passes were detected at meteorological buoy sites and use was sporadic when compared to sites on offshore islands (Stantec 2016). In addition, the data from 3 years of post-construction monitoring around Block Island Wind Farm found relatively low numbers of bats and only during fall, and no northern long-eared bats (Stantec 2020). While the buoy data and Block Island Wind Farm data were collected outside of the Project's Wind Farm Area, the information is still applicable to the overall use of bats on the OCS. Furthermore, as previously mentioned, surveys conducted offshore New Jersey for the NJDEP EBS that cover the Project's Wind Farm Area recorded several observations of bats flying over the ocean, but not as far as Ocean Wind 1's Wind Farm Area (NJDEP 2010) (Figure 3.5-2). Therefore, because available information indicating bat presence on the OCS is limited, BOEM anticipates the presence of structures to have a negligible to minor impact on bats. Ocean Wind has also committed to implementing an *Avian and Bat Post-Construction Monitoring Framework* (COP Appendix AB; Ocean Wind 2023) that outlines an approach to post-construction bat monitoring that supports advancement of the understanding of bat interactions with offshore wind farms. The scope of monitoring is designed to meet federal requirements (30 CFR 585.626(b)(15) and 585.622(b)) and is scaled to the size and risk profile of the Project with a focus on species of conservation concern.

Land disturbance: Impacts associated with construction of onshore elements of the Proposed Action could occur if construction activities occur during the active season (generally April through October), and may result in injury or mortality of individuals, particularly juveniles who are unable to flush from a roost, if occupied by bats at the time of removal. There would be some potential for habitat impacts on bats as a result of the loss of potentially suitable roosting or foraging habitat. However, impacts on bat habitat from onshore construction activities would be limited because, whenever possible, facilities (including overhead transmission lines) would be co-located with existing developed areas (i.e., roads and existing transmission lines) to limit disturbance. Where necessary, construction of onshore facilities may require clearing and some permanent removal of some trees along the edge of the construction corridor. The existing habitat at the proposed onshore substation sites at BL England and Oyster Creek is already developed and fragmented. Any remnant habitat within the permanent substation site would be converted to developed land with landscaping for the duration of the Project's operational lifetime.

Approximately 12.6 acres of tree clearing would be required to construct the Oyster Creek substation (Table 3.5-3). However, the substation area is previously disturbed and sparsely vegetated, is characterized as upland meadow early-successional forest with some patches of emergent wetlands and small scattered trees, and is not suitable bat roosting habitat. The Oyster Creek onshore cable route does include tree clearing in some forested areas characterized as mixed pine barrens/oak-dominated forest. An estimated 4.1 acres would be permanently cleared and 10.3 acres temporarily cleared for the Oyster Creek onshore cable route (Table 3.5-3). However, these forested areas are predominantly previously disturbed farmland and are composed primarily of successional stage pitch pine and small mixed oaks typical of coastal New Jersey and are generally not suitable bat roosting habitat, with few trees at least 3 inches in diameter.

The BL England substation is predominantly upland meadow, as it occupies much of a former golf course that continues to be mowed regularly, but there are areas of upland forest with a moderate to dense tree canopy with a mix of pines and hardwoods. Forested areas within the substation parcel feature a moderate to dense tree canopy with a mix of coniferous and deciduous species, and an open shrub and sapling layer. Trees are generally small (6 to 10 inches in diameter) with the exception of a few larger pitch pines and red maples. Dominant tree species are red maple, pitch pine, Eastern red cedar, black tupelo, sweetgum, and white pine. Construction of the substation would not require permanent or temporary tree clearing (Table 3.5-3). The BL England onshore export cable route is mostly within paved roadways but would require 0.7 acre of permanent and 0.5 acre of temporary tree clearing near the proposed substation.

Table 3.5-3 Estimated Areas of Tree Clearing (Acres)

Location	Permanent Tree Clearing[1]	Temporary Tree Clearing[1,2]	Total Tree Clearing
Oyster Creek			
Oyster Creek Export Cable	4.1	10.3	14.4
Oyster Creek Substation	12.6	0	12.6
Oyster Creek Total	16.7	10.3	27.0
BL England			
BL England Export Cable	0.7	0.5	1.2
BL England Substation	0	0	0
BL England Total	0.7	0.5	1.2

The areas in the table are based on the proposed limits of disturbance and canopy coverage from aerial photography. Once tree surveys are concluded, these areas will be refined.
[1] Some areas within the limit of disturbance will be cleared of trees permanently; however, much of this area is not forested.
[2] Temporary tree clearing may be required for construction laydown and access and will be allowed to naturally revegetate or be replanted.

To avoid and minimize impacts on bats, Ocean Wind is proposing to conduct tree clearing during winter months, to the extent practicable, to develop avoidance and minimization measures with USFWS and NJDEP specific to the northern long-eared bat and to conduct pre-construction habitat surveys for northern long-eared bat (BAT-01, BAT-02; see COP Volume II, Table 1.1-2; Ocean Wind 2023). Additional measures proposed by Ocean Wind that are not specific to bats would further avoid and minimize land disturbance impacts on bats (GEN-01, GEN-13, TCHF-01, and TCHF-02; see COP Volume II, Table 1.1-2; Ocean Wind 2023). BOEM anticipates that impacts would be negligible to minor given the limited amount of habitat removal, and that any potential impact would be avoided or significantly reduced due to Ocean Wind’s proposed APMs; therefore, impacts would not result in individual fitness or population-level effects.

3.5.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities. Ongoing and planned non-offshore wind activities related to submarine cables and pipelines, oil and gas activities, marine minerals extraction, onshore development, and port expansions would contribute to impacts on bats through the primary IPFs of noise, presence of structures, and land disturbance. The construction, O&M, and decommissioning of both onshore and offshore infrastructure for offshore wind activities across the geographic analysis area would also contribute to the primary IPFs of noise, presence of structures, and land disturbance. Given the infrequent and limited anticipated use of the OCS by migrating tree bats during spring and fall migration and given that cave bats do not typically occur on the OCS, offshore wind activities would not appreciably contribute to impacts on bats. Temporary disturbance and permanent loss of onshore habitat may occur as a result of constructing onshore infrastructure such as onshore substations and onshore export cables for offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the geographic analysis area. Ongoing and planned offshore wind activities in combination with the Proposed Action would result in an estimated 2,952 WTGs, to which the Proposed Action would contribute 98 WTGs or 3 percent.

The cumulative impacts on bats would likely be negligible to minor because the occurrence of bats offshore is low, and onshore habitat loss is expected to be minimal. The Proposed Action would contribute an undetectable increment to the cumulative noise, presence of structures, and land disturbance impacts on bats.

3.5.5.3. Conclusions

Impacts of the Proposed Action. BOEM anticipates construction and installation, O&M, and conceptual decommissioning of the Proposed Action would have **negligible** to **minor** impacts on bats, especially if tree clearing is conducted outside the active season. The primary risks would be from potential onshore removal of habitat and operation of the offshore WTGs, which could lead to negligible to minor long-term impacts in the form of mortality, although BOEM anticipates this to be rare. Noise effects from construction are expected to be limited to temporary and localized behavioral avoidance of pile-driving or construction activity that would cease once construction is complete.

Cumulative Impacts of the Proposed Action. BOEM anticipates that the cumulative impacts on bats in the geographic analysis area would be **negligible** to **minor**. The incremental impacts contributed by the Proposed Action to the cumulative impacts on bats would be undetectable. Because the occurrence of bats offshore is low, the Proposed Action would contribute to the cumulative impacts primarily through the permanent impacts from onshore habitat loss related to onshore cable installation and substation construction.

3.5.6 Impacts of Alternatives B, C, and D on Bats

Impacts of Alternatives B, C, and D. The impacts resulting from individual IPFs associated with construction and installation, O&M, and conceptual decommissioning of the Project under Alternatives B, C, and D would be similar to those described under the Proposed Action. BOEM expects the elimination of WTGs under Alternatives B-1 (up to 9 WTGs), B-2 (up to 19 WTGs), and D (up to 15 WTGs) to have a reduced impact on bats given the smaller number of WTGs compared to the Proposed Action. BOEM does not expect relocation of the eight WTGs and compression of the 98 WTGs under Alternatives C-1 and C-2, respectively, to significantly change the potential impacts compared to the Proposed Action because the total number of WTGs would remain the same, the overall footprint would be the same or slightly less, and the Wind Farm Area does not include areas with high bat densities.

Given the infrequent and limited use of the OCS by bats during spring and fall migration and the similar or smaller footprints under Alternatives B-1, B-2, C-1, C-2, and D, BOEM does not anticipate impacts to be materially different than those described under the Proposed Action.

Cumulative Impacts of Alternatives B, C, and D. The cumulative impacts on bats would likely be negligible to minor because the occurrence of bats offshore is low, and onshore habitat loss is expected to be minimal. The incremental impacts contributed by Alternatives B, C, and D to the cumulative impacts on bats would be similar to those described under the Proposed Action.

3.5.6.1. Conclusions

Impacts of Alternatives B, C, and D. As discussed in the above sections, the anticipated negligible to minor impacts associated with the Proposed Action would not change substantially under Alternatives B, C, and D. While Alternatives B, C, and D could slightly change the impacts on bats within the Offshore and Onshore Project areas, ultimately the same construction, O&M, and decommissioning impacts would still occur. Alternatives B-1, B-2, and D may result in slightly less, but not materially different, negligible to minor impacts on bats than those described under the Proposed Action. Alternative C-1 would have the same WTG number and Wind Farm Area footprint as the Proposed Action and, therefore, would have similar negligible to minor impacts on bats. Alternative C-2 would have the same number of WTGs as the Proposed Action, but compressed in a smaller footprint, and, therefore, would have similar negligible to minor impacts on bats. Therefore, the **negligible** to **minor** impacts would be very similar among the Proposed Action and Alternatives B, C, and D.

Cumulative Impacts of Alternatives B, C, and D. The incremental impacts contributed by Alternatives B, C, and D to the cumulative impacts on bats would be undetectable. However, the differences in impacts among Alternatives B, C, and D should still be considered alongside the impacts of other factors. Therefore, impacts on bats would be slightly less, but not materially different, under Alternatives B-1, B-2, and D and similar, but not materially different, under Alternatives C-1 and C-2. BOEM anticipates the that the cumulative impacts of Alternatives B, C, and D would likely be **negligible** to **minor**. This impact rating is driven primarily by ongoing activities as well as limited disturbance and habitat removal associated with onshore construction of the alternatives.

3.5.7 Impacts of Alternative E on Bats

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Project under Alternative E would be similar to those described under the Proposed Action. In contrast to the Proposed Action, which includes two Oyster Creek cable route options as part of Ocean Wind’s PDE to cross Island Beach State Park, Alternative E would cross Island Beach State Park on the more northerly route where SAV impacts would be avoided (refer to Section 2.1.6). BOEM expects that the modifications to the Oyster Creek export cable route to avoid impacts on SAV in Barnegat Bay under Alternative E would not significantly change the potential impact compared to the Proposed Action. Alternative E would affect an additional 0.9 acre of undisturbed scrub/shrub and wetland habitat, which can support bats, compared to the southern cable route under the Proposed Action. This habitat impact would occur in the vicinity of an existing maintenance/storage yard across from the Park Office on Central Avenue/Shore Road and would be a primarily temporary impact to support HDD staging and workspace, but some permanent cable easements would be required after the staging and workspaces are restored. Alternative E would also slightly increase the length of the onshore cable route compared to the southern option under the Proposed Action, but the cable would be placed along the parking area and Central Avenue/Shore Road where vegetation impacts are anticipated to be minimal. While the construction duration under Alternatives E could be longer than under the Proposed Action if the southern cable route option is constructed due to the slightly increased cable length, non-habitat impacts (e.g., noise) would be temporary, lasting only the duration of construction. Any timing restrictions for construction to avoid impacts on bats (e.g., not clearing trees during winter) would be the same as under the Proposed Action. Impacts on bat habitat from onshore construction activities under

Alternative E would increase slightly compared to the Proposed Action due to HDD staging and workspace and permanent impacts from widening existing rights-of-way, but would still remain relatively limited because facilities would be co-located with existing developed areas (i.e., roads, parking areas, and maintenance yards) to limit disturbance and affected habitats would be mostly restored or would be minimal in the context of the surrounding available habitat.

Cumulative Impacts of Alternative E. The cumulative impacts on bats would likely be negligible to minor because the occurrence of bats offshore is low, and onshore habitat loss is expected to be minimal. The incremental impacts contributed by Alternative E to the cumulative impacts on bats would be similar to those described under the Proposed Action.

3.5.7.1. Conclusions

Impacts of Alternative E. The anticipated negligible to minor impacts associated with the Proposed Action alone would not change substantially under Alternative E. While Alternative E could slightly change the impacts on bats within the Onshore Project area, ultimately the same construction, O&M, and decommissioning impacts would still occur. Alternative E would have a slightly different onshore cable route than the southern option under the Proposed Action that could result in negligible to minor impacts for onshore ground disturbance due to potential temporary and permanent impacts, but impacts on bat habitat from onshore construction activities would not be materially different than those of the Proposed Action and would still remain limited. Therefore, Alternative E would have negligible to minor impacts on bats.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on bats would be undetectable. Considering all the IPFs together, BOEM anticipates that the cumulative impacts on bats associated with Alternative E would be **negligible** to **minor**. This impact rating is driven primarily by ongoing activities as well as limited disturbance and habitat removal associated with onshore construction of Alternative E.

3.5.8 Proposed Mitigation Measures

Several measures are proposed minimize impacts on bats (Appendix H, Table H-2). If the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced.

Table 3.5-4 Measures Resulting from Consultations (Also Identified in Appendix H, Table H-2): Bats

Measure[1]	Description	Effect
Adaptive mitigation for birds and bats	BOEM will require that Ocean Wind develops and implements an Avian and Bat Post-Construction Monitoring Plan based on COP Appendix III, Appendix AB Avian and Bat Post-Construction Monitoring Framework in coordination with USFWS, NJDEP, and other relevant regulatory agencies. Annual monitoring reports will be used to determine the need for adjustments to monitoring approaches, consideration of new monitoring technologies, and/or additional periods of monitoring (see Appendix H, Table H-2 for more detail).	If the reported post-construction bat monitoring results (generated as part of Ocean Wind's *Avian and Bat Post-Construction Monitoring Framework* [COP Appendix AB, Ocean Wind 2023]) indicate bat impacts deviate substantially from the impact analysis included in this EIS, then Ocean Wind must make recommendations for new mitigation measures or monitoring methods (refer to Appendix H, Table H-2).
Annual bird and	Annual Bird Mortality Reporting during	Annual bat mortality reporting can

Measure[1]	Description	Effect
bat mortality reporting	construction and operation, and decommissioning. The Lessee must submit an annual report covering each calendar year, due by January 31 of the following year, documenting any dead (or injured) birds or bats found on vessels and structures during construction, operations, and decommissioning. The report must be submitted to BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWSubmittals@bsee.gov) and USFWS. The report must contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with federal or research bands must be reported to the United States Geological Survey Bird Band Laboratory. Any occurrence of dead ESA birds or bats must be reported to BOEM, BSEE, and USFWS as soon as practicable (taking into account crew and vessel safety), but no later than 24 hours after the sighting, and if practicable, carefully collect the dead specimen and preserve the material in the best possible state.	inform the Avian and Bat Post-Construction Monitoring Plan (see previous measure), which could lead to Ocean Wind recommending new mitigation measures or monitoring methods to reduce impacts on bats. In addition, mortality data can inform future BOEM offshore wind EIS analyses for proposed wind farms on the Atlantic OCS.
Survey (ESA-listed bats)	BOEM will require that Ocean Wind conducts pre-construction surveys for ESA-listed bats and implements avoidance and minimization measures in coordination with USFWS and NJDEP.	Pre-construction surveys would identify the potential presence of ESA-listed bats, and the survey results would inform whether measures should be implemented to avoid or minimize impacts on ESA-listed bats. While Ocean Wind has already proposed pre-construction surveys for northern long-eared bat and to conduct clearing during the winter (as much as practicable), as well as already having conducted bat surveys in 2022 along its preferred route (see results in Section 3.5.1), this measure could result in additional impact reduction on ESA-listed bats, proposed ESA-listed bats, and non protected bats.
Bat habitat impact reduction	GEN-13 will be modified to enhance bat habitat in coordination with USFWS and NJDEP. Ocean Wind must develop and implement a replanting plan in areas of temporary deforestation. The replanting plan must include the identification of specific tree species and densities, timing of planting, protection of saplings from herbivory, monitoring, and invasive species control in	Coordination with USFWS and NJDEP on restoring temporarily disturbed areas during construction would ensure that any bat habitat disturbed would be enhanced to minimize any potential loss or modification of bat habitat.

Measure[1]	Description	Effect
	order to provide high-quality bat habitat and must be provided to BOEM and USFWS for approval prior to commencing onshore construction activities.	
Surveys, Avoidance, and Minimization (bat acoustic surveys)	If Ocean Wind elects to construct an Oyster Creek onshore cable route option other than the Holtec route, Ocean Wind must coordinate with BOEM, USFWS, and NJDEP prior to commencing onshore construction activities. After coordination with BOEM, USFWS, and NJDEP, Ocean Wind must retain the services of a USFWS Recognized and Qualified Bat Surveyor to conduct presence/absence surveys (acoustic or mist netting) along the proposed route that are consistent with the USFWS' Rangewide Indiana Bat and Northern Long-eared Bat Survey Guidelines. A survey work plan must be submitted to USFWS for approval before commencing the survey. A survey report, including maps and associated spatial files in an ESRI ArcGIS/ArcPro compatible format, must be provided to BOEM and USFWS for review no later than 30 calendar days after the survey has been completed. BOEM and USFWS will complete their reviews and identify any deficiencies that require a report revision by Ocean Wind. Based on the results of the presence/ absence surveys, USFWS may recommend additional field investigations, such as a tree survey to assess roost habitat suitability and/or a mist netting/bat tracking effort to locate occupied roosts. If potential NLEB or tricolored bat roosting habitat will be impacted by Project activities, Ocean Wind must coordinate with USFWS to develop appropriate conservation measures that Ocean Wind is required to implement to avoid adverse effects to this species. Conservation Measures may include a seasonal restriction on tree clearing and avoidance of likely or known roost trees.	Pre-construction surveys along the Oyster Creek onshore cable route would identify the potential presence of ESA listed and proposed bats, and the survey results would inform the coordination with BOEM, NJDEP, and USFWS on whether or not measures should be implemented to avoid or minimize impacts on these bats. While Ocean Wind has already proposed pre-construction surveys for Northern long-eared bat and to conduct clearing during the winter (as much as practicable), this measure could result in additional impact reduction on ESA-listed bats, proposed ESA-listed bats, and non protected bats.
Bat habitat impact reduction (non-routine tree clearing)	Ocean Wind will coordinate with the USFWS prior to any clearing of trees (> 3 inches dbh) required during operation and maintenance.	Prior to tree clearing during O&M, coordinating with USFWS on the removal of trees that may be suitable for bat use would ensure that impacts on bats and their habitat would be avoided or minimized to the extent practicable.
Bat habitat impact reduction (building/structure	Ocean Wind must contact USFWS to assess the potential risk to ESA-listed bat species should any abandoned or dilapidated	Coordinating with USFWS on potential bat habitat impacts, in this case abandoned or dilapidated

Measure[1]	Description	Effect
demolition)	buildings or structures require demolition during the O&M phase. If USFWS determines that adverse effects exist, Ocean Wind must coordinate with USFWS to develop appropriate mitigation measures that Ocean Wind is required to implement to avoid adverse effects to listed bat species.	buildings/structures, would ensure that impacts on bats would be avoided or minimized to the extent practicable.

[1] All BOEM bat measures in this table are a result of BOEM's ESA Section 7 consultation with USFWS. These same measures are listed in BOEM's BA for species under USFWS jurisdiction and would likely benefit non ESA-listed bat species in the Project area.
dbh = diameters at breast height; NLEB = northern long-eared bat

3.5.8.1. Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.5-4 and Table H-2 in Appendix H, *Mitigation and Monitoring*, are incorporated in the Preferred Alternative. These measures would further define how the effectiveness and enforcement of APMs would be ensured and improve accountability for compliance with APMs by requiring monitoring, reporting, and adaptive management of potential bat impacts on the OCS. However, given the infrequent and limited anticipated use of the OCS by migrating tree bats during spring and fall migration, and given that cave bats do not typically occur on the OCS, offshore wind activities are unlikely to appreciably contribute to impacts on bats regardless of measures intended to address potential offshore bat impacts. In the onshore environment, conducting pre-construction surveys and coordinating with NJDEP and USFWS would ensure impacts on bats and their habitats would be avoided and minimized to the extent practicable. Because these measures ensure the effectiveness of and compliance with APMs that are already analyzed as part of the Proposed Action, implementation of these measures would not further reduce the impact level of the Proposed Action from what is described in Section 3.5.2, *Environmental Consequences*.

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3.7. Birds

This section discusses potential impacts on bird resources from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area for birds. The geographic analysis area for birds, as shown on Figure 3.7-1, includes the United States coastline from Maine to Florida; the offshore limit is 100 miles (161 kilometers) from the Atlantic shore and the onshore limit is 0.5 mile (0.8 kilometer) inland. The geographic analysis area was established to capture resident species and migratory species that winter as far south as South America and the Caribbean, and those that breed in the Arctic or along the Atlantic Coast that travel through the area. The offshore limit was established to cover the migratory movement of most species in this group. The onshore limit was established to cover onshore habitats used by the species that may be affected by onshore and offshore components of the proposed Project.

3.7.1 Description of the Affected Environment for Birds

This section discusses bird species that use onshore and offshore habitats, including both resident bird species that use the proposed Project area during all (or portions of) the year and migrating bird species with the potential to pass through the proposed Project area during fall migration, spring migration, or both. Detailed information regarding habitats and bird species potentially present can be found in the COP Volume II, Section 2.2.3, and Appendix H (Ocean Wind 2023). Given the differences in life history characteristics and habitat use between offshore and onshore bird species, the sections below provide a separate discussion of each group. This section also discusses bald and golden eagles. In addition, this section addresses federally listed threatened and endangered birds, which are further addressed in the Ocean Wind 1 BA prepared for USFWS (BOEM 2022).

The mid-Atlantic Coast plays an important role in the ecology of many bird species. The Atlantic Flyway is a major route for migratory birds, which are protected under the Migratory Bird Treaty Act of 1918. Chapter 4.2.4 of the Atlantic OCS Proposed Geological and Geophysical Activities Programmatic EIS (BOEM 2014a) discusses the use of Atlantic Coast habitats by migratory birds. Birds in the geographic analysis area are subject to pressure from ongoing activities, such as onshore construction, marine minerals extraction, port expansions, and installation of new structures in the OCS, but particularly from accidental releases; new cable, transmission line, and pipeline emplacement; interactions with fisheries and fishing gear; and climate change. More than one-third of bird species that occur in North America (37 percent, 432 species) are at risk of extinction unless significant conservation actions are taken (NABCI 2016). This is likely representative of the conditions of birds within the geographic analysis area. Species that live or migrate through the Atlantic Flyway have historically been, and will continue to be, subject to a variety of ongoing anthropogenic stressors, including hunting pressure (approximately 86,000 seaducks are harvested annually [Roberts 2019]), commercial fisheries by-catch (approximately 2,600 seabirds are killed annually on the Atlantic [Hatch 2017; Sigourney et al. 2019]), and climate change, which have the potential to have adverse impacts on bird species.

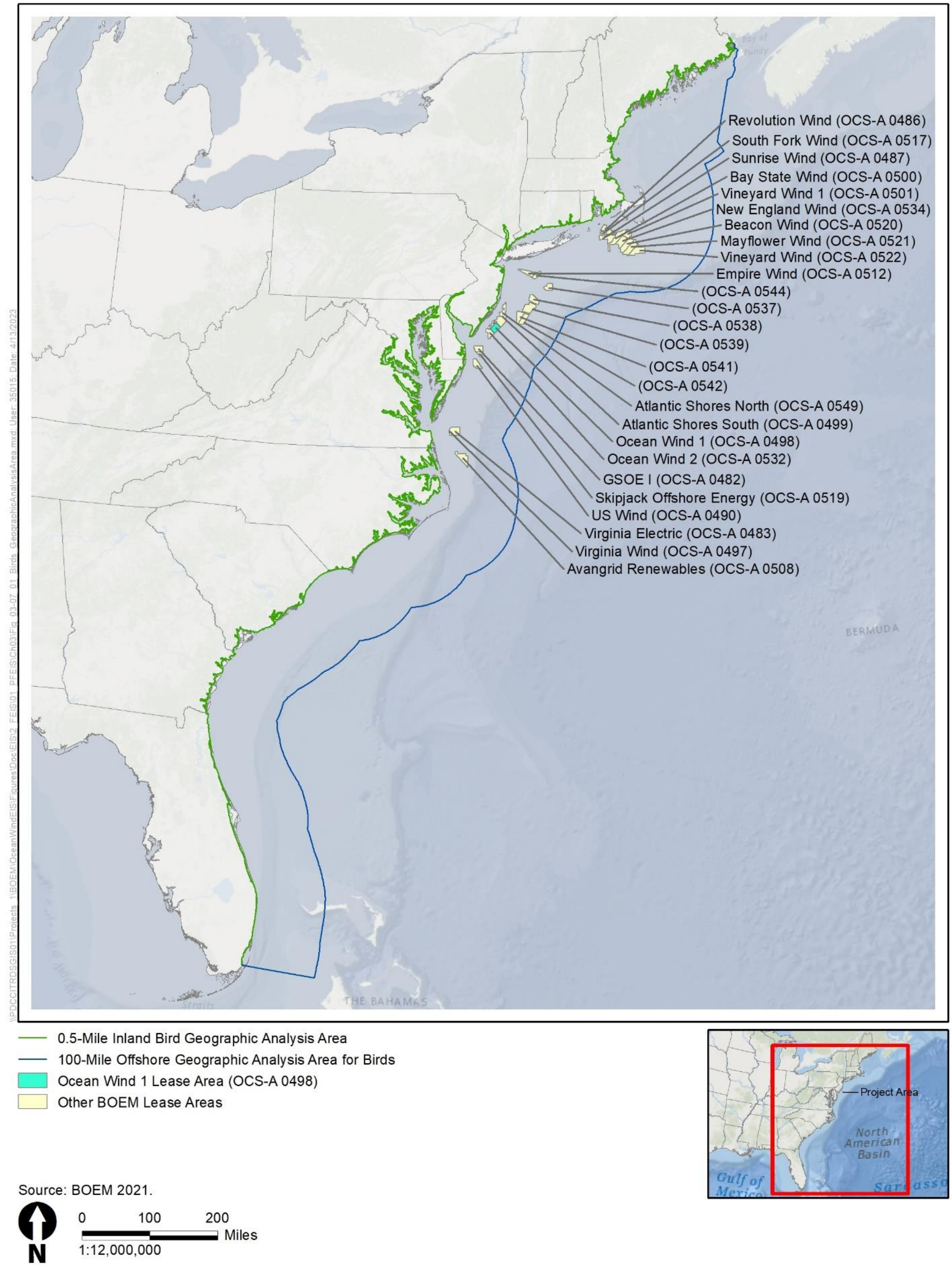

Figure 3.7-1 Birds Geographic Analysis Area

According to the North American Bird Conservation Initiative (NABCI), more than half of the offshore bird species (57 percent, 31 species) have been placed on the NABCI watch list as a result of small ranges, small and declining populations, and threats to required habitats. This watch list identified species of high conservation concern based upon high vulnerability to a variety of factors, including population size, breeding distribution, non-breeding distribution, threats to breeding, threats to non-breeding, and population trend (NABCI 2016). Globally, monitored offshore bird populations have declined by nearly 70 percent from 1950 to 2010, which may be representative of the overall population trend of seabirds (Paleczny et al. 2015) including those that forage, breed, and migrate over the Atlantic OCS. Overall, offshore bird populations are decreasing; however, considerable differences in population trajectories of offshore bird families have been documented.

Coastal birds, especially those that nest in coastal marshes and other low-elevation habitats, are vulnerable to sea-level rise and the increasing frequency of strong storms as a result of global climate change. According to NABCI, nearly 40 percent of the more than 100 bird species that rely on coastal habitats for breeding or for migration are on the NABCI watch list. Many of these coastal species have small population size or restricted distributions, making them especially vulnerable to habitat loss or degradation and other stressors (NABCI 2016). Models of vulnerability to climate change estimate that, throughout New Jersey, 20 percent of New Jersey's 248 bird species are vulnerable to climate change across all seasons (Audubon 2019), some of which occur in the geographic analysis area. These ongoing impacts on birds would continue regardless of the offshore wind industry.

A broad group of avian species may pass through the Offshore Project area, including migrants (such as raptors and songbirds), coastal birds (such as shorebirds, waterfowl, and waders), and marine birds (such as seabirds and seaducks). The migration of birds along the coast of New Jersey is notable, with an average of nearly 800,000 birds counted annually at the Avalon Seawatch – Cape May Bird Observatory; in some years the bird count approaches one million (New Jersey Audubon Society n.d.). Approximately 159 bird species have been identified as potentially occurring in the Offshore Project area through public databases and baseline studies (see Table 3-1 in COP Volume III Appendix H; Ocean Wind 2023). Of these 159 species, nine are state-listed as endangered for at least one life stage (i.e., breeding or non-breeding), four are state-listed as threatened for at least one life stage, 19 are state-listed as special concern species for at least one life stage, two are federally listed as threatened, and one is federally listed as endangered. There is high diversity of marine birds that may use the Wind Farm Area because it is in the Mid-Atlantic Bight, which overlaps with the ranges of both northern and southern species and falls within the Atlantic Flyway (a major migratory pathway for birds in the eastern United States and Canada). Migrant terrestrial species may follow the coastline on their annual trips or choose more direct flight routes over expanses of open water. Many marine birds also make annual migrations up and down the eastern seaboard (e.g., gannets, loons, and seaducks), taking them directly through the mid-Atlantic region in spring and fall. This results in a complex ecosystem where the community composition shifts regularly and temporal and geographic patterns are highly variable. The mid-Atlantic supports large populations of birds in summer, some of which breed in the area, such as coastal gulls and terns. Other summer residents, such as shearwaters and storm-petrels, visit from the Southern Hemisphere (where they breed during the austral summer). In the fall, many of the summer residents leave the area and migrate south to warmer climates, and are replaced by species that breed farther north and winter in the mid-Atlantic. Table 3.7-1 summarizes the bird presence in the Offshore Project area by bird type.

Table 3.7-1 Bird Presence in the Offshore Project Area by Bird Type

Bird Type	Potential Bird Presence in Offshore Project Area
Non-Marine Migratory Birds	
Shorebirds	Shorebirds are coastal breeders and foragers and generally avoid straying out over deep waters during breeding. Of the shorebirds, only red phalarope and red-necked phalarope are generally considered marine species. Overall, exposure of shorebirds to the offshore infrastructure will be limited to migration, and, with the exception of phalaropes, the offshore marine environment does not provide habitat for shorebirds.
Wading Birds	Most long-legged wading birds breed and migrate in coastal and inland areas. Like the smaller shorebirds, wading birds are coastal breeders and foragers and generally avoid straying out over deep waters, but may traverse the Wind Farm Area during spring and fall migration periods. The USFWS IPaC database did not indicate any wading birds in the Wind Farm Area or adjacent waters that are identified as vulnerable or Birds of Conservation Concern, and the NJDEP EBS surveys detected few herons and egrets offshore (see COP Volume III, Appendix H).
Raptors	Except for falcons, most raptors do not fly in the offshore marine environment due to their wing morphology, which requires thermal column formation to support their gliding flight. Falcons are encountered offshore because they can make large water crossings. Merlins and peregrine falcons are commonly observed offshore, fly offshore during migration, and have been observed on offshore oil platforms. Therefore, falcons may pass through the Wind Farm Area during migration. Ospreys fly over open water crossings; however, satellite telemetry data from ospreys in New England and the mid-Atlantic suggest these birds generally follow coastal or inland migration routes.
Songbirds	Songbirds almost exclusively use terrestrial, freshwater, and coastal habitats and do not use the offshore marine system except during migration. Songbirds regularly cross large bodies of water, and there is some evidence that species migrate over the northern Atlantic. Some birds may briefly fly over the water while others, like the blackpoll warbler, can migrate over vast expanses of ocean. Evidence for a variety of species suggests that overwater migration in the Atlantic is much more common in fall (than in spring), when the frequency of overwater flights increases perhaps due to consistent tailwinds from the northwest. Overall, the exposure of songbirds to the Wind Farm Area will be limited to migration.
Coastal Waterbirds	Coastal waterbirds (including waterfowl) use terrestrial or coastal wetland habitats and rarely use the marine offshore environment. The species in this group are generally restricted to freshwater or use saltmarshes, beaches, and other strictly coastal habitats and are unlikely to pass through the Wind Farm Area. Seaducks are discussed below in the marine bird section.
Marine Birds	
Loons	Common loons and red-throated loons use the Atlantic OCS in winter. Analysis of satellite-tracked red-throated loons, captured and tagged in the mid-Atlantic area, found their winter distributions to be largely inshore of the mid-Atlantic WEAs, although they did overlap with the Wind Farm Area during spring migration. However, large aggregations of common loons intersect the western boundary of the Wind Farm Area in fall, winter, and spring as detected by the AMAPPS and other offshore survey programs. The NJDEP EBS surveys and MDAT models show higher use of the Wind Farm Area by loons in the spring than other seasons.

Bird Type	Potential Bird Presence in Offshore Project Area
Seaducks	The seaducks use the Atlantic OCS heavily in winter. Most seaducks forage on mussels and other benthic invertebrates, and generally winter in shallower inshore waters or out over large offshore shoals, where they can access benthic prey. Surf scoters tracked with satellite transmitters remained largely inshore of the Wind Farm Area. Exposure to the Wind Farm Area will be primarily limited to migration or travel between wintering sites.
Petrel Group	This group consists mostly of shearwaters and storm-petrels that breed in the southern hemisphere and visit the northern hemisphere during the austral winter (boreal summer) and may pass through the Wind Farm Area. These species use the Atlantic OCS region heavily, but mostly concentrate offshore and in the Gulf of Maine.
Gannets, Cormorants, and Pelicans	Northern gannets use the Atlantic OCS primarily during winter. They breed in southeastern Canada and winter along the mid-Atlantic region and in the Gulf of Mexico. They are opportunistic foragers, capable of long-distance oceanic movements, and large aggregations intersect the western boundaries of the Wind Farm Area regularly during the non-breeding period as detected on surveys conducted by the AMAPPS and other offshore survey programs. The double-crested cormorant is the most likely species of cormorant exposed to the Wind Farm Area, but regional MDAT abundance models show that cormorants are concentrated closer to shore and not commonly encountered well offshore. Brown pelicans are rare in the area and unlikely to pass through the Wind Farm Area in any numbers.
Gulls, Skuas, and Jaegers	Nine species in this group were observed in the NJDEP EBS surveys and could potentially pass through the Wind Farm Area. The regional MDAT abundance models show that these birds have wide distributions, ranging from near shore (gulls) to offshore (jaegers). The herring gull and great black-backed gull reside in the region year-round, and are found farther offshore outside of the breeding season. The parasitic jaeger is often observed closer to shore during migration than the other species and great skuas may pass along the Atlantic OCS outside the breeding season.
Terns	Seven species of tern are present in New Jersey during the spring, summer, and fall. Of these, there are breeding records in New Jersey of Caspian tern, common tern, Forster’s tern, gull-billed tern, least tern, and royal tern. Terns generally restrict themselves to coastal waters during breeding, although they may pass through the Wind Farm Area to forage and during migration. Roseate terns are federally and state-listed, and infrequently occur in New Jersey during summer and fall.
Auks	Auk species present in New Jersey offshore waters are generally northern or Arctic breeders that winter along the Atlantic OCS. The annual abundance and distribution of auks along the eastern seaboard in winter is erratic, however, depending upon broad climatic conditions and the availability of prey. In winters with prolonged harsh weather, which may prevent foraging for extended periods, these generally pelagic species often move inshore or are driven considerably farther south than usual. The MDAT abundance models show that auks are generally concentrated offshore and south of Nova Scotia, but some individuals may pass through the Wind Farm Area during winter.

Source: COP Appendix H; Ocean Wind 2023; USFWS 2021a.
IPaC = Information for Planning and Consultation; MDAT = Marine-life Data and Analysis Team

The Onshore Project area includes multiple potential onshore export cable routes that contain a diverse set of habitats, including coastal wetlands, forested wetlands, forested uplands, forested lowlands, barrier beaches, and bay island habitats. A broad group of avian species utilize these onshore habitats during breeding, wintering, and migration periods, and avian groups found in these habitats include songbirds, shorebirds, raptors, waterfowl, waders, and seabirds. See Tables 4-5 and 4-6 in COP Volume III, Appendix H (Ocean Wind 2023) for a list of bird species with potential to occur in proximity to the BL England and Oyster Creek substations and onshore export cable routes. These birds include 59 species that are federally listed as threatened and endangered, USFWS-designated Birds of Conservation Concern, state-listed threatened and endangered birds, and state Special Concern birds (see Table 2.2.3-1 in COP Volume II; Ocean Wind 2023). The BL England Onshore Project area is within the Delaware Bay and Atlantic Coastal landscape regions, where the Focal Species of Greatest Conservation Need (SGCN)[1] include American oystercatcher, American woodcock, black rail, black skimmer, bluewinged warbler, common tern, Forster's tern, least tern, little blue heron, northern harrier, peregrine falcon, pied-billed grebe, piping plover, red knot, red-headed woodpecker, ruddy turnstone, scarlet tanager, snowy egret, tricolored heron, bobolink, eastern meadowlark, grasshopper sparrow, Kentucky warbler, northern bobwhite, prothonotary warbler, vesper sparrow, and wood thrush. The nearest recorded peregrine falcon nesting activity in 2019 was in the vicinity of the BL England landfall site in Ocean City on a nesting platform in a marsh, as well as on the Ocean City-Longport Bridge. COP Appendix H, Figure 3-11, shows documented locations of peregrine falcons in the Onshore Project area. The Oyster Creek Onshore Project area is within the Pinelands and Atlantic Coastal landscape regions, where the Focal SGCN are the same as in the BL England Onshore Project area but with one additional species: cerulean warbler. The nearest recorded peregrine falcon nesting activity in 2019 was reported along the barrier beaches at Sedge Island approximately 4.4 miles to the east and southeast of the Oyster Creek landfall site (Ocean Wind 2023).

There are multiple onshore export cable system route options to the BL England and Oyster Creek substations. The onshore export cable system route options would be co-located with existing developed areas (e.g., roads, existing transmission lines, rail) to the extent practicable. Habitat along the route options varies, but includes high-density urban residential areas (edge habitat), commercial areas, salt marsh, shrubs, grasses, mixed forest (predominantly deciduous forest with scattered cedars and pines), and deciduous forest. The cable landfall locations are in the Atlantic Coastal Landscape Region, which includes barrier islands, beaches, tidal salt marshes, rivers, shallow bays, and lagoons. The BL England substation parcel consists of a preexisting substation bordered by Great Egg Harbor Bay, salt marsh, and mowed lawn with scattered deciduous tree habitat. The grid interconnection would be in an existing highly disturbed and industrialized area adjacent to a golf course; the area is primarily covered with existing impervious surfaces that effectively do not provide viable bird habitat. The parcels for the Oyster Creek substation are in areas of pineland forest and shrubland. The grid interconnection would be in an existing and highly disturbed and industrialized area that is primarily covered with existing impervious surfaces and sparse vegetation, which does not provide viable bird habitat. A short section of overhead transmission line, extending up to 0.5 mile (0.8 kilometer), would potentially be installed in this area.

Bald eagles (*Haliaeetus leucocephalus*), which are listed as endangered (breeding) and threatened (non-breeding) in New Jersey, are federally protected by the Bald and Golden Eagle Protection Act, 16 USC § 668 et seq., as are golden eagles (*Aquila chrysaetos*). Bald eagles are broadly distributed across North America and generally nest and perch in areas associated with water (lakes, rivers, bays) in both freshwater and marine habitats, often remaining largely within roughly 1,640 feet of the shoreline. Bald eagles are present year-round in New Jersey and nesting is concentrated on the edge of Delaware Bay. In a study evaluating the space use of bald eagles captured in Chesapeake Bay, the coast of New Jersey was associated with moderate levels of use. The general morphology of bald eagles dissuades long-distance

[1] SGCN are wildlife species with low, declining, or vulnerable populations, and for whom conservation actions are needed to prevent or reverse declines over the next 10 years (NJDEP 2018). Focal SGCN are considered "upper tier" SGCN that include a discrete set of wildlife that are both in need of immediate protection and perceived to be responsive to known and feasible conservation actions (NJDEP 2018). Implementing targeted efforts toward their conservation will benefit many other species (NJDEP 2018).

movements in offshore settings, as the species generally relies upon thermal formations, which develop poorly over the open ocean, during long-distance movements. As such, bald eagles are unlikely to fly through the Wind Farm Area. In 2019, bald eagle nesting activity was recorded at Beesley's Point, within a few kilometers of the BL England landfall site and proposed substation location and in Waretown, within a few kilometers of the Oyster Creek landfall site and proposed substation location. This nest fledged two young (Ocean Wind 2023).

Golden eagles are found throughout the United States, but mostly in the western half of the United States and are rare in the eastern states (Cornell University 2019). In New Jersey, golden eagles are associated with forest habitats in the Delaware Bay, Piedmont Intercoastal Plain, Pinelands, and Skylands landscape regions (NJDEP 2018). The Onshore Project area is primarily within the Atlantic Coastal Landscape region, which is not associated with golden eagles; however, portions of the Onshore Project areas are within the Pinelands and Delaware Bay landscape region and include some forested areas (New Jersey Bureau of GIS 2018). Like with bald eagle, the general morphology of golden eagle dissuades long-distance movements in offshore settings (Kerlinger 1985), as the species generally relies upon thermal formations, which develop poorly over the open ocean, during long-distance movements. As such, golden eagles are unlikely to fly through the Wind Farm Area.

Four species of birds listed as threatened or endangered under the ESA may occur in the Onshore and Offshore Project areas: the threatened piping plover (*Charadrius m. melodus*), endangered roseate tern (*Sterna d. dougallii*), threatened eastern black rail (*Laterallus jamaicensis* ssp. *jamaicensis*), and threatened *Rufa* subspecies of the red knot (*Calidris canutus rufa*) (USFWS 2021a; Ocean Wind 2021). The Ocean Wind 1 BA provides a detailed discussion of ESA-listed species and potential impacts on these species as a result of the Project (BOEM 2022).

Impacts from reasonably foreseeable offshore wind activities on ESA-listed species will be discussed in detail in subsequent project-specific analysis documents. As is the case with the proposed Ocean Wind 1 Project, each proposed project will be required to address ESA-listed species at the individual project scale and cumulatively. Additionally, BOEM is currently working on a programmatic framework for ESA consultation with USFWS to address the potential impacts of the anticipated development of Atlantic offshore wind energy facilities on ESA-listed species.

3.7.2 Environmental Consequences

3.7.2.1. Impact Level Definitions for Birds

Definitions of impact levels are provided in Table 3.7-2.

Table 3.7-2 Impact Level Definitions for Birds

Impact Level	Impact Level	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
	Beneficial	Impacts would be so small as to be unmeasurable.
Minor	Adverse	Most impacts would be avoided; if impacts occur, the loss of one or few individuals or temporary alteration of habitat could represent a minor impact, depending on the time of year and number of individuals involved.
	Beneficial	Impacts would be localized to a small area but with some measurable effect on one or a few individuals or habitat.

Impact Level	Impact Level	Definition
Moderate	Adverse	Impacts would be unavoidable but would not result in population-level effects or threaten overall habitat function.
	Beneficial	Impacts would affect more than a few individuals in a broad area but not regionally, and would not result in population-level effects.
Major	Adverse	Impacts would result in severe, long-term habitat or population-level effects on species.
	Beneficial	Long-term beneficial population-level effects would occur.

3.7.3 Impacts of the No Action Alternative on Birds

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on birds, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for birds. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.7.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for birds described in Section 3.7.1, *Description of the Affected Environment for Birds*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on birds are generally associated with onshore impacts (including onshore construction and coastal lighting), activities in the offshore environment (e.g., vessel traffic, commercial fisheries), and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect bird species through temporary and permanent habitat removal or conversion, temporary noise impacts related to construction, collisions (e.g., presence of structures), and lighting effects, which could cause avoidance behavior and displacement as well as injury to or mortality of individual birds. However, population-level effects would not be anticipated. Activities in the offshore environment could result in bird avoidance behavior and displacement, but population-level effects would not be anticipated. Impacts of climate change, such as increased storm severity and frequency, ocean acidification, altered migration patterns, increased disease frequency, protective measures, and increased erosion and sediment deposition, have the potential to result in long-term, potentially high-consequence risks to birds and could lead to changes in prey abundance and distribution, changes in nesting and foraging habitat abundance and distribution, and changes to migration patterns and timing.

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on birds include:

- Continued O&M of the Block Island project (five WTGs) installed in state waters;
- Continued O&M of the Coastal Virginia Offshore Wind project (two WTGs) installed in OCS-A 0497; and
- Ongoing construction of two offshore wind projects, the Vineyard Wind 1 project (62 WTGs and 1 OSS) in OCS-A 0501 and the South Fork project (12 WTGs and 1 OSS) in OCS-A 0517.

The effects of approved projects have been evaluated through previous NEPA review and are incorporated by reference. Ongoing O&M of the Block Island and Coastal Virginia Offshore Wind projects and ongoing construction of the Vineyard Wind 1 and South Fork projects would affect birds through the primary IPFs of accidental releases, lighting, cable emplacement and maintenance, noise, presence of structures, traffic (aircraft), and land disturbance. Ongoing offshore wind activities would have the same type of impacts from accidental releases, lighting, cable emplacement and maintenance, noise, presence of structures, traffic (aircraft), and land disturbance that are described in detail in Section 3.7.3.2 for planned offshore wind activities but the impacts would be of lower intensity.

3.7.3.2. Cumulative Impacts of the No Action Alternative

Other planned non-offshore wind activities that may affect birds include installation of new submarine cables and pipelines, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS (see Section F.2 in Appendix F for a complete description of planned activities). These activities may result in temporary and permanent impacts on birds including disturbance, displacement, injury, mortality, habitat degradation, and habitat conversion. See Table F1-4 for a summary of potential impacts associated with planned non-offshore wind activities by IPF for birds.

BOEM expects future offshore wind development activities to affect birds through the following primary IPFs.

Accidental releases: Accidental releases of fuel/fluids, other contaminants, and trash and debris could occur as a result of offshore wind activities. The risk of any type of accidental release would be increased primarily during construction, but also during operations and decommissioning of offshore wind facilities. Ingestion of fuel and other hazardous contaminants has the potential to result in lethal and sublethal impacts on birds, including decreased hematological function, dehydration, drowning, hypothermia, starvation, and weight loss (Briggs et al. 1997; Haney et al. 2017; Paruk et al. 2016). Additionally, even small exposures that result in oiling of feathers can lead to sublethal effects that include changes in flight efficiencies and result in increased energy expenditure during daily and seasonal activities, including chick provisioning, commuting, courtship, foraging, long-distance migration, predator evasion, and territory defense (Maggini et al. 2017). Based on the volumes potentially involved (refer to Table F-3 in Appendix F, *Planned Activities Scenario*), the likely amount of releases associated with offshore wind development would fall within the range of accidental releases that already occur on an ongoing basis from non-offshore wind activities and would represent a negligible impact on birds.

Vessel compliance with USCG regulations would minimize trash or other debris; therefore, BOEM expects accidental trash releases from offshore wind vessels to be rare and localized in nature. In the unlikely event of a release, lethal and sublethal impacts on individuals could occur as a result of blockages caused by both hard and soft plastic debris (Roman et al. 2019). Given that accidental releases are anticipated to be rare and localized, BOEM expects that accidental releases of trash and debris would not appreciably contribute to overall impacts on birds.

Lighting: Nighttime lighting associated with offshore wind structures and vessels could represent a source of bird attraction. Under the No Action Alternative, up to 2,946 WTGs and 163 OSS would have hazard and aviation lighting that would be incrementally added beginning in 2023 and continuing through 2030. However, BOEM anticipates this impact to be significantly reduced due to the anticipated use of ADLS, which is a system that would activate WTG lighting only when an aircraft enters a predefined airspace. For example, the recently approved Vineyard 1 offshore wind project will implement ADLS and, based on historical air traffic data, WTG light activation under ADLS is estimated to occur 235 times per year, for a total illumination duration of less than 4 hours per year (illuminating less than 0.1 percent of the nighttime hours per year) (BOEM 2021a). Another recently approved offshore wind project—South Fork—will also implement ADLS as part of BOEM's COP approval terms and conditions, and several offshore wind projects currently under BOEM consideration are proposing/considering ADLS (pending FAA and BOEM approval) (e.g., Atlantic Shores, Ocean Wind, Coastal Virginia Offshore Wind). As such, BOEM anticipates ADLS to significantly reduce the potential WTG lighting impacts on birds. In addition, and as discussed in more detail below in the presence of structures IPF, the abundance of bird species that overlap with the anticipated development of wind energy facilities on the Atlantic OCS is relatively small (Figure 3.7-2), and the relative seasonal exposure of bird populations is generally very low (Table 3.7-2).

Construction vessels are also a source of artificial lighting, which could attract birds and cause disorientation and collision or predation risk. However, the potential impact would be short term, lasting only the duration of construction and, as previously described, the abundance of bird species on the OCS that overlap with the anticipated wind development of wind energy facilities is relatively small. Overall, BOEM anticipates lighting impacts related to offshore wind structures and vessels would be negligible.

Cable emplacement and maintenance: Generally, emplacement of submarine cables would result in increased suspended sediments that may affect diving birds, result in displacement of foraging individuals or decreased foraging success, and have impacts on some prey species (e.g., benthic assemblages) (Cook and Burton 2010). The total area of seafloor disturbed by offshore export and inter-array cables for offshore wind facilities is estimated to be up to 32,346 acres (131 km^2). Impacts associated with cable emplacement would be temporary and localized, and birds would be able to successfully forage in adjacent areas not affected by increased suspended sediments. Any dredging necessary prior to cable installation could contribute to additional impacts. Disturbed seafloor from construction of offshore wind projects may affect some bird prey species; however, assuming future projects use installation procedures similar to those proposed in the Ocean Wind 1 COP, the duration and extent of impacts would be limited and short term, and benthic assemblages would recover from disturbance. Section 3.6, *Benthic Resources*, and Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*, provide more information. Impacts would be negligible because increased suspended sediments would be temporary and generally localized to the emplacement corridor and no individual fitness or population-level effects on birds would be expected.

Noise: Anthropogenic noise on the OCS associated with offshore wind development, including noise from aircraft, pile-driving activities, G&G surveys, offshore construction, and vessel traffic, has the potential to result in impacts on birds on the OCS. Additionally, onshore construction noise has the potential to result in impacts on birds. BOEM anticipates that noise impacts would be negligible because noise would be localized and temporary. Potential impacts could be greater if avoidance and displacement of birds occurs during seasonal migration periods.

Aircraft flying at low altitudes may cause birds to flush, resulting in increased energy expenditure. Disturbance to birds, if any, would be temporary and localized, with impacts dissipating once the aircraft has left the area. No individual or population-level effects would be expected.

Construction of up to 3,101 offshore structures would create noise and may temporarily affect diving birds. The greatest impact of noise is likely to be caused by pile-driving activities during construction. Noise transmitted through water has the potential to result in temporary displacement of diving birds in a limited space around each pile and can cause short-term stress and behavioral changes ranging from mild annoyance to escape behavior (BOEM 2014b, 2016). Additionally, noise impacts on prey species may affect bird foraging success. Similar to pile driving, G&G site characterization surveys for offshore wind facilities would create high-intensity impulsive noise around sites of investigation, leading to similar impacts on birds.

Onshore noise associated with intermittent construction of required offshore wind development infrastructure may also result in localized and temporary impacts, including avoidance and displacement, although no individual fitness or population-level effects would be expected to occur.

Noise associated with project vessels could disturb some individual diving birds, but they would likely acclimate to the noise or move away, potentially resulting in a temporary loss of habitat (BOEM 2012). However, brief, temporary responses, if any, would be expected to dissipate once the vessel has passed or the individual has moved away. No individual fitness or population-level effects would be expected.

Presence of structures: The presence of structures can lead to impacts, both beneficial and adverse, on birds through fish aggregation and associated increase in foraging opportunities, as well as entanglement and gear loss or damage, migration disturbances, and WTG strikes and displacement. These impacts may arise from buoys, meteorological towers, foundations, scour and cable protections, and transmission cable infrastructure.

The primary threat to birds from the presence of structures would be from collision with WTGs. The Atlantic Flyway is an important migratory pathway for as many as 164 species of waterbirds, and a similar number of land birds, with the greatest volume of birds using the Atlantic Flyway during annual migrations between wintering and breeding grounds (Watts 2010). Within the Atlantic Flyway along the North American Atlantic Coast, much of the bird activity is concentrated along the coastline (Watts 2010). Waterbirds use a corridor between the coast and several kilometers out onto the OCS, while land birds tend to use a wider corridor extending from the coastline to tens of kilometers inland (Watts 2010). While both groups may occur over land or water within the flyway and may extend considerable distances from shore, the highest diversity and density are centered on the shoreline. Building on this information, Robinson Wilmott et al. (Robinson Wilmott et al. 2013) evaluated the sensitivity of bird resources to collision and displacement due to offshore wind development on the Atlantic OCS and included the 164 species selected by Watts (Watts 2010) plus an additional 13 species, for a total of 177 species that may occur on the Atlantic OCS from Maine to Florida during all or some portion of the year. As discussed in Robinson Willmott et al. (Robinson Wilmott et al. 2013) and consistent with Garthe and Hüppop (Garthe and Hüppop 2004), Furness and Wade (Furness and Wade 2012), and Furness et al. (Furness et al. 2013), species with high scores for sensitivity for collision include gulls, jaegers, and the northern gannet (*Morus bassanus*). In many cases, high collision sensitivity was driven by high occurrence on the OCS, low avoidance rates with high uncertainty, and time spent in the RSZ. Many of the species addressed in Robinson Willmott et al. (Robinson Willmott et al. 2013) had low collision sensitivity including passerines that spend very little time on the Atlantic OCS during migration and typically fly above the RSZ. As described by Watts (2010), 55 seabird species occur on the Atlantic OCS at a distance from shore where WTGs could be operating. However, generally the abundance of bird species that overlap with the anticipated development of wind energy facilities on the Atlantic OCS is relatively small (Figure 3.7-2).

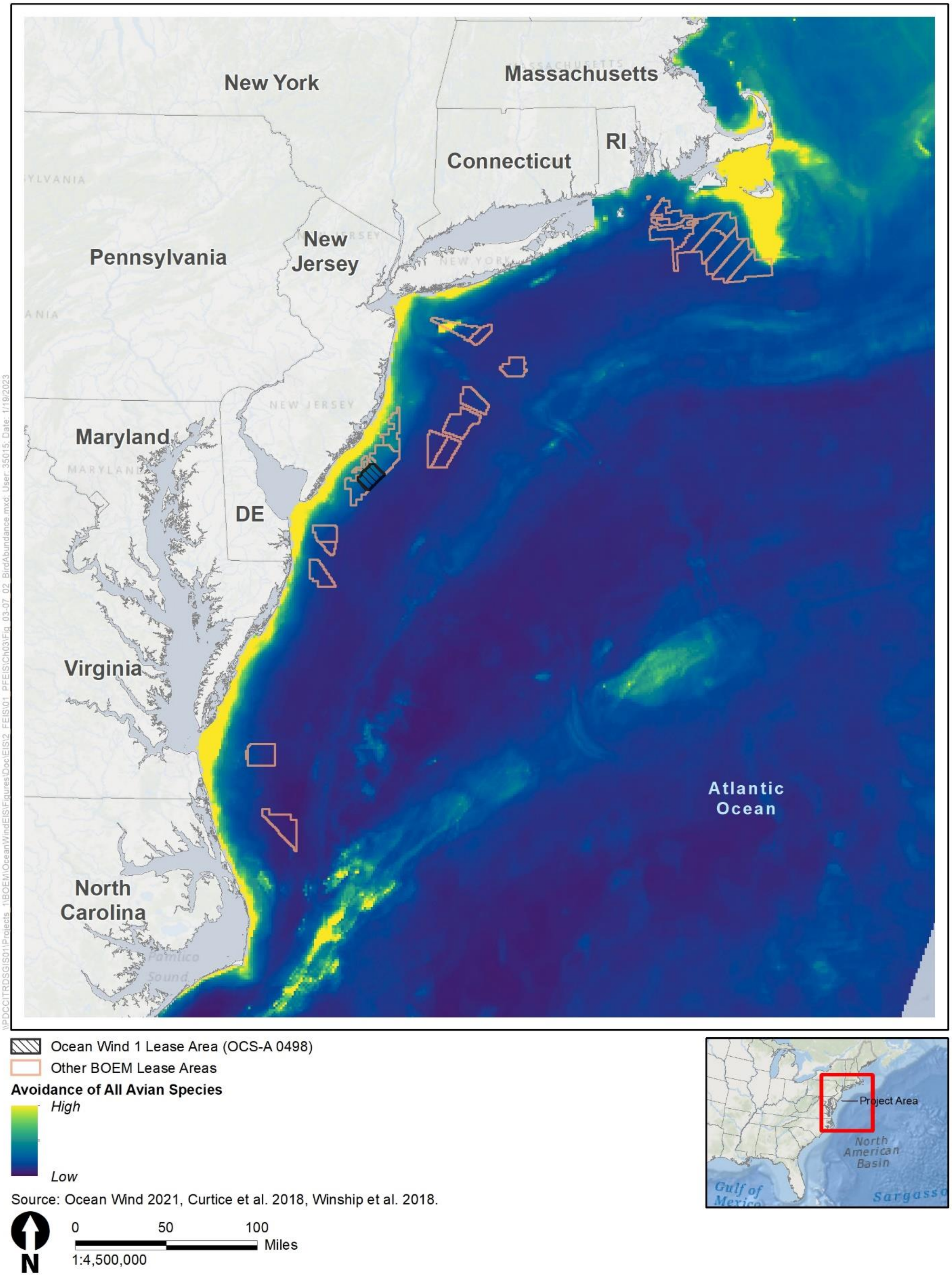

Figure 3.7-2 Total Avian Relative Abundance Distribution Map

Of the 55 seabird species, 47 seabird species have sufficient survey data to calculate the modeled percentage of a species population that would overlap with the anticipated offshore wind development on the Atlantic OCS (Winship et al. 2018); the relative seasonal exposure is generally very low, ranging from 0.0 to 5.2 percent (Table 3.7-3). The estimated percentage of the more sensitive Birds of Conservation Concern populations that overlap offshore wind development areas is 0 percent for three birds and between 0.1 and 0.9 percent for two birds (Table 3.7-3). BOEM assumes that the 47 species (85 percent) with sufficient data to model the relative distribution and abundance on the Atlantic OCS are representative of the 55 species that may overlap with offshore wind development on the Atlantic OCS.

Table 3.7-3 Percentage of Each Atlantic Seabird Population that Overlaps with Anticipated Offshore Wind Energy Development on the Outer Continental Shelf by Season

Species	Spring	Summer	Fall	Winter
Artic Tern (*Sterna paradisaea*)	NA	0.2	NA	NA
Atlantic Puffin (*Fratercula arctica*)[1]	0.2	0.1	0.1	0.2
Audubon Shearwater (*Puffinus lherminieri*)[2]	0.0	0.0	0.0	0.0
Black-capped Petrel (*Pterodroma hasitata*)[2]	0.0	0.0	0.0	0.0
Black Guillemot (*Cepphus grille*)	NA	0.3	NA	NA
Black-legged Kittiwake (*Rissa tridactyla*)[1]	0.7	NA	0.7	0.5
Black Scoter (*Melanitta americana*)	0.2	NA	0.4	0.5
Bonaparte’s Gull (*Chroicocephalus philadelphia*)	0.5	NA	0.4	0.3
Brown Pelican (*Pelecanus occidentalis*)	0.1	0.0	0.0	0.0
Band-rumped Storm-Petrel (*Oceanodroma castro*)[2]	NA	0.0	NA	NA
Bridled Tern (*Onychoprion anaethetus*)	NA	0.1	0.1	NA
Common Eider (*Somateria mollissima*)[1]	0.3	0.1	0.5	0.6
Common Loon (*Gavia immer*)	3.9	1.0	1.3	2.1
Common Murre (*Uria aalge*)	0.4	NA	NA	1.9
Common Tern (*Sterna hirundo*)[1]	2.1	3.0	0.5	NA
Cory’s Shearwater (*Calonectris borealis*)[2]	0.1	0.9	0.3	NA
Double-crested Cormorant (*Phalacrocorax auritus*)	0.7	0.6	0.5	0.4
Dovekie (*Alle alle*)	0.1	0.1	0.3	0.2
Great Black-backed Gull (*Larus marinus*)[1]	1.3	0.5	0.7	0.6
Great Shearwater (*Puffinus gravis*)	0.1	0.3	0.3	0.1
Great Skua (*Stercorarius skua*)	NA	NA	0.1	NA
Herring Gull (*Larus argentatus*)[1]	1.0	1.3	0.9	0.5
Horned Grebe (*Podiceps auritus*)	NA	NA	NA	0.3
Laughing Gull (*Leucophaeus atricilla*)	1.0	3.6	0.9	0.1
Leach’s Storm-Petrel (*Oceanodroma leucorhoa*)	0.1	0.0	0.0	NA
Least Tern (*Sternula antillarum*)	NA	0.3	0.0	NA
Long-tailed Ducks (*Clangula hyemalis*)	0.6	0.0	0.4	0.5
Manx Shearwater (*Puffinus puffinus*)[1, 2]	0.0	0.5	0.1	NA
Northern Fulmar (*Fulmarus glacialis*)[1]	0.1	0.2	0.1	0.2
Northern Gannet (*Morus bassanus*)[1]	1.5	0.4	1.4	1.4
Parasitic Jaeger (*Stercorarius parasiticus*)	0.4	0.5	0.4	NA
Pomarine Jaeger (*Stercorarius pomarinus*)	0.1	0.3	0.2	NA

Species	Spring	Summer	Fall	Winter
Razorbill (*Alca torda*)[1]	5.2	0.2	0.4	2.1
Ring-billed Gull (*Larus delawarensis*)	0.5	0.5	0.9	0.5
Red-breasted Merganser (*Mergus serrator*)	0.5	NA	NA	0.7
Red Phalarope (*Phalaropus fulicarius*)	0.4	0.4	0.2	NA
Red-necked Phalarope (*Phalaropus lobatus*)	0.3	0.3	0.2	NA
Roseate Tern (*Sterna dougallii*)	0.6	0.0	0.5	NA
Royal Tern (*Thalasseus maximus*)	0.0	0.2	0.1	NA
Red-throated Loon (*Gavia stellate*)[1]	1.6	NA	0.5	1.0
Sooty Shearwater (*Ardenna grisea*)	0.3	0.4	0.2	NA
Sooty Tern (*Onychoprion fuscatus*)	0.0	0.0	NA	NA
South Polar Skua (*Stercorarius maccormicki*)	NA	0.2	0.1	NA
Surf Scoter (*Melanitta perspicillata*)	1.2	NA	0.4	0.5
Thick-billed Murre (*Uria lomvia*)	0.1	NA	NA	0.1
Wilson's Storm-Petrel (*Oceanites oceanicus*)	0.2	0.9	0.2	NA
White-winged Scoter (*Melanitta deglandi*)	0.7	NA	0.2	1.3

Source: Winship et al. 2018.
[1] Species used in collision risk modeling.
[2] Species considered Birds of Conservation Concern by USFWS (USFWS 2021b).
NA = not applicable

The greatest risk to birds associated with offshore wind development would be collision with operating WTGs while flying through lease areas or approaching WTGs to perch on the structure. Motion smear, a phenomenon where spinning turbine blades become deceptively transparent to the eye, can also factor into collision risk (Hodos 2013). Offshore wind development would add up to 2,946 WTGs in the bird geographic analysis area (Table F-3). In the contiguous United States, bird collisions with operating WTGs are relatively rare events, with an estimated 140,000 to 500,000 (mean = 320,000) birds killed annually from about 49,000 onshore wind turbines in 39 states (USFWS 2018). Bird collisions with turbines in the eastern United States is estimated at 6.86 birds per turbine per year (USFWS 2018). Based on this mortality rate, an estimated 20,210 birds could be killed annually from the 2,946 WTGs that would be added for offshore wind development. This represents a worst-case scenario and does not consider mitigating factors, such as landscape and weather patterns, or bird species that are expected to occur. Given that the relative density of birds in the OCS is low, relatively few birds are likely to encounter WTGs (see Figure 3.7-2) and annual per-turbine mortalities are anticipated to be lower offshore compared to onshore. Potential annual bird kills from WTGs would be relatively low compared to other causes of migratory bird deaths in the United States; feral cats are the primary cause of migratory bird deaths in the United States (2.4 billion per year), followed by collisions with building glass (599 million per year), collisions with vehicles (214.5 million per year), poison (72 million per year), collisions with electrical lines (25.5 million per year), collisions with communication towers (6.6 million per year), and electrocutions (5.6 million per year) (USFWS 2021c). Not all individuals that occur or migrate along the Atlantic Coast are expected to encounter the RSZ of one or more operating WTGs associated with offshore wind development. Generally, only a small percentage of a species' seasonal population would potentially encounter operating WTGs (Table 3.7-3). The addition of WTGs to the offshore environment may result in increased functional loss of habitat for those species with higher displacement sensitivity. However, a recent study of long-term data collected in the North Sea found that despite the extensive observed displacement of loons in response to the development of 20 wind farms, there was no decline in the region's loon population (Vilela et al. 2021). Furthermore, substantial foraging habitat for resident birds would remain available outside of the proposed offshore lease areas. Impacts on birds due to the presence of operating WTGs would likely be minor, with no individual fitness or population-level impacts expected to occur.

Because most structures would be spaced 0.6 to 1 nm apart, ample space between WTGs should allow birds that are not flying above WTGs to fly through individual lease areas without changing course or to make minor course corrections to avoid operating WTGs. The effects of offshore wind farms on bird movement ultimately depends on the bird species, size of the offshore wind farm, spacing of the turbines, and extent of extra energy cost incurred by the displacement of flying birds (relative to normal flight costs pre-construction) and their ability to compensate for this degree of added energy expenditure. Little quantitative information is available on how offshore wind farms may act as a barrier to movement, but Madsen et al. (2012) modeled bird movement through offshore wind farms using bird (common eider) movement data collected at the Nysted offshore wind farm in the western Baltic Sea just south of Denmark. After running several hundred thousand simulations for different layouts/configurations for a 100-WTG offshore wind farm, Madsen et al. found the proportion of birds traveling between turbines increased as distance between turbines increased. With eight WTG columns at 200-meter (0.1-nm) spacing, no birds passed between the turbines. However, increasing inter-turbine distance to 500 meters (0.27 nm) increased the percentage of birds to more than 20 percent, while a spacing of 1,000 meters (0.54 nm) increased this further to 99 percent. The 0.6- to 1-nm spacing estimated for most structures that will be proposed on the Atlantic OCS is greater than the distance at which 99 percent of the birds passed through in the model. As such, adverse impacts of additional energy expenditure due to minor course corrections or complete avoidance of offshore wind lease areas would not be expected to be biologically significant. Any additional flight distances would likely be small for most migrating birds when compared with the overall migratory distances traveled, and no individual fitness or population-level effects would be expected to occur.

In the Northeast and mid-Atlantic waters, there are 2,570 seabird fatalities through interaction with commercial fishing gear each year; of those, 84 percent are with gillnets involving shearwaters/fulmars and loons (Hatch 2017). Abandoned or lost fishing nets from commercial fishing may get tangled with foundations, reducing the chance that abandoned gear would cause additional harm to birds and other wildlife if left to drift until sinking or washing ashore. A reduction in derelict fishing gear (in this case by entanglement with foundations) has a beneficial impact on bird populations (Regular et al. 2013). In contrast, the presence of structures may also increase recreational fishing and thus expose individual birds to harm from fishing line and hooks.

The presence of new structures could result in increased prey items for some marine bird species. Offshore wind foundations could increase the mixing of surface waters and deepen the thermocline, possibly increasing pelagic productivity in local areas (English et al. 2017). Additionally, the new structures may create habitat for structure-oriented and hard-bottom species. This reef effect has been observed around WTGs, leading to local increases in biomass and diversity (Causon and Gill 2018). Recent studies have found increased biomass for benthic fish and invertebrates, and possibly for pelagic fish, marine mammals, and birds as well (Raoux et al. 2017, Pezy et al. 2018, Wang et al. 2019), indicating that offshore wind energy facilities can generate beneficial permanent impacts on local ecosystems, translating to increased foraging opportunities for individuals of some marine bird species. BOEM anticipates that the presence of structures may result in long-term, moderate, beneficial impacts. Conversely, increased foraging opportunities could attract marine birds, potentially exposing those individuals to increased collision risk associated with operating WTGs.

Traffic (aircraft): General aviation traffic accounts for approximately two bird strikes per 100,000 flights (Dolbeer et al. 2019). Because aircraft flights associated with offshore wind development are expected to be minimal in comparison to baseline conditions, aircraft strikes with birds are highly unlikely to occur. As such, aircraft traffic impacts would be negligible and not expected to appreciably contribute to overall impacts on birds.

Land disturbance (onshore construction): Onshore construction of offshore wind development infrastructure has the potential to result in some impacts due to habitat loss or fragmentation. However, onshore construction would be expected to account for only a very small increase in development relative to other ongoing development activities. Furthermore, construction would be expected to generally occur in previously disturbed habitats, and no individual fitness or population-level impacts on birds would be expected to occur. As such, onshore construction impacts associated with offshore wind development would be negligible and not expected to appreciably contribute to overall impacts on birds.

3.7.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, birds would continue to be affected by existing environmental trends and ongoing activities. BOEM expects ongoing activities to have continuing temporary and permanent impacts (disturbance, displacement, injury, mortality, habitat degradation, habitat conversion) on birds primarily through construction and climate change. Given that the abundance of bird species that overlap with ongoing wind energy facilities on the Atlantic OCS is relatively small, ongoing wind activities would not appreciably contribute to impacts on birds. Temporary disturbance and permanent loss of habitat onshore may occur as a result of offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the geographic analysis area. The No Action Alternative would result in **minor** impacts on birds.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and birds would continue to be affected by natural and human-caused IPFs. Planned activities would contribute to the impacts on birds due to habitat loss from increased onshore construction and interactions with offshore development.

BOEM anticipates that the impacts associated with offshore wind activities in the geographic analysis area would result in adverse impacts but could potentially include beneficial impacts because of the presence of structures. The majority of offshore structures in the geographic analysis area would be attributable to the offshore wind development. Migratory birds that use the offshore wind lease areas during all or parts of the year would either be exposed to new collision risk or experience long-term functional habitat loss due to behavioral avoidance and displacement from wind lease areas on the OCS. The offshore wind development would also be responsible for the majority of impacts related to new cable emplacement and pile-driving noise, but effects on birds resulting from these IPFs would be localized and temporary and would not be expected to be biologically significant.

BOEM anticipates that the cumulative impacts of the No Action Alternative would have **moderate** adverse impact on birds but could include **moderate beneficial** impacts because of the presence of offshore structures.

3.7.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on birds:

- The new onshore substations, which could require the removal of trees on the edge of the construction footprint;
- The number, size, and location of the WTGs;

- The routing variants within the selected onshore export cable system, which could require removal of trees on the edge of the construction corridor; and
- The time of year during which construction occurs.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- WTG number, size, and location: the level of hazard related to WTGs is proportional to the number of WTGs installed; fewer WTGs would present less hazard to birds.
- Onshore export cable routes and substations footprint: the route chosen (including variants within the general route) and substation footprint would determine the amount of habitat affected.
- Season of construction: The activity and distribution of birds exhibit distinct seasonal changes. For instance, summer and fall months (generally May through October) constitute the most active season for birds in the Project area, and the months on either side coincide with major migration events. Therefore, construction during months in which birds are not present, not breeding, or less active would have a lesser impact on birds than construction during more active times.

Ocean Wind has committed to measures to minimize impacts on birds. These measures include, but are not limited to, cutting trees and vegetation, where possible, during the winter months when most migratory birds are not present (BIRD-03) and using lighting technology that minimizes impacts on avian species to the extent practicable (BIRD-04) (COP Volume II, Table 1.1-2; Ocean Wind 2023).

3.7.5 Impacts of the Proposed Action on Birds

3.7.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.7.7, *Impacts of Alternative E on Birds*.

The sections below summarize the potential impacts of the Proposed Action on birds during the various phases of the proposed Project. Routine activities would include construction, O&M, and decommissioning of the proposed Project, as described in Chapter 2, *Alternatives*. The most impactful IPF is expected to be the presence of structures, which could lead to adverse impacts including injury and mortality or elicit an avoidance response. BOEM prepared a BA for the potential effects on USFWS federally listed species, which found that the Proposed Action was *not likely to adversely affect*, or would have *no effect*, on listed species (BOEM 2022). BOEM requested concurrence on its conclusion that the impacts of the proposed activities are expected to be discountable and insignificant, and thus *may affect but are not likely to adversely affect* piping plovers, roseate terns, eastern black rails, and rufa red knots. There are no critical habitats designated for these species in the action area defined in the BA (BOEM 2022). Consultation with USFWS pursuant to Section 7 of the ESA is ongoing and results of consultation will be presented in the Final EIS.

Accidental releases: Some potential exists for mortality, decreased fitness, and health effects due to the accidental release of fuel, hazardous materials, and trash and debris from vessels associated with the Proposed Action. Vessels associated with the Proposed Action may potentially generate operational waste, including bilge and ballast water, sanitary and domestic wastes, and trash and debris. All vessels associated with the Proposed Action would comply with USCG requirements for the prevention and control of oil and fuel spills. Proper vessel regulations and operating procedures would minimize effects on offshore bird species resulting from the release of debris, fuel, hazardous materials, or waste (BOEM

2012). In addition, Ocean Wind has committed to preparing and implementing waste management plans and hazardous materials plans, which would minimize the potential for spills and identify procedures in the event of a spill (GEN-10). All vessels would be certified to conform to vessel O&M protocols designed to minimize the risk of fuel spills and leaks (WQ-01). These releases, if any, would occur infrequently at discrete locations and vary widely in space and time; as such, BOEM expects localized, temporary, and negligible impacts on birds. Offshore wind activities would contribute to an increased risk of spills and associated impacts due to fuel, fluid, or hazardous materials exposure but, compared to the overall spill risk from ongoing activities, the contribution from offshore wind and the Proposed Action would be low.

Lighting: Under the Proposed Action, up to 98 WTGs and three OSS would be lit with navigational and FAA hazard lighting; these lights have some potential to attract birds and result in increased collision risk (Hüppop et al. 2006). In accordance with BOEM lighting guidelines (2021c) and as outlined in the Ocean Wind 1 COP (Volume I, Section 7.4; Ocean Wind 2023), each WTG above 699 feet about ground level would be lit with two FAA model L-864 aviation red flashing obstruction lights on the highest point of the nacelle and up to four FAA model L-810 red flashing lights at mid-mast level, adding up to 588 new red flashing lights to the offshore environment where none currently exist. However, red flashing aviation obstruction lights are commonly used at land-based wind facilities without any observed increase in avian mortality compared with unlit turbine towers (Kerlinger et al. 2010, Orr et al. 2013). Additionally, marine navigation lighting would consist of multiple flashing yellow lights on each WTG and on the corners of each OSS.

The Project is proposing to use an ADLS, which if implemented would only activate WTG lighting when aircraft enter a predefined airspace. The short-duration synchronized flashing of the ADLS would have less impact on birds at night than the standard continuous, medium-intensity red strobe light aircraft warning systems. Based on Ocean Wind’s ADLS Efficacy Analysis that looked at historical air traffic data from FAA, ADLS-controlled obstruction lights would be activated for a total of 1 hours and 19 minutes and 17 seconds over a 1-year period. While the activation time ranged from 40 seconds (January) to 23 minutes and 40 seconds (February), for most months of the year the activation time would be less than 10 minutes. This would reduce impacts already associated with WTG lighting. To further reduce impacts on birds, Ocean Wind proposes to use lighting technology that minimizes impacts on avian species to the extent practicable (BIRD-04). As such, BOEM expects impacts, if any, to be long term but negligible from lighting. Vessel lights during construction, O&M, and decommissioning would be minimal and likely limited to vessels transiting to and from construction areas.

The impact of the Proposed Action alone would not noticeably increase the impacts of light beyond those described under the No Action Alternative. Under the planned action scenario, up to 2,952 WTGs and 64 OSS would have lights, and these would be incrementally added over time beginning in 2023 and continuing through 2030. Lighting of WTGs and other structures would be minimal (navigation and aviation hazard lights) and in accordance with BOEM (2021c) guidance.

Cable emplacement and maintenance: The Proposed Action would disturb up to 3,785 acres (15 km^2) of seafloor associated with the installation of array cable and offshore cable, which would result in turbidity effects that have the potential to reduce marine bird foraging success or have temporary and localized impacts on marine bird prey species. These impacts are expected to be temporary, with sediments settling quickly to the seabed and potential plumes limited to right above the seabed and not within the water column; turbidity concentrations greater than 10 mg/L would be short in duration—up to 6 hours—and limited to within approximately 50 to 200 meters of the trench in offshore areas. Dredging, which may also occur along the proposed cable route in locations where sand waves (naturally mobile slopes on the seabed) are encountered or when crossing federal and state navigation channels, would produce similar effects, but with plumes likely to last longer and extend farther out. As BOEM (2018) notes, while turbidity would likely be high in the areas affected by dredging, the sediment would not affect water quality after it settles, and the period of sediment suspension would be very short term and localized. Individual birds would be expected to successfully forage in nearby areas not affected by increased sedimentation during cable emplacement, and only non-measurable impacts, if any, on individuals or populations would be expected given the localized and temporary nature of the potential impacts. Given the localized nature of these impacts, impacts associated with the emplacement of cables for other offshore wind projects in the geographic analysis area are not anticipated to overlap spatially with the Proposed Action, and impacts would be negligible.

Noise: The expected impacts of aircraft, G&G survey, and pile-driving noise associated with Proposed Action alone would not increase the impacts of noise beyond those described under the No Action Alternative. Effects on offshore bird species could occur during the construction phase of the Proposed Action because of equipment noise (including pile-driving noise). The pile-driving noise impacts would be short term (4 hours per pile). Vessel and construction noise could disturb offshore bird species, but they would likely acclimate to the noise or move away, potentially resulting in a temporary loss of habitat (BOEM 2012). BOEM anticipates the temporary impacts, if any, related to construction and installation of the offshore components would be negligible.

Normal operation of the substations would generate continuous noise, but BOEM expects negligible long-term impacts when considered in the context of the other commercial and industrial noises near the proposed substations.

Presence of structures: The various types of impacts on birds that could result from the presence of structures, such as fish aggregation and associated increase in foraging opportunities, entanglement and fishing gear loss or damage, migration disturbances, and WTG strikes and displacement, are described in detail in Section 3.7.3.2, *Cumulative Impacts of the No Action Alternative*. The impacts of the Proposed Action alone as a result of presence of structures would be long term but minor, and may include some minor beneficial impacts. Due to the anticipated use of flashing red tower lights, restricted time period of exposure during migration, and small number of migrants that could cross the Wind Farm Area, BOEM concludes that the Proposed Action would not likely adversely affect roseate terns, piping plovers, eastern black rail, and red knots. See the Ocean Wind 1 BA (BOEM 2022) for a complete discussion of the potential collision risk to ESA-listed species as a result of operation of the proposed Project.

As previously described and depicted for the offshore wind lease areas on Figure 3.7-3 and Figure 3.7-4, the locations of the OCS offshore wind lease areas were selected to minimize impacts on all resources, including birds. Within the Atlantic Flyway along the North American Atlantic Coast, much of the bird activity is concentrated along the coastline (Watts 2010). Waterbirds use a corridor between the coast and several kilometers out onto the OCS, while land birds tend to use a wider corridor extending from the coastline to tens of kilometers inland (Watts 2010). However, operation of the Proposed Action would result in impacts on some individuals of offshore bird species and possibly some individuals of coastal and inland bird species during spring and fall migration. These impacts could arise through direct mortality from collisions with WTGs or through behavioral avoidance and habitat loss (Drewitt and Langston 2006, Fox et al. 2006, Goodale and Millman 2016). The predicted activity of bird populations that have a higher sensitivity to collision (as defined by Robinson Willmott et al. [2013]) is relatively low in the OCS during all seasons of the year (Figure 3.7-3), suggesting that bird fatalities due to collision are likely to be low. When WTGs are present, many birds would avoid the WTG site altogether, especially the species that ranked “high” in vulnerability to displacement by offshore wind energy development (Robinson Willmott et al. 2013). In addition, many birds would likely adjust their flight paths to avoid WTGs by flying above, below, or between them (e.g., Desholm and Kahlert 2005, Plonczkier and Simms 2012, Skov et al. 2018) and others may take extra precautions to avoid WTGs when the WTGs are moving (Johnston et al. 2014). Several species have very high avoidance rates; for example, the northern gannet, black-legged kittiwake, herring gull, and great black-backed gull have measured avoidance rates of at least 99.6 percent (Skov et al. 2018). Vattenfall (a European energy company) recently studied bird movements within an offshore wind farm situated 3–4.9 kilometers off the coast of Aberdeen, Scotland (Vattenfall 2023). The purpose of the study was to improve the understanding of seabird flight behavior inside an offshore wind farm with a focus on the bird breeding period and post-breeding period when densities are highest. The study was robust in that seabirds were tracked inside the array with video cameras and radar tracks, which allowed for measuring avoidance movements (meso- and micro-avoidance)[2] with high confidence and at the species level. Detailed statistical analyses of the seabird flight data were enabled both by the large sample sizes and by the high temporal resolution in the combined radar track and video camera data. Meso-avoidance behavior showed that species avoided the RSZ by flying in between the turbines, with very few avoiding by changing their flight altitude in order to fly either below or above the rotors. The most frequently recorded adjustment under micro-avoidance behavior was birds flying along the plane of the rotor; other adjustments included crossing the rotor either obliquely or perpendicularly, and some birds crossed the RSZ without making any adjustments to the spinning rotors. The study concluded that, together with the recorded high levels of micro-avoidance in all species (greater than 0.96), it is now evident that seabirds will be exposed to very low risks of collision in offshore wind farms during daylight hours. This was substantiated by the fact that no collisions or even narrow escapes were recorded in over 10,000 bird videos during the 2 years of monitoring covering the April–October period. The study's calculated micro-avoidance rate (greater than 0.96) is similar to that reported in Skov et al. (2018).

Ocean Wind performed an exposure assessment to estimate the risk of various offshore bird species encountering the Wind Farm Area (COP Volume III, Appendix H; Ocean Wind 2023). Most species were identified as having "minimal" to "low" overall exposure risk. Of the approximately 40 species of marine birds that use the mid-Atlantic marine environment, the northern gannet and loons had the highest potential exposure, both considered "low-medium" exposure risk. In addition, two raptors—peregrine falcon and merlin—were found to have "low-medium" exposure risk; non-falcon raptors were found to have limited use of the offshore environment. While some non-marine birds have the potential to be exposed to the Wind Farm Area, the Wind Farm Area is far enough offshore as to be beyond the range of most breeding terrestrial or coastal bird species. Of the species considered to have a higher overall exposure risk (i.e., loons, northern gannet, peregrine falcon, and merlin), two have a special status designation: red-throated loon is a Bird of Conservation Concern and peregrine falcon is state-listed as endangered (breeding) and special concern (non-breeding).

During migration, many bird species, including songbirds, likely fly at heights well above or below the RSZ (70.8 feet to 906 feet [22 to 276 meters] above MLLW) (COP Volume III, Appendix H; Ocean Wind 2023 and references in COP Volume III, Appendix H; Ocean Wind 2023). As shown in Robinson Willmott et al. (Robinson Willmott et al. 2013), species with low sensitivity scores include many passerines that only cross the Atlantic OCS briefly during migration and typically fly well above the RSZ.

[2] Micro-avoidance is flight behavior within and in the immediate vicinity of individual wind turbine RSZs (i.e., last-second action to avoid collision); meso-avoidance is flight behavior within and in the immediate vicinity of the wind farm (i.e., anticipatory/impulsive evasion of rows of turbines in a wind farm).

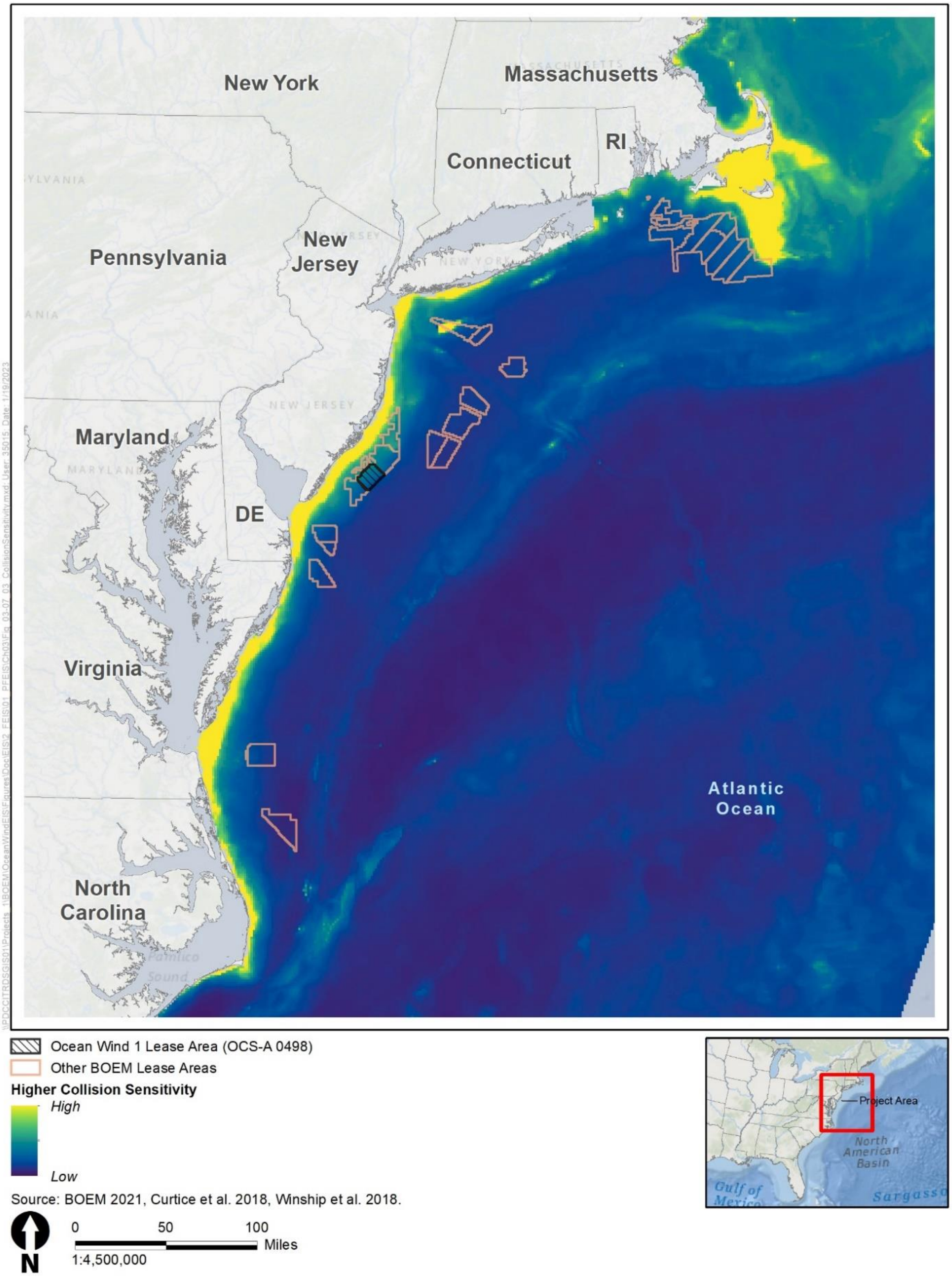

Figure 3.7-3 Total Avian Relative Abundance Distribution Map for the Higher Collision Sensitivity Species Group

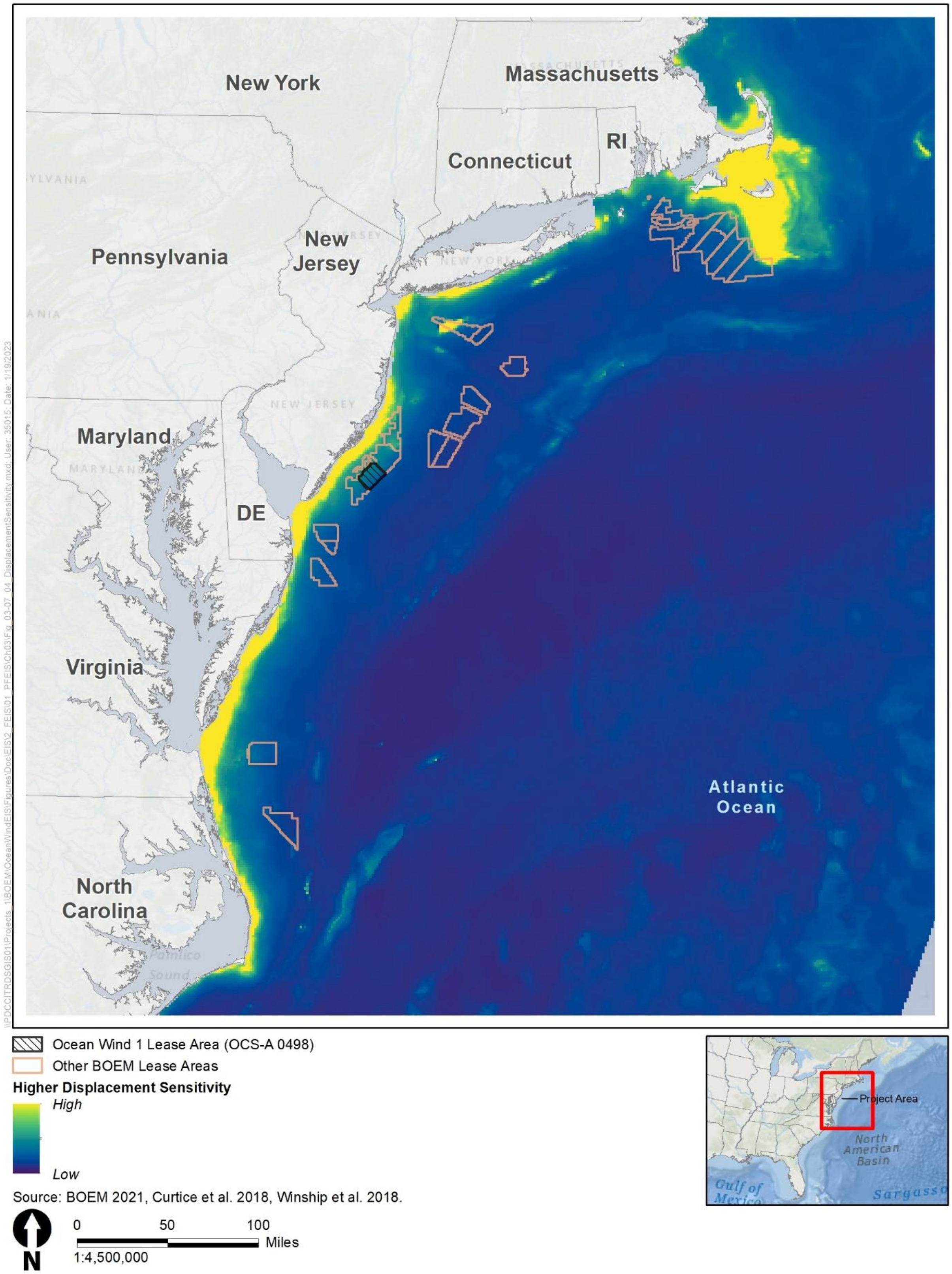

Figure 3.7-4 Total Avian Relative Abundance Distribution Map for the Higher Displacement Sensitivity Species Group

It is generally assumed that inclement weather and reduced visibility cause changes to migration altitudes (Ainley et al. 2015) and could potentially lead to large-scale mortality events. However, this has not been shown to be the case in studies of offshore wind facilities in Europe, with oversea migration completely, or nearly so, ceasing during inclement weather (Fox et al. 2006, Pettersson 2005, Hüppop et al. 2006), and with migrating birds avoiding flying through fog and low clouds (Panuccio et al. 2019). Furthermore, many of these passerine species, while detected on the OCS during migration as part of BOEM's Acoustic/Thermographic Offshore Monitoring project (Robinson Willmott and Forcey 2014), they were documented in relatively low numbers. While several studies documenting bird flight and wind speeds over terrestrial environments have shown birds to fly at variable wind speeds, including above the typical cut-in speeds of wind turbines (Abdulle and Fraser 2018; Bloch and Bruderer 1982; Bruderer and Boldt 2001; Chapman et al. 2016), Robinson Willmott and Forcey (2014) found that most of the bird activity (including blackpoll warblers) in the offshore environment on the OCS occurred during windspeeds below 10 kilometers per hour (2.8 m/s) (see Figure 109 in Robinson Willmott and Forcey 2014). The cut-in speed for the Ocean Wind 1 WTGs is 3.5 m/s; therefore, based on the Robinson Willmott and Forcey (2014) offshore study, passerines would likely be migrating when the turbine blades are idle (Ørsted 2022). Furthermore, most carcasses of small migratory songbirds found at land-based wind energy facilities in the Northeast were within 2 meters of the turbine towers, suggesting that they are colliding with towers rather than moving turbine blades (Choi et al. 2020). Although it is possible that migrating passerines could collide with offshore structures, migrating passerines are also occasionally found dead on boats, presumably from exhaustion (e.g., Stabile et al. 2017).

Some marine bird species might avoid the Wind Farm Area during its operation, leading to an effective loss of habitat. For example, loons (Dierschke et al. 2016, Drewitt and Langston 2006, Lindeboom et al. 2011, Percival 2010, Petersen et al. 2006), grebes (Dierschke et al. 2016, Leopold et al. 2011, Leopold et al. 2013), seaducks (Drewitt and Langston 2006, Petersen et al. 2006), and northern gannets (Drewitt and Langston 2006, Lindeboom et al. 2011, Petersen et al. 2006) typically avoid offshore wind developments. As depicted on Figure 3.7-4, modeled use of the Wind Farm Area by bird species with high displacement sensitivity is low. A complete list of species included in the higher displacement sensitivity group can be found in Robinson Willmott et al. (Robinson Willmott et al. 2013)). Although the proposed Project may no longer provide foraging opportunities to species with high displacement sensitivity, suitable foraging habitat exists in the immediate vicinity of the proposed Project and throughout the region. Because the Wind Farm Area is not likely to contain important foraging habitat for the species susceptible to displacement, BOEM expects this loss of habitat to be insignificant. Population-level, long-term impacts resulting from habitat loss would likely be negligible.

Generally, onshore operation is not expected to pose any significant IPFs (i.e., hazards) to birds because activities would disturb little if any habitat, and the transmission lines would be primarily below ground. Overhead transmission lines are unlikely to be a significant IPF because they are short (less than 0.5 mile [0.8 kilometer]); they are in existing, highly disturbed, industrial areas that are unlikely to provide important bird habitat; and best practices, such as implementing Avian Power Line Interaction Committee (2012) standard design guidance to the extent practicable, would be used to minimize potential impacts from collision and electrocution.

Traffic (aircraft): The expected impacts of aircraft traffic associated with the Proposed Action would be negligible, similar to those of the No Action Alternative.

Land disturbance (onshore construction): The expected impacts of onshore construction associated with the Proposed Action would not increase the impacts of this IPF beyond those described under the No Action Alternative. Ocean Wind proposes to use trenchless technology (e.g., HDD) to go under barrier beaches, which would avoid beach habitat for nesting shorebirds; as such, temporary impact on birds, particularly nesting shorebirds, resulting from the landfall location would be negligible.

Collisions between birds and vehicles or construction equipment have some limited potential to cause mortality. However, these temporary impacts, if any, would be negligible, as most individuals would avoid noisy construction areas (Bayne et al. 2008, Goodwin and Shriver 2010, McLaughlin and Kunc 2013).

Overall, impacts on bird habitat from onshore construction activities would be limited because, whenever possible, facilities (including overhead transmission lines) would be co-located with existing developed areas (i.e., roads and existing transmission lines) to limit disturbance. The maximum design for the Oyster Creek cable corridor would require an approximate construction disturbance up to 5.3 miles long and 50 feet wide and a permanent easement up to 30 feet wide, equating to approximately 32 acres of total disturbance and 19 acres of permanent disturbance. The maximum design for the BL England cable corridor would require an approximate construction disturbance up to 8 miles long and 50 feet wide and a permanent easement up to 30 feet wide, equating to approximately 48 acres of total disturbance and 29 acres of permanent disturbance. While most of this disturbance would occur in already disturbed areas that would provide little, if any, bird habitat, construction of onshore facilities may require clearing and some permanent removal of some trees and shrubs (COP Volume II, Sections 2.2.1.2.1 and 2.2.3.2.1; Ocean Wind 2023).

Clearing and grading during construction within temporary workspaces would result in temporary loss of forage and cover for birds within the area. Construction of the onshore substations would result in temporary and permanent impacts on habitat from construction of the permanent substation facilities and use of temporary construction workspace. However, the existing habitat at the proposed onshore substation sites at BL England and Oyster Creek is already developed and fragmented. The BL England and Oyster Creek substation sites would require approximately 13 and 31.5 acres, respectively. Any remnant habitat within the permanent substation site would be converted to developed land with landscaping for the duration of the Project's operational lifetime (COP Volume 2, page 126; Ocean Wind 2023). Landscaped areas would provide some habitat for species acclimated to human activity. However, the work would not affect habitat outside the construction area.

Impacts on nesting bald eagles are not anticipated because, as described in Section 3.7.1, no bald eagle nest activity has been identified along or adjacent to any of the onshore Project components. Peregrine falcons have been documented throughout the Onshore Project area (see COP Appendix H, Figure 3-11; Ocean Wind 2023), with nesting documented in the vicinity of the landfall sites (see Section 3.7.1) but none in the location of an onshore Project component. Due to the short duration of the activities and the APMs (see COP Volume II, Table 1.1-2; Ocean Wind 2023) that Ocean Wind has committed to implementing to reduce impacts, population-level impacts on birds from habitat modification and impacts are unlikely. Given the nature of the existing habitat, its abundance on the landscape, and the temporary nature of construction, the impacts on birds are expected to be negligible.

3.7.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities. Ongoing and planned non-offshore wind activities related to installation of new submarine cables and pipelines, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS would contribute to impacts on birds through the primary IPFs of accidental releases, lighting, cable emplacement and maintenance, presence of structures, traffic (aircraft), and land disturbance. The construction, O&M, and decommissioning of both onshore and offshore infrastructure for offshore wind activities across the geographic analysis area would also contribute to the primary IPFs of accidental releases, lighting, cable emplacement and maintenance, presence of structures, traffic (aircraft), and land disturbance. Given that the abundance of bird species that overlap with wind energy facilities on the Atlantic OCS is relatively small, offshore wind activities would not appreciably contribute to impacts on bird populations.

Temporary disturbance and permanent loss of habitat onshore may occur as a result of offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the geographic analysis area. Ongoing and planned offshore wind activities in combination with the Proposed Action would result in an estimated 2,952 WTGs, to which the Proposed Action would contribute 98 or about 3 percent, and would include up to more than 185,762 acres (752 km^2) of seafloor disturbed from the offshore export cable and inter-array cables.

The cumulative impacts on birds would likely be moderate because, although bird abundance on the OCS is low, there could be unavoidable impacts offshore and onshore; however, BOEM does not anticipate the impacts to result in population-level effects or threaten overall habitat function. The Proposed Action would contribute a undetectable increment to the cumulative accidental releases, lighting, cable emplacement and maintenance, presence of structures, traffic (aircraft), and land disturbance impacts on birds.

3.7.5.3. Conclusions

Impacts of the Proposed Action. Overall, the Proposed Action would have **minor** impacts on birds, depending on the location, timing, and species affected by an activity. The primary factors of the Proposed Action affecting birds are habitat loss and collision-induced mortality from rotating WTGs and permanent habitat loss and conversion from onshore construction. The Proposed Action would also result in potential **minor beneficial** impacts for marine birds associated with foraging opportunities due to the presence of structures.

Cumulative Impacts of the Proposed Action. BOEM anticipates that the cumulative impacts on birds in the geographic analysis area would be **moderate**, as well as **moderate beneficial**. The incremental impacts contributed by the Proposed Action to the cumulative impacts on birds would be undetectable. The Proposed Action would contribute to the cumulative impacts primarily through the permanent impacts from the presence of structures and long-term impacts from habitat loss related to construction and O&M of the onshore Project components.

3.7.6 Impacts of Alternatives B, C, and D on Birds

Impacts of Alternatives B, C, and D. The impacts resulting from Alternatives B, C, and D would be less than or similar to those described under the Proposed Action. BOEM expects the elimination of WTGs under Alternatives B-1 (up to 9 WTGs), B-2 (up to 19 WTGs), and D (up to 15 WTGs) to have a reduced impact on birds given the smaller number of WTGs compared to the Proposed Action. BOEM does not expect relocation of the eight WTGs and compression of the 98 WTGs under Alternatives C-1 and C-2, respectively, to significantly change the potential impacts compared to the Proposed Action because the total number of WTGs would remain the same, the overall footprint would be the same or slightly less, and the Wind Farm Area does not include areas with high bird densities.

Cumulative Impacts of Alternatives B, C, and D. The cumulative impacts on birds would be moderate and moderate beneficial for the same reasons described for the Proposed Action. The incremental impacts contributed by Alternatives B, C, and D to the cumulative impacts on birds would be similar to those described under the Proposed Action. However, the differences in impacts among Alternatives B, C, and D would still apply when considered alongside the impacts of other ongoing and planned activities. Therefore, impacts on birds would be similar under Alternatives C-1 and C-2 and slightly lower but not materially different under Alternatives B-1, B-2, and D.

3.7.6.1. Conclusions

Impacts of Alternatives B, C, and D. As discussed in the above sections, the expected **minor** impacts and potential **minor beneficial** impacts associated with the Proposed Action would not change substantially under Alternatives B, C, and D. While Alternatives B, C, and D have some potential to result in slightly different impacts on birds, the same construction, O&M, and decommissioning activities would still occur, albeit at differing scales in some cases. Alternatives B-1, B-2, and D may result in slightly less, but not materially different, minor impacts and minor beneficial impacts on species with high collision sensitivity and high displacement sensitivity due to a reduced number of WTGs and Project area. Alternative C-1 would have the same WTG number and overall Wind Farm Area footprint as the Proposed Action and, therefore, would have similar minor impacts and minor beneficial impacts on species with higher collision sensitivity and higher displacement sensitivity. Alternative C-2 would have the same number of WTGs as the Proposed Action, but compressed into a smaller footprint, and, therefore, would have similar minor impacts and minor beneficial impacts on species with higher collision sensitivity and higher displacement sensitivity.

Cumulative Impacts of Alternatives B, C, and D. The incremental impacts contributed by Alternatives B, C, and D to the cumulative impacts on birds would be undetectable. Because the impacts of the Proposed Action would not substantially change under Alternatives B, C, and D, BOEM anticipates that the cumulative impacts of Alternatives B, C, and D would be the same as those described for the Proposed Action. Therefore, cumulative impacts of Alternatives B, C, and D would be **moderate** adverse due to behavioral avoidance and temporary or permanent displacement, injury, and mortality, and may include **moderate beneficial** impacts due to the presence of structures, which may provide increased foraging opportunities for bird species within the geographic analysis area.

3.7.7 Impacts of Alternative E on Birds

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Project under Alternative E would be similar to those described under the Proposed Action because Alternative E would differ only with respect to a short distance of onshore export cable at the landing site for Oyster Creek (see Figure 2-11). The only IPFs that would be meaningfully different under Alternative E compared to the Proposed Action are land disturbance and new cable emplacement/maintenance. All other offshore and onshore Project components of Alternative E would be the same as those of the Proposed Action and the other IPFs are not anticipated to differ.

In contrast to the Proposed Action, which includes two Oyster Creek cable route options as part of Ocean Wind's PDE to cross Island Beach State Park, Alternative E would cross Island Beach State Park on the more northerly route where SAV impacts would be avoided (refer to Section 2.1.6). BOEM expects that the modifications to the Oyster Creek export cable route to avoid impacts on SAV in Barnegat Bay under Alternative E would not significantly change the overall potential impact compared to the Proposed Action. While minimization of SAV impacts under Alternative E would benefit bird species that could use this habitat, Alternative E would affect an additional 0.9 acre of undisturbed scrub/shrub dune and wetland habitat compared to the southern cable route under the Proposed Action. The impact on this habitat, which can support federally and state-listed bird foraging and nesting habitat, would occur in the vicinity of an existing maintenance/storage yard across from the Park Office on Central Avenue/Shore Road and would be a primarily temporary impact to support HDD staging and workspace, but some permanent cable easements would be required after the staging and workspaces are restored.

Alternative E would place the export cable route along the parking area and Central Avenue/Shore Road, where vegetation impacts are anticipated to be minimal. While the construction duration under Alternative E could be longer than under the Proposed Action if the southern cable route option is constructed due to the slightly increased cable length, non-habitat impacts (e.g., noise) would be temporary and short term, lasting only the duration of construction. Any timing restrictions for construction to avoid impacts on birds would be the same as under the Proposed Action for potential habitats for sensitive species or as required by federal and state agency requirements.

In the aquatic environment, cable emplacement would still result in short-term and localized sediment suspension and individual birds would be expected to successfully forage in nearby areas. Impacts on bird habitat from onshore construction activities under Alternative E would remain relatively limited because facilities would be co-located with existing developed areas (i.e., roads, parking areas, and existing maintenance yards) to limit disturbance and affected habitats would be mostly restored. The impacts of Alternative E would not be materially different than those described under the Proposed Action.

Cumulative Impacts of Alternative E. The cumulative impacts on birds would be moderate and moderate beneficial for the same reasons described for the Proposed Action. The incremental impacts contributed by Alternative E to the cumulative impacts on birds would be similar to those described under the Proposed Action because Alternative E would not significantly change the overall potential impact compared to the Proposed Action.

3.7.7.1. Conclusions

Impacts of Alternative E. The expected **minor** impacts and potential **minor beneficial** impacts associated with the Proposed Action alone would not change substantially under Alternative E. While Alternative E has some potential to result in slightly different impacts on birds, the same construction and installation, O&M, and decommissioning activities would still occur. Alternative E would result in similar negligible impacts on birds in relation to sediment disturbance and turbidity, and minor impacts for onshore ground disturbance due to the potential temporary and permanent impacts on bird habitat.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on birds would be undetectable. Because the impacts of the Proposed Action would not substantially change under Alternative E, BOEM anticipates that the cumulative impacts on birds associated with Alternative E would be the same as those described for the Proposed Action. Therefore, cumulative impacts of Alternative E would be **moderate** adverse and may include **moderate beneficial** impacts due to the presence of structures, which may provide increased foraging opportunities for bird species within the geographic analysis area.

3.7.8 Proposed Mitigation Measures

Several measures are proposed to minimize impacts on birds (Appendix H, Table H-2). If the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced.

Table 3.7-4 Measures Resulting from Consultations (Also Identified in Appendix H, Table H-2): Birds

Measure[1]	Description	Effect
Adaptive mitigation for birds and bats	BOEM will require that Ocean Wind develops and implements an Avian and Bat Post-Construction Monitoring Plan based on COP Appendix III, Appendix AB Avian and Bat Post-Construction Monitoring Framework in coordination with USFWS, NJDEP, and other relevant regulatory agencies. Annual monitoring reports will be used to determine the need for adjustments to monitoring approaches, consideration of new monitoring technologies, and/or additional periods of monitoring (see Appendix H, Table H-2 for more detail).	If the reported post-construction bird monitoring results (generated as part of Ocean Wind's *Avian and Bat Post-Construction Monitoring Framework* [COP Appendix AB, Ocean Wind 2023]) indicate bird impacts deviate substantially from the impact analysis included in this EIS, then Ocean Wind must make recommendations for new mitigation measures or monitoring methods (refer to Appendix H, Table H-2).
Reporting	Annual Bird Mortality Reporting during construction and operation, and decommissioning. The Lessee must submit an annual report covering each calendar year, due by January 31 of the following year, documenting any dead (or injured) birds or bats found on vessels and structures during construction, operations, and decommissioning. The report must be submitted to BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWSubmittals@bsee.gov) and USFWS. The report must contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with Federal or research bands must be reported to the United States Geological Survey Bird Band Laboratory. Any occurrence of dead ESA birds or bats must be reported to BOEM, BSEE, and USFWS as soon as practicable (taking into account crew and vessel safety), but no later than 24 hours after the sighting, and if practicable, carefully collect the dead specimen and preserve the material in the best possible state.	Annual bird mortality reporting can inform the Avian and Bat Post-Construction Monitoring Plan (see previous measure), which could lead to Ocean Wind recommending new mitigation measures or monitoring methods to reduce impacts on birds. In addition, mortality data can inform future BOEM offshore wind EIS analyses for proposed wind farms on the Atlantic OCS.
Monitoring	BOEM will require that Ocean Wind implements monitoring and/or other conservation measures to minimize disturbance of rufa red knots and other ESA-listed birds, in coordination with USFWS and NJDEP.	Coordination with USFWS and NJDEP in developing monitoring or conservation measures would avoid or reduce noise disturbance on ESA-listed birds during construction in the onshore environment, primarily those disturbances that could affect energy budgets or displacement from otherwise suitable habitat.

Measure[1]	Description	Effect
Bird Perching Deterrent	To minimize attracting birds to operating turbines, Ocean Wind must install bird perching-deterrent devices on each WTG and OSS. Ocean Wind must submit a plan to deter perching on offshore infrastructure by roseate terns and other marine birds for BOEM and USFWS approval. The plan must include the type(s) and locations of bird perching deterrent devices, include a maintenance plan for the life of the project, allow for modifications and updates as new information and technology becomes available, and track the efficacy of the deterrents. The location of bird perching-deterrent devices must be proposed by Ocean Wind based on best management practices applicable to the appropriate operation and safe installation of the devices. Ocean Wind must confirm the locations of bird perching-deterrent devices as part of the documentation it must submit with the FDR.	While bird presence on the OCS is anticipated to be low, potential collision impacts with offshore WTGs and OSS could be reduced by requiring installation of bird perching–deterrent devices to minimize bird attraction to operating WTGs and on the OSS.
Light Impact Reduction	Ocean Wind must use an FAA-approved vendor for the Aircraft Detection Lighting System (ADLS), which will activate the FAA hazard lighting only when an aircraft is in the vicinity of the wind facility to reduce visual impacts at night. Ocean Wind must confirm the use of an FAA-approved vendor for ADLS on WTGs and OSSs in the FIR.	While the presence of birds on the OCS is anticipated to be low, implementation of ADLS would reduce bird attraction to and potential collisions with offshore WTGs and OSS, given the limited amount of time that lights would actually be illuminated.
Light Impact Reduction	Ocean Wind must light each WTG and OSS in a manner that is visible by mariners in a 360-degree arc around the WTG and OSS. To minimize the potential of attracting migratory birds, the top of each light shall be shielded to minimize upward illumination (Conditional on USCG approval) BOEM must provide USFWS with a copy of Ocean Wind's application to USCG to establish Private Aids to Navigation (PATON), which includes a lighting, marking, and signaling plan. The PATON application will include design specifications for maritime navigational lighting. Upon approval of the PATON by USCG, BOEM and USFWS will work together to determine the color, intensity, and duration of any light from maritime lanterns that is likely to reach the typical flight heights of listed birds, and will assess the degree to which the lighting is likely to attract or disorient birds.	While the presence of birds on the OCS is anticipated to be low, shielding of light downward could minimize the potential for light attraction and collision.

Measure[1]	Description	Effect
Collision Reduction	For overhead power lines, Ocean Wind must follow best practices from the Avian Power Line Interaction Committee.	While only a very short distance of overhead power line would be constructed (up to 0.5 mile), installing bird-deterrent or collision-avoidance devices per the Avian Power Line Interaction Committee could avoid and minimize potential bird collisions and electrocutions.
Habitat Impact Reduction	Both during and after construction, Ocean Wind must avoid Project-related intrusion (i.e., access through or disturbance from personnel or equipment) into any beach or dune from March 1 to August 31. In the event that emergency access to this area is needed during the restricted season, Ocean Wind must coordinate with the USFWS and the NJDEP's Endangered and Nongame Species Program to seek approval.	While Ocean Wind proposes to avoid barrier beaches and dunes (via HDD), coordination with and approval from USFWS and NJDEP for an unforeseen circumstance that requires intrusion into this habitat between March 1 and August 31 would avoid and minimize potential impacts on bird habitat and disturbances that affect bird energy budgets or displacement from otherwise suitable habitat.
Species Disturbance Reduction	Both during and after construction, Ocean Wind must avoid Project activities within 500 feet of any beach or dune from March 15 to August 31. In the event that essential access to this area is needed during the restricted season, Ocean Wind must coordinate with the USFWS and the NJDEP's Endangered and Nongame Species Program to seek approval.	Coordination with USFWS and NJDEP for any Project activities within 500 feet of beach or dune habitat between March 15 and August 31 would avoid and minimize potential impacts on bird habitat and disturbances that affect bird energy budgets or displacement from otherwise suitable habitat.
Habitat Impact Reduction	Rufa red knot: Along onshore export cable routes, Ocean Wind must avoid permanent modification of suitable red knot habitats. Where temporary habitat disturbance is unavoidable, Ocean Wind must develop a restoration plan in coordination with USFWS for BOEM and USFWS approval.	Avoiding permanent modifications to suitable red knot habitat and developing a restoration plan in coordination with USFWS for unavoidable temporary habitat impacts would ensure no permanent loss or alteration of rufa red knot habitat. Non-ESA listed birds that have similar habitat requirements as red knot would also benefit from this measure.

Measure[1]	Description	Effect
Species Disturbance Reduction	Roseate tern: Ocean Wind must avoid disturbing roosting terns to the extent practicable during construction and operations and maintenance, affording at least a 300-foot buffer for people on foot and for vehicles to avoid flushing the birds. USFWS anticipates most staging flocks of terns will occur from July through September.	Establishing a 300-foot buffer around roosting roseate terns would minimize and avoid potential disturbances that result in flushing of birds, which could affect energy budgets or displacement from otherwise suitable habitat. This measure would also benefit other bird species with similar habitat requirements and presence from July through September.
Surveys, Avoidance, and Minimization	Eastern black rail and saltmarsh sparrow: No planned or routine Project entry or intrusion into Wetlands A, B, or C (adjacent to Roosevelt Blvd.) either during or after construction will occur. Emergency access must be coordinated with USFWS and NJDEP. If Ocean Wind elects to construct an Oyster Creek onshore cable route option other than the Holtec property route, Ocean Wind must retain a species expert to conduct a desktop and field assessment and to map suitable eastern black rail and saltmarsh sparrow habitat within the limits of disturbance. Ocean Wind must provide the assessment, mapping and associated spatial files in an ESRI ArcMap/ArcPro compatible format, and qualifications of the expert to BOEM and USFWS for review no later than 30 calendar days after the assessment has been completed. BOEM and USFWS will complete their reviews and identify any deficiencies that require a report revision by Ocean Wind within 30 calendar days of receipt of the assessment. If areas of suitable eastern black rail and/or saltmarsh sparrow habitat will be impacted by Project activities, Ocean Wind must coordinate with USFWS to develop appropriate conservation measures that Ocean Wind is required to implement to avoid adverse effects to these species. Conservation measures will include that construction activities and other Project-related intrusions into areas of suitable habitat will be seasonally restricted from April 1 through September 30 (April 1 through September 30 for eastern black rail and May 1 to September 30 for saltmarsh sparrow) in order to minimize the risk of directly disturbing or injuring adults, eggs, or chicks during sensitive periods of the breeding season.	Although there would be no anticipated impacts on wetlands A and C because construction is outside of these wetlands and generally within existing paved road, this measure would ensure Ocean Wind would avoid these wetlands during construction and routine maintenance. If emergency access is needed, coordination with USFWS and NJDEP would ensure impacts would be avoided or minimized to the extent practicable. A desktop and field assessment along the Oyster Creek onshore cable route would identify the potential presence of eastern black rail and saltmarsh sparrow habitat, and the survey results would inform the coordination with BOEM, NJDEP, and USFWS on whether measures (including the specific measures listed) should be implemented to avoid or minimize impacts on these birds. Measures implemented would avoid or reduce disturbance on these birds during construction and other Project intrusions in the habitat, primarily those disturbances that could affect energy budgets or displacement from otherwise suitable habitat. This measure would also benefit other bird species with similar habitat requirements and similar time frames of presence.

Measure[1]	Description	Effect
USFWS Biological Opinion Conservation Measures and Reasonable and Prudent Measures/Terms and Conditions	Conservation Measures and Reasonable and Prudent Measures/Terms and Conditions for activities under BOEM's jurisdiction were provided related to the design of the turbine configuration, offshore lighting, ongoing support for and regular utilization of a Collision Risk Model, monitoring and data collection as part of implementation of an Avian and Bat Post-Construction Monitoring Plan, incidental mortality reporting, and compensatory mitigation for collisions of listed birds. collision mitigation.	These measures would reduce potential for collision risk to listed birds posed by operation of the WTGs. These measures also include an ongoing, long-term commitment to reduce the uncertainty associated with the estimated rates of collision mortality for each of the three listed bird species. Implementation of these conservation measures would provide incremental reductions in impacts on birds, would improve accountability, and would reduce uncertainty associated with estimated rates of collision mortality, but would not alter the overall impact determination of the Proposed Action.

[1] Most of the bird measures in this table are a result of BOEM's ESA Section 7 consultation with USFWS. These same measures are listed in BOEM's BA for species under USFWS jurisdiction and would likely benefit non-ESA-listed bird species with similar habitat in the Project area.
FDR = Facility Design Report; FIR = Fabrication and Installation Report

3.7.8.1. Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.7-4 and Table H-2 in Appendix H, *Mitigation and Monitoring*, are incorporated in the Preferred Alternative. These measures would further define how the effectiveness and enforcement of APMs would be ensured and improve accountability for compliance with APMs by requiring monitoring, reporting, and adaptive management of potential bird impacts on the OCS. In addition, implementation of collision and light reduction measures on the offshore Project components would ensure interactions between birds and the offshore wind infrastructure would be minimized. However, given bird use of the OCS is anticipated to be low, offshore wind activities are unlikely to appreciably contribute to impacts on birds regardless of measures intended to address potential offshore bird impacts. In the onshore environment, conducting surveys and coordinating with NJDEP and USFWS, and implementing species- and habitat-avoidance measures, would ensure impacts on birds and their habitats would be avoided and minimized to the extent practicable. Because most of these measures ensure the effectiveness of and compliance with APMs that are already analyzed as part of the Proposed Action, and because added measures are not anticipated to appreciably reduce impacts on birds (e.g., establishing buffers, temporary avoidance), implementation of these measures would not further reduce the impact level of the Proposed Action from what is described in Section 3.7.2, *Environmental Consequences*.

3.8. Coastal Habitat and Fauna

This section discusses potential impacts on coastal habitat and fauna resources from the Proposed Action, alternatives, and ongoing and planned activities in the coastal habitat and fauna geographic analysis area. Coastal habitat includes flora and fauna within state waters (which extend 3 nm from the shoreline) inland to the mainland, including the foreshore, backshore, dunes, and interdunal areas. The coastal habitat and fauna geographic analysis area, as shown on Figure 3.8-1, includes the area within a 1.0-mile (1.6-kilometer) buffer of the Onshore Project area that includes the export cable landfalls, onshore export cable routes, the onshore substation, and the connection from the onshore substation to the points of interconnection at Oyster Creek and BL England. BOEM expects the resources in this area to have small home ranges. These resources are unlikely to be affected by impacts outside their home ranges.

This section analyzes the affected environment and environmental consequences of the Proposed Action and alternatives on coastal flora and fauna, including special-status species. The affected environment and environmental consequences of Project activities that are within the geographic analysis area and extend into state waters (i.e., HDD for cable landfalls and cable laying within 1 mile [1.6 kilometers] of cable landfalls) are presented in Sections 3.6, *Benthic Resources*; 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*; 3.15, *Marine Mammals*; 3.19, *Sea Turtles*; and 3.21, *Water Quality*. Additional information on birds, bats, and wetlands is presented in Section 3.7, *Birds*; Section 3.5, *Bats*; and Section 3.22, *Wetlands*, respectively.

3.8.1 Description of the Affected Environment for Coastal Habitat and Fauna

This section describes vegetation communities under existing conditions in upland portions of the geographic analysis area and includes information about special-status species and habitats within the Onshore Project area. Vegetation communities occurring in wetlands are described in Section 3.22, *Wetlands*. Benthic resources, including SAV, are described in Section 3.6, *Benthic Resources*.

The Project is within the Atlantic and Gulf Coast Lowland Forest and Crop Region. This land resource region is composed of coastal lowlands, coastal plains, drowned estuaries, tidal marshes, islands, and beaches along the Atlantic Coast. Native vegetation in most of the region is a mixture of pines and hardwoods (USDA NRCS 2006). This section also describes fauna occurring in upland portions of the geographic analysis area. Bats and birds are described in Sections 3.5 and 3.7, respectively.

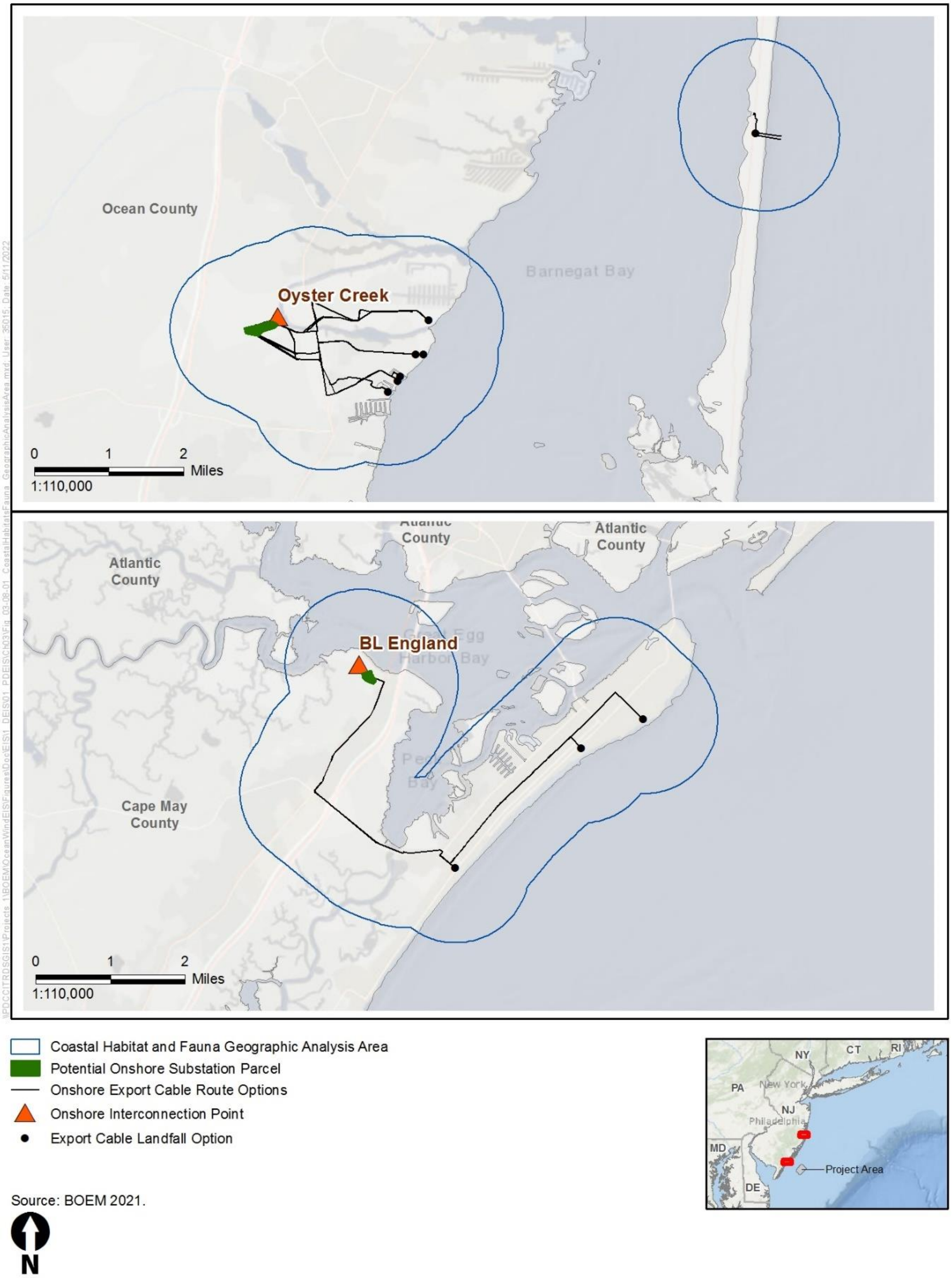

Figure 3.8-1 Coastal Habitat and Fauna Geographic Analysis Area

Coastal Flora Special-Status Species and Habitats

Based on BOEM's BA that addresses federally listed species under USFWS jurisdiction, there are five threatened or endangered plant species may occur within the geographic analysis area: American chaffseed (*Schwalbea americana*—endangered), Knieskern's beaked-rush (*Rhynchospora knieskernii*—threatened), seabeach amaranth (*Amaranthus pumilus*—threatened), sensitive joint-vetch (*Aeschynomene virginica*—threatened), and swamp pink (*Helonias bullata*—threatened). USFWS has not designated or proposed critical habitat for any of these listed species. The habitat requirements for these five species are summarized below, taken from federally listed species descriptions provided by the New Jersey Field Office of USFWS (USFWS 2023).

- **American chaffseed** occurs in highly diverse communities consisting of grasses, sedges, and savanna dicots. It is mainly found in early successional habitats described as open, moist pine flatwoods, fire-maintained savannas, ecotonal areas between peaty wetlands and dry sandy soils, bog borders, and other open grass-sedge systems. This species is dependent on fire, mowing, or fluctuating water tables to maintain the open to partly open conditions it requires.
- **Knieskern's beaked-rush** is an obligate wetland species that is endemic to New Jersey. It occurs in early successional wetland habitats, often on bog-iron substrates adjacent to slow-moving streams in the Pinelands region. This species is also found in abandoned borrow pits, clay pits, ditches, rights-of-way, and unimproved roads that exhibit similar early successional stages due to water fluctuation or periodic disturbance from vehicles, mowing, or fire. It is intolerant of shade and competition, especially from woody species, and is sometimes found on relatively bare substrates.
- **Seabeach amaranth** is an annual plant that is endemic to Atlantic Coast beaches and barrier islands. The primary habitat of seabeach amaranth consists of overwash flats at accreting ends of islands, lower foredunes, and upper strands of non-eroding beaches (landward of the wrack line). The plant grows on a nearly pure sand substrate, occasionally with shell fragments mixed in, above the high tide line and is intolerant of even occasional flooding during its growing season.
- **Sensitive joint-vetch** is an annual member of the pea family that inhabits the intertidal zone of fresh to brackish tidal river segments, typically in areas where sediments accumulate and extensive marshes are formed. It requires bare or sparsely vegetated substrate and usually grows on river banks within 6 feet of the low water mark. It can also occur on accreting point bars and in sparsely vegetated microhabitats of tidal marsh interiors.
- **Swamp pink** is an obligate wetland species that occurs in a variety of palustrine forested wetlands, including swampy forested wetlands bordering meandering streamlets, headwater wetlands, sphagnous Atlantic white-cedar swamps, and spring seepages. Specific hydrologic requirements limit its occurrence within these wetlands to areas that are perennially saturated, but not inundated. Swamp pink is shade tolerant and is often found growing on hummocks formed by trees, shrubs, and sphagnum moss (*Sphagnum* spp.).

The New Jersey Natural Heritage Database has documented several rare plants in the Oyster Creek Onshore Project area in addition to those described above, including smooth orange milkweed (*Asclepias lanceolata*), seabeach sedge (*Carex silicea*), large-fruit fireweed (*Erechtites hieraciifolia* var. *megalocarpa*), swamp-pink (*Helonias bullata*), seabeach sandwort (*Honckenya peploides* var. *robusta*), bog asphodel (*Narthecium americanum*) (three records), sea-beach knotweed (*Polygonum glaucum*), pale beaked-rush (*Rhynchospora pallida*), curly grass fern (*Schizaea pusilla*) (two records), saltmarsh bulrush (*Schoenoplectus maritimus*), and pine barren bellwort (*Uvularia puberula* var. *nitida*). The BL England Onshore Project area contains one record of a New Jersey state rare plant: sea-beach evening-primrose (*Oenothera humifusa*). The New Jersey Natural Heritage Database also identified one rare ecological community in the Oyster Creek Onshore Project area: coastal dune woodland. Ocean Wind would coordinate with NJDEP and USFWS to identify unique or protected habitat or known habitat for threatened or endangered and candidate species and avoid these areas to the extent practicable (APM TCHF-01; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2023). In addition, Island Beach State Park and Ocean City have Beach Management Plans that provide a framework for protecting federally and state-listed plant species that occur along the beach habitats (Island Beach State Park 2017; City of Ocean City 2016). Ocean Wind would need to coordinate with the local beach management entity and comply with any requirements of the beach management plans.

Coastal Fauna Special-Status Species

The geographic analysis area contains protected species habitat based on NJDEP's Landscape Project 3.3 data. Areas with Rank 3, 4, or 5 designations are considered most critical because they represent habitat areas utilized by species on the State Threatened, State Endangered, and Federal Threatened and Endangered Species lists (NJDFW 2017a, 2017b). As depicted on Figure 2.2.1-1 of the COP (Ocean Wind 2023), most of the BL England area contains Rank 4 habitat, indicating documented occurrences of state-listed endangered species or habitats. Portions of the coastline are designated as Rank 5 habitat, indicating documented occurrences of federally listed endangered species or habitats. All Rank 5 habitat is classified based on the potential occurrence of federally listed birds, which are addressed in Section 3.7. As depicted on Figure 2.2.1-2 of the COP, the Oyster Creek area contains a mix of Rank 3 and Rank 4 habitat, indicating documented occurrences of state-listed threatened and endangered species or habitat, respectively (Ocean Wind 2023). Fragmented Rank 1 habitat, indicating habitat patches meeting habitat-specific suitability requirements but no confirmed occurrences of special-status species, is mapped throughout, and Rank 5 habitat is designated within Oyster Creek for federally listed sea turtles, which are addressed in Section 3.19. Additionally, the proposed HDD exit pits and export cable routes on Island Beach State Park are adjacent to habitats designated as Rank 5 for federally listed birds (see Section 3.7).

Based on BOEM's BA that addresses federally listed species under USFWS jurisdiction, there are six faunal species under the jurisdiction of USFWS may occur: northern long-eared bat (*Myotis septentrionalis*—threatened), eastern black rail (*Laterallus jamaicensis* ssp. jamaicensis—threatened), piping plover (*Charadrius melodus*—threatened), red knot (*Calidris canutus rufa*—threatened), roseate tern (*Sterna dougallii*—endangered), and bog turtle (*Clemmys muhlenbergii*—threatened). The monarch butterfly (*Danaus plexippus*) is currently a candidate for federal listing and could occur in the geographic analysis area. Candidate species are provided no statutory protection under the ESA. USFWS has either not designated or proposed critical habitat for these species or designated or proposed critical habitat is not within the geographic analysis area. In addition to the federally listed species, the following state-listed species may occur, according to the NJDEP Landscape Project: bobcat (*Lynx rufus*—state-listed as endangered), corn snake (*Elaphe guttata*—state-listed as endangered), northern pine snake (*Pituophis melanoleucus*—state-listed as threatened), timber rattlesnake (*Crotalus horridus*—state-listed as endangered), wood turtle (*Glyptemys insculpta*—state-listed as threatened), Pine Barrens treefrog (*Hyla andersonii*—state-listed as threatened), and Cope's gray treefrog (*Hyla chrysoscelis*—state-listed as endangered). Northern long-eared bats are discussed in Section 3.5, and eastern black rail, piping plover, red knot, and roseate tern are discussed in Section 3.7. The remaining species' habitat requirements are summarized below, taken from the New Jersey Endangered and Threatened Species Field Guide (Conserve Wildlife Foundation of New Jersey 2021) and USFWS species reports (USFWS 2023).

- **Bog turtle** habitat includes well-drained, calcareous fens, sphagnum bogs, and wet, grassy pastures with soft, thick, mucky substrates and tussock-forming herbaceous vegetation. Open areas are required for basking and nesting. Emergent wetland areas recently or currently used as pastures are common places to find bog turtles, as grazing maintains open areas and keeps the ground soft.

- **Monarch butterfly** caterpillars feed almost exclusively on milkweed (*Asclepias* spp.) and as adults feed on nectar from a wide range of flowers. In the spring, summer, and early fall, they can be found in New Jersey wherever there is milkweed and other native nectar plants.
- **Bobcat** habitat typically consists of large areas of contiguous forest and fragmented forests interspersed with agricultural areas or early successional vegetation. Bobcats often utilize rock outcrops, caves, and ledges for shelter and cover for hunting, resting, and rearing young. When rocky areas are unavailable, swamps, bogs, conifer stands, and rhododendron and mountain laurel thickets can provide cover and hunting grounds.
- **Corn snake** habitat is primarily mature upland pine forests with stump holes, uprooted trees, rotten logs, and sandy or loamy soils. These features allow corn snakes to burrow. Abandoned buildings or foundations provide nesting and hibernation habitat. They require a nearby water source such as a stream or pond and utilize open fields and forest edges for foraging.
- **Northern pine snakes** live in dry pine and oak forests with sandy soils. Disturbances, both natural and human, create openings used for nesting, basking, and burrowing, and sandy soils allow them to dig out burrows for hibernating and summer denning.
- **Timber rattlesnakes** are typically found in pinelands habitats in southern New Jersey that consist primarily of pitch pine, shortleaf pine, scrub oak, blackjack oak, and blueberry (*Vaccinium* spp.). Dens are usually found in cedar swamps and along streambanks.
- **Wood turtles** reside in both aquatic and terrestrial environments. Aquatic habitats are required for mating, feeding, and hibernation, while terrestrial habitats are used for foraging and egg laying. Freshwater streams, brooks, creeks, or rivers that are relatively remote provide the habitat needed by these turtles. These tributaries are characteristically clean, free of litter and pollutants, and located within undisturbed uplands such as fields, meadows, or forests. Wood turtle habitats typically contain few roads and are often over 0.5 mile away from developed or populated areas.
- **Pine Barrens treefrog** habitat consists of acidic Atlantic white cedar swamps and pitch pine lowlands associated with dense sphagnum moss. The species requires an open-canopy, dense shrub layer, and heavy ground cover in sandy and mucky soils. Breeding areas include vernal pools, bogs, and seepage areas with approximately 12 to 24 inches (30 to 61 centimeters) of acidic water. More-disturbed areas such as roadside ditches, vehicle ruts, and borrow pits may also serve as breeding areas, provided enough associated vegetation is present.
- **Cope’s gray treefrogs** utilize both aquatic and terrestrial habitats. They spend most of their time high in the trees, except during breeding season when they are at the water’s edge. Breeding pools include vernal pools, gravel pits, retention basins, floodplain corridors, bogs, weedy lakes, cattail or sedge marshes, and farm ponds, typically within or near deciduous or mixed forest, with bare horizontal branches over water near preferred calling sites.

Other state special concern species that could potentially occur in the geographic analysis area include the spotted turtle (*Clemmys guttata*), northern diamondback terrapin (*Malaclemys terrapin terrapin*), and eastern box turtle (*Terrapene carolina carolina*) (Ocean Wind 2023). Ocean Wind would coordinate with NJDEP and USFWS to identify unique or protected habitat or known habitat for threatened or endangered and candidate species and avoid these areas to the extent practicable (APM TCHF-01; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2023). In addition, Island Beach State Park and Ocean City have Beach Management Plans that provide a framework for protecting federally and state-listed animal species that occur along the beach habitats (Island Beach State Park 2017; City of Ocean City 2016). Ocean Wind would need to coordinate with the local beach management entity and comply with any requirements of the beach management plans.

BL England

BL England Flora

The proposed landfall sites are along the coastline of the barrier island, within Ocean City, New Jersey. The landfall locations would be primarily in developed areas. However, unvegetated beaches and vegetated dunes occur along the coastline. American beachgrass (*Ammophila breviligulata*) is the primary plant species found on foredunes in New Jersey (New Jersey Sea Grant Consortium n.d.). Multiple species of plants colonize areas landward of the foredunes; in New Jersey, these species typically include rugosa rose (*Rugosa rosa*), bayberry (*Morella pensylvanica*), and goldenrod (*Solidago* sp.) (New Jersey Sea Grant Consortium n.d.).

From the coastline, the onshore export cable route(s) would traverse heavily developed sections of Ocean City, New Jersey. This area is largely devoid of vegetation except for some landscape plants and maintained lawns. Farther inland, the onshore export cable route(s) would traverse areas of mixed forested communities interspersed with suburban development. The upland forests are characterized by pines, especially pitch pine (*Pinus rigida*) and shortleaf pine (*P. echinata*). Pitch pine is the most abundant, and its associations include shortleaf pine and oaks. Communities within the upland association include pine-black oak (*Quercus velutina*), pine-black oak-scrub oak (*Q. berberidifolia*), and oak-pine (Ocean Wind 2023 citing Atlantic County 1973). The location proposed for the onshore substation was once a golf course and is now dominated by herbaceous vegetation and interspersed trees. The vegetation communities at the substation site are similar to those along the onshore export cable route(s). Table 2.2.1-1 of the COP provides a list of common plant species occurring in the BL England area (COP Volume II, Section 2.2.1.1.1; Ocean Wind 2023).

Suitable habitat for seabeach amaranth is present along the Ocean City coastline within the upper beach zone, above the high tide line. These areas are generally depicted as “barren land” along the coastline on Figure 2.3.5-1 of the COP (Ocean Wind 2023). Open meadows that would provide suitable habitat for American chaffseed are present within the BL England area, although it is unlikely that any areas provide the appropriate disturbance regime required for the plant to germinate and grow. Wetland habitats that would provide suitable habitat for Knieskern’s beaked-rush, sensitive joint-vetch, and swamp pink do not occur within the BL England area.

BL England Fauna

Ghost or sand crabs (Ocypodidae) are likely to occur on the upper beach and edge of the dunes (Wootton et al. 2016). Due to the fragmentation and urbanization of the upland forest along the export cable route, animal species commonly found in these habitats in New Jersey would be most likely to occur. Common mammal species would likely include the gray squirrel (*Sciurus carolinensis*), eastern cottontail (*Sylvilagus floridanus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), red fox (*Vulpes vulpes*), and house mouse (*Mus musculus*). Common reptiles would likely include the black rat snake (*Pantherophis obsoletus*) and eastern garter snake (*Thamnophis sirtalis*). Common amphibians may include the spring peeper (*Pseudacris crucifer*) and gray treefrog (*Hyla versicolor*). The open fields at the proposed onshore substation site likely contain small mammals such as the deer mouse (*Peromyscus maniculatus*), white-footed mouse (*Peromyscus leucopus*), meadow vole (*Microtus pennsylvanicus*), eastern mole (*Scalopus aquaticus*), and short-tailed shrew (*Blarina brevicauda*). As the location of the proposed onshore substation site is less developed, additional species such as the white-tailed deer (*Odocoileus virginianus*) and gray fox (*Urocyon cinereoargenteus*) may inhabit the area. Table 2.2.2-1 of the COP provides a list of animal species potentially occurring in the BL England area (Ocean Wind 2023).

In coordination with USFWS and NJDEP, Ocean Wind commissioned species surveys within portions of the Onshore Project area that contained potentially suitable habitat for listed species. Based on this coordination, a bog turtle Phase 1 Habitat Assessment Survey was conducted on the BL England onshore substation parcel. The surveys found that suitable bog turtle habitat does not occur on the substation parcel. Surveys were not conducted along the BL England landfall site or export cable route(s) because potentially suitable habitat does not occur. As depicted on Figure 2.3.5-1 of the COP (Ocean Wind 2023), the proposed landfall sites and cable route corridors are highly developed, and the wetland crossing along Roosevelt Boulevard contains brackish water, whereas bog turtles are freshwater species. The federal candidate species, monarch butterfly, is likely to utilize the open fields and other undeveloped land where milkweed and other native nectar plants are present. The preferred remote, undisturbed habitats for wood turtle are not present. Corn snake, timber rattlesnake, and northern pine snake may occur in forested uplands, particularly in less developed areas near the substation site. Breeding and non-breeding habitats for Pine Barrens and Cope’s gray treefrog could also occur.

Oyster Creek

Oyster Creek Flora

This EIS evaluates six landfall sites for the Oyster Creek area. All export cable routes would landfall and cross Island Beach State Park prior to traversing Barnegat Bay to the mainland landfall. The mainland landfall site options include landfall locations in Waretown (Ocean Township) and Forked River (Lacey Township). These landfall sites are described in further detail below. From the selected landfall site, the onshore export cable would extend to the proposed onshore substation next to the Oyster Creek Generating Station, which consists of previously disturbed herbaceous vegetation.

Island Beach State Park. The proposed onshore export cable route at Oyster Creek would first make landfall in a parking lot in Island Beach State Park on the Barnegat Peninsula before crossing Barnegat Bay to landfall sites on the mainland. Upland vegetation communities at Island Beach State Park include primary dune, secondary dune, road edge, thicket, bayshore, and maritime forest. The primary dunes are dominated by American beachgrass, with beach pea (*Lathyrus maritimus*), Japanese sedge (*Carex kobomugi*), seaside goldenrod (*Solidago sempervirens*), and sea rocket (*Cakile edentula*) also occurring. The secondary dune community is more diverse than the primary dune community, with representative species including beach plum (*Prunus maritima*), bayberry (*Myrica pensylvanica*), beach heather (*Hudsonia tomentosa*), pineweed (*Hypericum gentianoides*), and salt spray rose (*Rosa rugosa*). Within the thicket, edge, and bayshore communities, 73, 140, and 22 plant species have been identified, respectively. The maritime forest community is dominated by American holly (*Ilex opaca forma sabintegra*), Atlantic white cedar (*Chamaecyparis thyoides*), white oak, and pitch pine (Kennish n.d.; Save Barnegat Bay 2019).

Island Beach State Park is designated as a Natural Heritage Priority Site (i.e., Island Beach Macrosite) and supports populations of state-listed endangered plant species and species of concern plant species such as the seaside sandplant (*Honckenya peploides* var. robusta), seabeach knotweed (*Polygonum glaucum*), seabeach sedge (*Carex silicea*), and sickle-leaf golden-aster (*Pityopsis falcate*) (Ocean Wind 2023).

Waretown and Forked River Landfalls. Six mainland landfall site options and onshore export cable routes would be in Waretown (Ocean Township) and Forked River (Lacey Township), New Jersey. The Lighthouse Drive option is in a developed area devoid of vegetation. Holtec Property and Bay Parkway occur in wetland areas (see Section 3.22 for a description of vegetative communities in wetlands). Other options would landfall within the Lighthouse Marina or Nautilus Drive and predominantly follow public right-of-way and previously disturbed areas or traverse private land. Upland communities farther west from the landfall site options along the onshore export cable route options include coniferous and mixed forests. These communities are typically dominated by oaks and pines. Table 2.2.1-2 of the COP provides a list of common plant species occurring in the Waretown and Forked River portions of the Oyster Creek area (COP Volume II, Section 2.2.1.1.1; Ocean Wind 2023).

Suitable habitat for seabeach amaranth is present within all of the Oyster Creek landfall and export cable route options, including on Island Beach State Park. Suitable locations are present along the coastline within the upper beach zone, above the high tide line. In 2019, 1,591 seabeach amaranth plants were counted at Island Beach State Park, a more than 500-percent increase from the 2018 total of 307 plants (Conserve Wildlife Foundation of New Jersey 2019). Open meadows that would provide suitable habitat for American chaffseed are not present. Wetlands within the Holtec Property and Bay Parkway landfall sites may provide suitable habitat for Knieskern's beaked-rush, sensitive joint-vetch, and swamp pink; wetland habitats are discussed in detail in Section 3.22. In coordination with USFWS, Ocean Wind commissioned species surveys within portions of the Onshore Project area that contained potentially suitable habitat for listed species. Based on this coordination, surveys were conducted for swamp pink and Knieskern's beaked-rush within the forested wetlands and ditch areas of the Holtec Property of Lacey Township. These surveys were conducted by a Professional Wetland Scientist with rare plant survey experience and were timed to coincide with the fruiting/blooming period for the species. No individuals of either species were observed during these surveys.

Oyster Creek Fauna

Long Beach Island would be expected to support wildlife species adapted to suburban and urban environments such as the Virginia opossum, eastern cottontail, Norway rat (*Rattus norvegicus*), house mouse, red fox, and raccoon. Reptile and amphibian species may include the American bullfrog (*Lithobates catesbeianus*), green frog (*Lithobates clamitans*), common snapping turtle (*Chelydra serpentina*), northern water snake (*Nerodia sipedon*), eastern garter snake, and rough green snake (*Opheodrys aestivus*) (Ocean County Planning Department 1976).

More than 30 species of land mammals occur in the Barnegat Bay watershed, which encompasses the remaining landfall sites and onshore export cable routes in the Oyster Creek area. Forest-dwelling species include the red fox, gray fox, raccoon, long-tailed weasel (*Mustela frenata*), short-tailed weasel (*Mustela erminea*), striped skunk, Virginia opossum, gray squirrel, red squirrel (*Tamiasciurus hudsonicus*), chipmunk (*Tamias striatus*), southern flying squirrel (*Glaucomys volans*), white-footed mouse, and pine vole (*Microtus pinetorum*). Species such as the red fox and raccoon occur on both the mainland and barrier islands, while white-tailed deer is found only on the mainland. Shrubland and grassland mammals include the meadow vole, meadow jumping mouse (*Zapus hudsonius*), woodchuck (*Marmota monax*), and eastern cottontail, as well as several of the species also found in forested areas (Kennish n.d.).

Three species of lizards occur in the Barnegat Bay region: the fence lizard (*Sceloporus undulatus hyacinthinus*), ground skink (*Scincella lateralis*), and five-lined skink (*Eumeces fasciatus*). Upland snake species include the black racer (*Coluber constrictor*), northern pine snake, corn snake, worm snake (*Carphophis punctatus*), and eastern hognose snake (*Heterodon platirhinos*). The box turtle (*Terrapene carolina*) is the only upland turtle species occurring in the area. Common salamander species include the red-backed salamander (*Plethodon cinereus*), northern two-lined salamander (*Eurycea bislineata*), four-toed salamander (*Hemidactylium scutatum*), and northern red salamander (*Pseudotriton ruber*). Widespread frog and toad species include the northern spring peeper (*Pseudacris crucifer*), northern gray treefrog (*Hyla versicolor*), New Jersey chorus frog (*Pseudacris triseriata kalmi*), bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans melanota*), wood frog (*Rana sylvatica*), southern leopard frog (*Rana utricularia*), pickerel frog (*Rana palustris*), and Fowler's toad (*Bufo woodhousii fowleri*) (Kennish n.d.). Table 2.2.2-2 of the COP provides a list of animal species potentially occurring in the Waretown and Forked River portions of the Oyster Creek area (COP Volume II, Section 2.2.2; Ocean Wind 2023).

Suitable habitat for the federally listed threatened bog turtle does not occur in the Oyster Creek area. Suitable habitat for bog turtle is only present where open-canopy freshwater wetlands with mucky substrates and tussock-forming vegetation are present. The state-listed threatened bobcat is unlikely to frequent the area due to the urban environment and proximity to roads and other human disturbance. Monarch butterfly is likely to occur throughout the Oyster Creek area in undeveloped lands or gardens where milkweed and other native nectar plants are present. Suitable habitat for the northern pine snake, timber rattlesnake, Pine Barrens treefrog, and Cope's gray treefrog is likely present in the less developed portions of the landfall sites, onshore export cable route, and substation area.

3.8.2 Environmental Consequences

3.8.2.1. Impact Level Definitions for Coastal Habitat and Fauna

Definitions of impact levels are provided in Table 3.8-1. There are no beneficial impacts on coastal habitat and fauna.

Table 3.8-1 Impact Level Definitions for Coastal Habitat and Fauna

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on species or habitat would be so small as to be unmeasurable.
Minor	Adverse	Most impacts on species would be avoided; if impacts occur, they may result in the loss of a few individuals. Impacts on sensitive habitats would be avoided; impacts that do occur are temporary or short term in nature.
Moderate	Adverse	Impacts on species would be unavoidable but would not result in population-level effects. Impacts on habitat may be short term, long term, or permanent and may include impacts on sensitive habitats but would not result in population-level effects on species that rely on them.
Major	Adverse	Impacts would affect the viability of the population and would not be fully recoverable. Impacts on habitats would result in population-level impacts on species that rely on them.

3.8.3 Impacts of the No Action Alternative on Coastal Habitat and Fauna

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on coastal habitat and fauna, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for coastal habitat and fauna. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.8.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for coastal habitat and fauna described in Section 3.8.1, *Description of the Affected Environment for Coastal Habitat and Fauna*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on coastal habitat and fauna are generally associated with onshore impacts, including onshore residential, commercial, and industrial development, and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect coastal flora and fauna through temporary and permanent habitat removal or conversion, temporary noise impacts during construction, and lighting, which could cause avoidance behavior and displacement of animals, as well as injury or mortality to individual animals or loss and alteration of vegetation and individual plants. However, population-level effects would not be anticipated. Climate change and associated sea level rise results in dieback of coastal habitats caused by rising groundwater tables and increased saltwater inundation from storm surges and exceptionally high tides (Sacatelli et al. 2020). Climate change may also affect coastal habitats through increases in instances and severity of droughts and range expansion of invasive species. Warmer temperatures will cause plants to flower earlier, will not provide needed periods of cold weather, and will likely result in declines in reproductive success of plant and pollinator species. Reptile and amphibian populations may experience shifts in distribution, range, reproductive ecology, and habitat availability. Increased temperatures could lead to changes in mating, nesting, reproductive, and foraging behaviors of species, including a change in the sex ratios in reptiles with temperature-dependent sex determination. The effects of climate change on animals will likely include loss of habitat, population declines, increased risk of extinction, decreased reproductive productivity, and changes in species distribution (NJDEP 2020).

There are no ongoing offshore wind activities within the geographic analysis area for coastal habitat and fauna.

3.8.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Other planned non-offshore wind activities that may affect coastal habitat and fauna primarily include increasing onshore development activities (see Section F.2 in Appendix F for descriptions). These activities may result in temporary and permanent impacts on animals and vegetation, including disturbance, displacement, injury, mortality, habitat and plant degradation and loss, and habitat conversion.

BOEM reviewed available information regarding the potential for planned offshore wind activities to occur within the geographic analysis area for coastal habitat and fauna. Atlantic Shores South proposes points of interconnection at the Cardiff Substation and Larrabee Substation (COP Volume I, Figure E-1 [Ocean Wind 2023]; Atlantic Shores 2021). Transmission lines rated at 138 kV and higher have sufficient thermal capability to deliver power from an offshore wind project to the utility’s load center. The *New Jersey Offshore Wind Energy: Feasibility Study* identified existing transmission lines and substations rated at 138 kV and above. These substations would be likely potential points of interconnection for future offshore wind activities; however, the substations and likely onshore routes to reach the substations are outside of the geographic analysis area.

Because cable landfalls and onshore infrastructure for other offshore wind projects would not be in the geographic analysis area for coastal habitat and fauna, BOEM does not expect other offshore wind activities to affect coastal habitat and fauna through the primary IPFs. Noise and lighting from other offshore wind construction activities are not expected to reach the geographic analysis area for Ocean Wind 1, which includes onshore and nearshore areas within 1.0 mile (1.6 kilometers) of landfalls and proposed onshore infrastructure. Therefore, increased noise and lighting resulting from other offshore wind activities would not affect coastal habitat and fauna, resulting in a negligible impact.

3.8.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, coastal habitat and fauna would continue to be affected by existing environmental trends and ongoing activities. BOEM expects ongoing activities would have continuing temporary and permanent impacts (disturbance, displacement, injury, mortality, and habitat conversion) on coastal habitat and fauna, primarily through onshore construction and climate change. BOEM anticipates that the potential impacts of ongoing activities on coastal habitat and fauna due to ongoing construction activities would likely be minor, but impacts from climate change could be moderate. Therefore, the No Action Alternative would result in **moderate** impacts on coastal habitats, primarily driven by climate change. Currently, there are no other offshore wind activities proposed in the geographic analysis area.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and coastal habitat and fauna would continue to be affected by natural and human-caused IPFs. Planned activities would contribute to the impacts on coastal habitat and fauna through construction-related activities that affect habitat, vegetation, and wildlife. Currently there are no future offshore wind activities proposed in the geographic analysis area. BOEM anticipates the No Action Alternative would result in **moderate** impacts on coastal habitat and fauna, primarily driven by climate change.

3.8.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on coastal habitat and fauna:

- The onshore export cable routes, including routing variants, and extent of land disturbance for new onshore substations, which could require the removal of vegetation.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- Onshore export cable routes and substation footprints: The route chosen (including variations of the general route) and substation footprints would determine the amount of habitat affected.

Ocean Wind has committed to measures to minimize impacts on coastal habitat and fauna, including avoiding areas of unique or protected habitat or known habitat for threatened or endangered and candidate species to the extent practicable (TCHF-01) and conducting maintenance and repair activities in a manner to avoid or minimize impacts on sensitive species and habitat such as beaches, dunes, and the near-shore zone (TCHF-02) (COP Volume II, Table 1.1-2; Ocean Wind 2023).

3.8.5 Impacts of the Proposed Action on Coastal Habitat and Fauna

3.8.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.8.7, *Impacts of Alternative E on Coastal Habitat and Fauna*.

The sections below summarize the potential impacts of the Proposed Action on coastal habitat and fauna and special-status species during the various phases of the Project. Routine activities would include construction, O&M, and decommissioning of the Project, as described in Chapter 2, *Alternatives*. BOEM prepared a BA for the potential effects on USFWS federally listed species, which found that the Proposed Action was *not likely to adversely affect*, or had *no effect*, on listed species (BOEM 2022). BOEM requested concurrence on its conclusion that the impacts of the proposed activities are expected to be discountable and insignificant, and thus *may affect but are not likely to adversely affec*t Knieskern's beaked-rush, sensitive joint-vetch, and swamp pink. The BA concluded that the Proposed Action would have *no effect* on bog turtle, American chaffseed, and seabeach amaranth. Results of consultation with USFWS pursuant to Section 7 of the ESA will be presented in the Final EIS.

Noise: Onshore construction noise associated with the Proposed Action alone is expected to result in short-term, temporary, highly localized, and negligible impacts. Impacts, if any, are expected to be limited to behavioral avoidance of construction activity and noise. The state-listed bobcat, although unlikely to be present within the Onshore Project area due to existing development, could experience stress and negative physiological effects that could affect individuals; however, the species can habituate to human presence (Carroll 2019). Construction would predominantly occur in already developed areas where wildlife is habituated to human activity and noise. Displaced wildlife could use adjacent habitat and would repopulate these areas once construction ceases.

Land disturbance: Impacts from the export cable landfall would vary based on the export cable route option chosen. Landfall would require up to 2 acres of workspace to accommodate two HDD exit pits and workspace, and additional workspace would be required for storage and staging. Most landfall options occur in developed areas; however, some clearing of vegetation may be required. Impacts on unvegetated beaches and vegetated dunes would be avoided for all options by using HDD to transition from offshore to onshore. Construction of the onshore export cable may require clearing and permanent removal of some trees along the edge of the construction corridor. Impacts on herbaceous communities would result from excavation, rutting, compaction, mixing of topsoil and subsoil, and potential alteration of habitat. The maximum design for the Oyster Creek cable corridor would require an approximate construction disturbance up to 5.3 miles long and 50 feet wide and a permanent easement up to 30 feet wide, equating to approximately 32 acres of total disturbance and 19 acres of permanent disturbance. The maximum design for the BL England cable corridor would require an approximate construction disturbance up to 8 miles long and 50 feet wide, and a permanent easement up to 30 feet wide, equating to approximately 48 acres of total disturbance and 29 acres of permanent disturbance. Installation of onshore cable is expected to take up to 30 months. The BL England and Oyster Creek substation sites would require approximately 13 and 31.5 acres, respectively. During construction, up to 3 acres would be required for temporary workspace. Construction of each onshore substation is expected to take up to a maximum of 36 months. The planned improvements to the onshore O&M facility would require permanently filling 0.15 acre of open water habitat, and Ocean Wind has already submitted a permit application to the USACE Philadelphia District for authorization of this impact.

To minimize impacts on sensitive habitat from land disturbance during construction, Ocean Wind proposes to use appropriate installation technology designed to minimize disturbance to sensitive habitat (such as beaches and dunes, wetlands and associated buffers, streams, hard-bottom habitats, seagrass beds, and the near-shore zone) (APM GEN-08; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2023). Areas that would require extensive onshore alterations would be avoided to the extent practicable (APM GEN-03; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2023). Ocean Wind proposes to restore disturbance areas in the Onshore Project area to pre-existing contours (maintaining natural surface drainage patterns) and allow vegetation to become reestablished once construction activities are completed, to the extent practicable (APM GEN-13; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2023). Temporarily affected upland and wetland communities would be expected to become reestablished within 1 to 3 years following construction. Permanent loss of wetland habitat could occur if placement of fill is required in wetlands. NJDEP-regulated adjacent transition areas may also be affected by clearing and soil disturbance. Ocean Wind proposes to avoid or minimize wetland impacts by implementing a site-specific monitoring program to ensure compliance with permit conditions during the construction, operation, and decommissioning phases (APM GEN-06; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2023). A detailed discussion of impacts on wetland communities is provided in Section 3.22. See Section 3.6 for information on potential impacts on SAV. In combination with federal, state, and local government agencies, academic institutions, non-governmental organizations, and businesses, the Barnegat Bay Partnership has established a Comprehensive Conservation and Management Plan for the Barnegat Bay-Little Egg Harbor Estuary. The plan identifies a living resources goal to protect, restore, and enhance habitats in Barnegat Bay and its watershed as well as ensure healthy and sustainable natural communities of plants and animals both now and in the future. BOEM is continuing to consult with USFWS on potential impacts of the Proposed Action on ESA-listed species and multiple mitigation measures have resulted from that consultation (Table H-2, Appendix H). Additionally, Ocean Wind has committed to avoidance and minimization of impacts on SAV and to restoration activities to mitigate impacts on SAV as a result of construction activities (Table H-2, Appendix H).

Impacts on habitat from onshore construction activities would be limited because, whenever possible, facilities (including overhead transmission lines) would be co-located with existing developed areas (i.e., roads and existing transmission rights-of-way) to limit disturbance (APM GEN-01; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2023). The existing habitat at the proposed onshore substation sites at BL England and Oyster Creek is already developed and fragmented. Any remnant habitat within the substation sites would be converted to developed land with landscaping for the duration of the Project's operational lifetime. Impacts on special-status plants species could occur due to the degradation of habitat and direct loss of individuals during construction. However, BOEM anticipates that any habitat impacts would not result in population-level effects, given the limited amount of habitat removal. Ocean Wind would coordinate with NJDEP and USFWS to identify unique or protected habitat or known habitat for threatened or endangered and candidate species and avoid these areas to the extent practicable (APM TCHF-01; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2023). Project implementation would be conditioned upon issuance of applicable federal and state permits and conducted in accordance with federal and state permit conditions. It is anticipated that permit conditions may include BMPs such as implementing seasonal work restrictions to avoid and minimize potential adverse effects on wetlands and protected species, clearly demarcating sensitive areas to avoid disturbance during construction, and controlling runoff and stabilizing soils to minimize the potential for soil erosion and sedimentation in wetlands during construction. Impacts on coastal habitat and fauna from land disturbance would be temporary, localized, and negligible.

For temporary impacts, including the effects of onshore construction, it is likely that a portion, possibly a majority, of such impacts from other planned activities would not overlap temporally or spatially with the Proposed Action. However, temporary impacts can also result in long-term to permanent impacts that would likely be negligible. Ocean Wind would likely abandon the onshore cables in place and relocate components of the onshore electrical infrastructure that may still have substantial life expectancies after 35 years (Chapter 2). Land disturbance during decommissioning would be limited to soil compaction and vegetation trampling, and minimal excavation to bury the ends of abandoned cables and remove certain electrical infrastructure. Therefore, onshore temporary impacts of decommissioning would be negligible.

Traffic: Collisions between wildlife and vehicles or construction equipment would be rare because most individuals are expected to avoid construction areas or have the mobility to avoid construction equipment. However, individuals of burrowing species (e.g., moles, voles) or those with limited mobility, especially herpetofauna, could be more vulnerable to this impact, particularly during land clearing and ground excavation. Impacts would be short term, temporary during the construction period, and negligible.

3.8.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities. Ongoing and planned non-offshore wind activities related to onshore development activities would contribute to impacts on coastal habitat and fauna through the primary IPFs of noise, traffic, and land disturbance. BOEM is not aware of any future offshore wind activities other than the Proposed Action that would overlap the geographic analysis area for coastal habitat and fauna.

The cumulative impact on coastal habitat and fauna would likely be moderate, mostly driven by climate change. The onshore cable routes and substation location are primarily within developed areas along coastal New Jersey, where large areas of natural habitat and habitat connectivity are more limited. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the cumulative noise, traffic, and land disturbance impacts on coastal habitat and fauna.

3.8.5.3. Conclusions

Impacts of the Proposed Action. BOEM expects the incremental impact of construction and installation, O&M, and conceptual decommissioning of the Proposed Action, when compared with the No Action Alternative, to have minor impacts on coastal habitat and fauna because habitat impacts would be limited and construction would predominantly occur in already developed areas where wildlife is habituated to human activity and noise. When including the baseline status (No Action Alternative), impacts on coastal habitats and fauna resulting from the Proposed Action would be **moderate**, primarily driven by climate change.

Cumulative Impacts of the Proposed Action. BOEM anticipates that the cumulative impacts on coastal habitat and fauna in the geographic analysis area would be **moderate**, primarily driven by climate change. The incremental impacts contributed by the Proposed Action to the overall impacts on coastal habitat and fauna would be undetectable. The Proposed Action would contribute to the cumulative impacts on coastal habitat and fauna in the geographic analysis area primarily through the permanent impacts on habitat associated with construction and O&M of the onshore Project components.

3.8.6 Impacts of Alternatives B, C, and D on Coastal Habitat and Fauna

Impacts of Alternatives B, C, and D. Because Alternatives B, C, and D involve modifications only to offshore components not within the geographic analysis area for coastal habitat and fauna, impacts on coastal habitat and fauna from those alternatives would be the same as those under the Proposed Action.

Cumulative Impacts of Alternatives B, C, and D. The cumulative impacts on coastal habitat and fauna would be moderate for the same reasons described for the Proposed Action. The incremental impacts contributed by Alternatives B, C, and D to the cumulative impacts on coastal habitat and fauna would be the same as those described for the Proposed Action for the reason described above.

3.8.6.1. Conclusions

Impacts of Alternatives B, C, and D. As discussed above, the anticipated **moderate** impacts associated with the Proposed Action would not change under Alternatives B, C, and D.

Cumulative Impacts of Alternatives B, C, and D. The incremental impacts contributed by Alternatives B, C, and D to the cumulative impacts on coastal habitat and fauna would be undetectable. Because the impacts of the Proposed Action would not change under Alternatives B, C, and D, BOEM anticipates that the cumulative impacts of Alternatives B, C, and D would be the same as those of the Proposed Action.

Therefore, cumulative impacts of Alternatives B, E, and F would be **moderate**, primarily driven by climate change.

3.8.7 Impacts of Alternative E on Coastal Habitat and Fauna

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. The types of impacts under Alternative E would be the same as those described for the Proposed Action. The onshore export cable route on Island Beach State Park under Alternative E would be limited to the slightly longer (about 2,000 feet [600 meters]) northern option. The construction of temporary workspace and installation of the export cable along the parking lot and across Central Avenue/Shore Road would result in 0.9 acre of vegetation clearing. Affected vegetation communities include roadside edges, forested wetlands, and scrub/shrub wetlands which are/are not are designated by NJDFW (2017a) as Rank 4 and 5 habitat due to documented occurrences of state- and federally listed endangered species or habitats; however, these special-status species are all birds and there is no suitable habitat for any non-avian special-status species. Impacts from noise and vehicle collisions would be similar to those of the Proposed Action. Alternative E would traverse Barnegat Bay and use the same landfall sites within the Oyster Creek area.

Cumulative Impacts of Alternative E. The cumulative impacts on coastal habitat and fauna would be moderate for the same reasons described for the Proposed Action. The incremental impacts contributed by Alternative E to the cumulative impacts on coastal habitat and fauna would be the same as those described for the Proposed Action.

3.8.7.1. Conclusions

Impacts of Alternative E. Alternative E could affect slightly more habitat at Island Beach State Park than under the Proposed Action and Alternatives B, C, and D (see Figure 3.22-2 in Section 3.22, *Wetlands*), but impacts on coastal habitat and fauna from onshore construction activities would still remain limited overall. Therefore, the **moderate** impacts associated with the Proposed Action would not substantially change under Alternative E.

As with the Proposed Action, if Alternative E is selected, Ocean Wind would conduct site-specific habitat surveys and surveys for individuals in suitable habitat to determine the location and extent of special-status species in the geographic analysis area so they can be avoided during construction, O&M, and decommissioning (TCHF-01).

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the overall impacts on coastal habitat and fauna would be undetectable. Because the impacts of the Proposed Action would not substantially change under Alternative E, BOEM anticipates that the cumulative impacts of Alternative E would be the same as described for the Proposed Action. Therefore, cumulative impacts of Alternative E would be **moderate**, primarily driven by climate change.

3.8.8 Proposed Mitigation Measures

Several measures are proposed to minimize impacts on coastal habitat and fauna (Appendix H, Table H-2 and Table H-3). If the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced.

Table 3.8-2 Measures Resulting from Consultations (Also Identified in Appendix H, Table H-2): Coastal Habitat and Fauna

Measure	Description	Effect
Surveys, Avoidance, and Minimization (ESA-listed plants)	Ocean Wind must conduct pre-construction habitat surveys for ESA-listed plants and implement avoidance and minimization measures in coordination with USFWS and NJDEP.	Identifying habitat and presence of ESA-listed plants and coordination with USFWS and NJDEP would ensure that if ESA-listed plants are identified during pre-construction surveys, potential impacts would be avoided and/or minimized.
Surveys, Avoidance, and Minimization (ESA-listed plants; swamp pink)	Swamp Pink: If Ocean Wind elects to construct an Oyster Creek onshore cable route option other than the Holtec property route, Ocean Wind must retain a USFWS qualified surveyor to conduct a survey in accordance with USFWS swamp pink survey guidelines of all suitable habitats (i.e., forested wetlands) that will be subject to temporary disturbance or permanent modification as a result of Project activities, both during construction and from post-construction O&M activities, including areas crossed by HDD. The survey area will also include all forested wetlands within 300 feet of upland disturbance. Ocean Wind must submit the survey area(s), timing, methods, and qualifications of the surveyor(s) for BOEM/USACE and USFWS approval prior to the start of the survey. A survey report, including maps and associated spatial files in an ESRI ArcMap/ArcPro compatible format, must be provided to BOEM/USACE and USFWS for review no later than 30 calendar days after the survey has been completed. BOEM/USACE and USFWS will complete their reviews and identify any deficiencies that require a report revision by Ocean Wind within 30 calendar days of receipt of the survey report. If any swamp pink is found during the survey, the surveyor must document the distribution and abundance of plants and submit both the full survey report and a completed Natural Heritage Rare Plant Species Reporting Form (https://www.nj.gov/dep/parksandforests/natural/docs/NHRPSR_Form.pdf) to BOEM/USACE, USFWS, and the New Jersey Natural Heritage Program. If swamp pink is present in or adjacent to Project activities, Ocean Wind must coordinate with USFWS to develop appropriate conservation measures that Ocean Wind is required to implement to avoid adverse effects to this species including through direct and indirect effects to its habitat and seek any required authorizations to perform such activities.	Identifying habitat and presence of swamp pink along the Oyster Creek onshore cable route and coordination with USFWS and NJDEP would ensure that if swamp plants are identified during pre-construction surveys, potential impacts would be avoided and/or minimized.

Measure	Description	Effect
Surveys, Avoidance, and Minimization (ESA-listed plants; Knieskern's beaked-rush)	Knieskern's beaked-rush: If Ocean Wind elect to construct an Oyster Creek onshore cable route option other than the Holtec property route, Ocean Wind must retain a USFWS qualified surveyor to conduct a survey between July and September and in accordance with USFWS Knieskern's beaked-rush survey guidelines of all suitable habitats that will be subject to temporary disturbance or permanent modification as a result of Project activities, both during construction and from post-construction O&M activities, including areas crossed by HDD. Survey areas must not be mowed for at least one month prior to the survey. Ocean Wind must submit the survey area(s), timing, methods, and qualifications of the surveyor(s) for BOEM/USACE and USFWS approval prior to the start of the survey. A survey report, including maps and associated spatial files in an ESRI ArcGIS/ArcPro compatible format, must be provided to BOEM/USACE and USFWS for review no later than 30 calendar days after the survey has been completed. BOEM/USACE and USFWS will complete their reviews and identify any deficiencies that require a report revision by Ocean Wind within 30 calendar days of receipt of the survey report. If any Knieskern's beaked-rush is found during the survey, the surveyor must document the distribution and abundance of plants, and submit both the full survey report and a completed Natural Heritage Rare Plant Species Reporting Form to both USFWS and the New Jersey Natural Heritage Program. If Knieskern's beaked-rush is present in or adjacent to Project activities, Ocean Wind must coordinate with USFWS to develop appropriate conservation measures that Ocean Wind is required to implement to avoid adverse effects to this species and seek any required authorizations to perform such activities.	Identifying habitat and presence of Knieskern's beaked-rush along the Oyster Creek onshore cable route and coordination with USFWS and NJDEP would ensure that if Knieskern's beaked-rush plants are identified during pre-construction surveys, potential impacts would be avoided or minimized.

Measure	Description	Effect
Surveys, Avoidance, and Minimization (ESA-listed plants, American chaffseed)	American chaffseed: Ocean Wind must retain a USFWS qualified surveyor to conduct a survey of all suitable American chaffseed habitats between June 1 and August 15 that will be subject to temporary disturbance or permanent modification as a result of Project activities, both during construction and from post-construction O&M activities, including areas crossed by HDD. Survey areas must not be mowed for at least one month prior to the survey and the survey will cover all areas of suitable habitat, not just transects. Ocean Wind must submit the survey area(s), timing, methods, and qualifications of the surveyor(s) for BOEM/USACE and USFWS approval prior to the start of the survey. A survey report, including maps and associated spatial files in an ESRI ArcGIS/ArcPro compatible format, must be provided to BOEM/USACE and USFWS for review no later than 30 calendar days after the survey has been completed. BOEM/USACE and USFWS will complete their reviews and identify any deficiencies that require a report revision by Ocean Wind within 30 calendar days of receipt of the survey report. If any American chaffseed is found during the survey, the surveyor must document the distribution and abundance of plants and submit both the full survey report and a completed Natural Heritage Rare Plant Species Reporting Form to BOEM, USFWS, and the New Jersey Natural Heritage Program. If American chaffseed is present in or adjacent to Project activities, Ocean Wind must coordinate with USFWS to develop appropriate conservation measures that Ocean Wind is required to implement to avoid adverse effects to this species and seek any required authorizations to perform such activities.	Identifying habitat and presence of American chaffseed and coordination with USFWS and NJDEP would ensure that if American chaffseed plants are identified during pre-construction surveys, potential impacts would be avoided or minimized.
Restoration with Native Vegetation	GEN-13 will be modified to clarify that disturbed areas would be reestablished with native vegetation, and in areas that are permanently landscaped (e.g., substation site), Ocean Wind would coordinate with NJDEP Fish & Wildlife to determine if wildlife friendly habitats could be created.	Coordination with NJDEP on restoring temporarily disturbed areas with native vegetation would minimize the establishment and potential spread of non-native plant species that could outcompete native vegetation that is important to the plant and animal ecosystem.
Surveys, Avoidance, and Minimization (monarch butterfly)	Monarch butterfly: Ocean Wind must conduct pre-construction surveys for milkweed (*Asclepias* spp.) and implement monarch butterfly avoidance and minimization measures in coordination with USFWS and NJDEP.	Identifying areas of milkweed and coordination with USFWS and NJDEP would ensure that potential impacts on monarch butterflies would be avoided or minimized to the extent practicable.

Measure	Description	Effect
Surveys, Avoidance, and Minimization (monarch butterfly; avoid in-season milkweed clearing)	Monarch butterfly: For areas where vegetation disturbance will occur during Project construction or post-construction operations and maintenance activities, Ocean Wind must survey the affected area for milkweed (*Asclepias* spp.) before the start of work. Ocean Wind must avoid clearing milkweed to the extent practical from May 15 through September 30 when monarch caterpillars may be present. If/when the monarch is proposed for federal listing, BOEM and Ocean Wind will coordinate with the USFWS prior to initiating any in-season vegetation disturbance that may involve milkweed.	Avoiding clearing areas of milkweed (if any identified during surveys) during the time period when the monarch butterfly could be present would avoid potential construction and maintenance impacts on the species.
Revegetation Plan	GEN-13 will be modified to enhance monarch butterfly habitat in coordination with USFWS and NJDEP. BOEM will require that Ocean Wind develops a Revegetation Plan to enhance monarch butterfly habitat for areas of temporary disturbance and incidental to other Project activities. Ocean Wind must consult the New Jersey Monarch Butterfly Conservation Guide in developing the plan and submit the plan for USFWS review.	Coordination with USFWS and NJDEP on restoring temporarily disturbed areas that are considered monarch butterfly habitat (if any is identified during surveys) would ensure that any monarch butterfly habitat disturbed would be enhanced to minimize any potential loss or modification of the habitat.
Milkweed Habitat Impact Reduction	Ocean Wind will not use herbicide for right-of way maintenance and in other portions of the Project where milkweed is likely to occur.	Not using herbicide for plant control in areas of milkweed (if any identified during surveys) would ensure that the potential effects of herbicide on milkweed (e.g., plant damage) would not occur and indirect effects on the monarch butterfly would not happen.

[1] Most of the measures in this table are a result of BOEM's ESA Section 7 consultation with USFWS. These same measures are listed in BOEM's BA for species under USFWS jurisdiction; some of these measures may also benefit non ESA-listed species.

Table 3.8-3 Additional Proposed Measures (Also Identified in Appendix H, Table H-3): Coastal Habitat and Fauna

Measure	Description	Effect
Revegetation	Areas of temporary disturbance on Island Beach State Park should be re-seeded or replanted with species native to New Jersey barrier islands, efforts to reduce soil erosion and sediment control should not include application of fertilizer or lime, and only native vegetation should be allowed to become re-established in other disturbed areas.	Re-seeding or replanting temporarily disturbed areas with native vegetation, allowing native vegetation to re-establish, and reducing soil erosion would minimize the establishment and potential spread of non-native plant species that could outcompete native vegetation that is important to the plant and animal ecosystem.

3.8.8.1. Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.8-2 and Table H-2 in Appendix H, *Mitigation and Monitoring*, are incorporated in the preferred alternative. BOEM has identified the following additional measures in Table 3.8-3 as incorporated in the preferred alternative: revegetation. These measures, if adopted, would ensure and improve accountability for compliance with APMs by requiring surveys, coordination with NJDEP and USFWS, and appropriate restoration of disturbed areas. Because most of these measures ensure the effectiveness of and compliance with APMs that are already analyzed as part of the Proposed Action, implementation of these measures would not further reduce the impact level of the Proposed Action from what is described in Section 3.8.2, *Environmental Consequences*.

3.11. Demographics, Employment, and Economics

This section discusses potential impacts on demographics, employment, and economics from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area, as shown on Figure 3.11-1, includes the counties where proposed onshore infrastructure and potential port cities are located, as well as the counties in closest proximity to the Wind Farm Area: Atlantic, Cape May, Cumberland, Gloucester, Ocean, and Salem Counties, New Jersey; city of Norfolk, Virginia; and Charleston County, South Carolina. These counties are the most likely to experience beneficial or adverse economic impacts from the proposed Project.

3.11.1 Description of the Affected Environment for Demographics, Employment, and Economics

Atlantic, Cape May, and Ocean Counties

Atlantic, Cape May, and Ocean Counties are some of the most densely populated coastal communities in the U.S. These counties are notable for coastal activities such as swimming, fishing, surfing, and sailing over the 127 miles of ocean beaches along the Jersey Shore from Sandy Hook to Cape May. Coastal communities provide hospitality, entertainment, and recreation for hundreds of thousands of visitors each year and benefit from high tourism employment. Many coastal amenities such as beaches do not directly generate employment, as they are accessible to the public for free but stimulate the recreation and tourism businesses (COP Volume II, Section 2.3.1.1.1; Ocean Wind 2023).

Data on population, demographics, income, and employment for the state of New Jersey and for Atlantic, Cape May, and Ocean Counties are provided in Table 3.11-1 and Table 3.11-2. The population of Atlantic and Cape May Counties declined between 2010 and 2019 while the population of New Jersey and Ocean County increased. The U.S. Census Bureau estimated the 2019 population of Atlantic County at about 270,000 residents. Atlantic County has the lowest percentage of residents over age 65. The population of Ocean County grew by 4.7 percent from 2010 to 2019, while the population of Atlantic and Cape May Counties declined by 2.6 percent and 4.7 percent, respectively. The population of these counties are all older, on average, than New Jersey as a whole, with a higher percentage of residents aged 65 or older. Atlantic, Cape May, and Ocean Counties compose 10.8 percent of New Jersey’s population (U.S. Census Bureau 2021a). In 2020, unemployment was 9.5 percent in Ocean County, 17.8 percent in Atlantic County, and 13.8 percent in Cape May County, compared to 9.8 percent in New Jersey (U.S. Bureau of Labor Statistics 2021). The average labor force participation rate, that is the proportion of the total population 16 years and older that are in the labor force, was 59 percent in Ocean County, 65 percent in Atlantic County, and 58 percent in Cape May County for the period from 2015 to 2019 (U.S. Census Bureau 2022a).

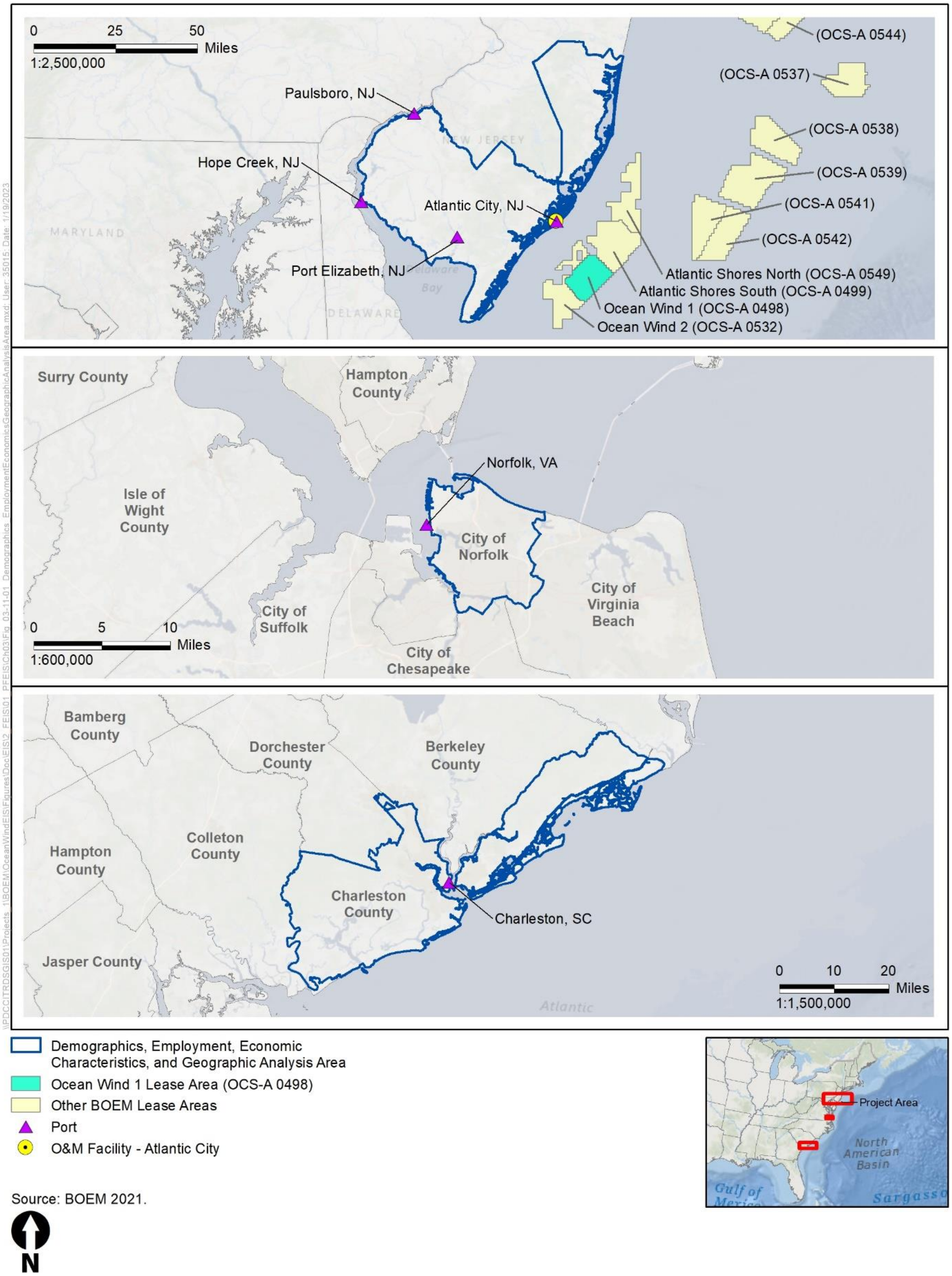

Figure 3.11-1 Demographics, Employment, and Economic Characteristics Geographic Analysis Area

Table 3.11-1 Demographic Trends, 2010–2019

Jurisdiction	2010 Population	2019 Population	Population Change, percent (2010–2019)	2019 Percent Population 18–64 Years	2019 Percent of Population 65 or Older	2019 Median Age
New Jersey	8,721,577	8,878,503	1.8	67.9	15.9	39.9
Ocean County	569,374	596,415	4.7	60.7	22.4	42.7
Atlantic County	273,162	266,105	-2.6	66.6	17.5	41.7
Cape May County	97,684	93,086	-4.7	61.1	25.8	49.6
Cumberland County	155,456	151,906	-2.3	61.3	14.9	37.6
Salem County	65,982	62,990	-4.5	65.5	18.3	42.1
Gloucester County	285,223	291,165	2.1	67.8	15.4	40.5
Virginia	7,841,754	8,454,463	7.8	68.9	15.0	38.2
City of Norfolk	242,143	244,601	1.0	76.0	10.9	30.7
South Carolina	4,511,428	5,020,806	11.3	66.6	17.2	39.4
Charleston County	342,434	401,165	17.2	70.2	15.9	37.8

Source: U.S. Census Bureau 2021a

Table 3.11-2 Population, Income, and Employment Data

Jurisdiction	Population (2019)	Population Density (persons per mi^2)	Per Capita Income (2019)	Total Employment (Jobs, 2019)	Labor Force Participation Rate	Unemployment Rate (2019)
New Jersey	8,878,503	1,207.4	42,745	4,689,849	66%	5.5
Ocean County	596,415	948.6	36,100	275,104	59%	5.1
Atlantic County	266,105	479.1	33,284	139,427	65%	8.4
Cape May County	93,086	369.2	40,389	45,904	58%	6.8
Cumberland County	151,906	314.4	25,694	66,521	56%	7.3
Salem County	62,990	189.1	34,047	31,221	61%	6
Gloucester County	291,165	904.5	39,337	158,168	67%	5.5
Virginia	8,454,463	214.2	39,278	4,477,253	69%	4.6
City of Norfolk	244,601	617.7	29,830	140,204	70%	7.6
South Carolina	5,020,806	167.1	29,426	2,447,854	61%	5.8
Charleston County	401,165	437.4	39,914	215,325	65%	3.7

Source: U.S. Census Bureau 2021b, 2022a, 2022b.
mi^2 = square mile

Ocean County occupies about 629 square miles of land area and contains 33 municipalities including its mainland and barrier island beaches. Ocean County is the second largest county in the state of New Jersey (COP Volume II, Section 2.3.1.1.1; Ocean Wind 2023). Atlantic County occupies about 556 square miles of land in the coastal region of New Jersey. Atlantic County has three barrier islands along its eastern coast, which, like the other barrier islands in New Jersey, are separated from the mainland by the Intracoastal Waterway. Egg Harbor Township is the one municipality in the BL England study area that is in Atlantic County. Cape May County occupies 251 square miles of land area on the southern tip of New Jersey. The eastern part of Cape May County is composed of five barrier islands extending 32 miles from Cape May City to Ocean City. These barrier beaches contain most of the county's infrastructure and are the heart of Cape May County's economy (Cape May County 2005).

Atlantic, Cape May, and Ocean Counties rely on tourism and visitors to their economies and have higher proportions of seasonal housing than New Jersey as a whole. Table 3.11-3 includes housing data for the geographic area of interest. Throughout New Jersey, 3.8 percent of housing units are seasonally occupied, compared to 6.4 percent of homes in Ocean County, 13.4 percent of homes in Atlantic County, and 50.9 percent of homes in Cape May County (U.S. Census Bureau 2021c). About 93,000 residents lived in Cape May County in 2019. During summer months, the population increases to at least six times the size of the permanent winter population because of tourism (Cape May County 2005). In 2013, Cape May County estimated its summer population at 796,695, or about eight times the permanent population (Cape May County 2013).

Table 3.11-3 Housing Data (2019)

Jurisdiction	Housing Units	Seasonal Vacant Units	Vacant Units (Non-Seasonal)	Non-Seasonal Vacancy Rate	Median Value (Owner-Occupied)	Median Monthly Rent (Renter-Occupied)
New Jersey	3,616,614	135,990	248,750	6.9	335,600	1,334
Ocean County	282,075	17,966	39,171	13.9	272,900	755
Atlantic County	127,987	17,190	11,211	8.8	218,300	890
Cape May County	99,157	50,452	8,689	8.8	296,600	1,884
Cumberland County	50,729	378	5,341	10.5	162,500	1,069
Salem County	27,644	3,472	190	0.7	185,300	794
Gloucester County	113,024	8,257	320	0.3	216,700	2,067
Virginia	3,491,091	87,550	275,437	7.4	264,900	1,767
City of Norfolk	97,257	8,768	549	0.6	199,400	1,532
South Carolina	2,286,826	128,239	236,725	10.4	162,300	1,246
Charleston County	184,610	17,348	11,410	6.2	295,600	1,701

Source: U.S. Census Bureau 2021c

Table 3.11-4 includes data on the industries where residents in these counties work. The industries that employ workers reflect recreation and tourism's importance to these counties. A greater proportion of residents in these counties work jobs in arts, entertainment, and recreation; and accommodation and food services (22.51 percent in Atlantic County, 16.4 percent in Cape May County, and 8.8 percent in Ocean

County) than in New Jersey as a whole (8.1 percent) (U.S. Census Bureau 2021d). Table 3.11-5 contains data on at-place employment by industry in the geographic areas of interest. A greater proportion of jobs in these counties are in accommodation and food services (37.4 percent in Atlantic County, 19.9 percent in Cape May County, and 10.2 percent in Ocean County) and retail trade (14.2 percent in Atlantic County, 21.7 in Cape May County, and 18.7 in Ocean County) than in New Jersey as a whole (8.9 percent and 11.9 percent, respectively) (U.S. Census Bureau 2021e).

NOAA tracks economic activity dependent upon the ocean in its “Ocean Economy” data, which generally include, among other categories, commercial fishing and seafood processing, marine construction, commercial shipping and cargo-handling facilities, ship and boat building, marine minerals, harbor and port authorities, passenger transportation, boat dealers, and coastal tourism and recreation. In Atlantic, Cape May, and Ocean Counties, tourism and recreation account for 94.2, 86.4, and 86.7 percent of the overall Ocean Economy gross domestic product (GDP), respectively (NOAA 2021a). The “living resource” sector of the Ocean Economy is smaller but contributes to the identity of local communities as well as tourism. This includes commercial fishing, aquaculture, seafood processing, and seafood markets. The living resource sector accounts for 2.6 percent of employment and 3.2 percent of the GDP of the U.S marine economy. However, seafood markets are the largest producer in the living resources sector, accounting for 41.5 percent of the sector’s GDP and for the most employed workers in the sector (NOAA 2021b). Among Atlantic, Cape May, Cumberland, Gloucester, Ocean, and Salem Counties, there are 88 living resources fisheries (NOAA 2021a).

The fishing industry is a large contributor to the economic vitality of New Jersey. The fishing industry has implications on fish and seafood markets and wholesalers, and seafood product preparation and packaging. In 2019, fish and seafood merchants brought in total annual wages of $61,404,501 with 1,083 average employees. Seafood product preparation and packaging brought in $26,374,344 with 517 average employees, and fish and seafood markets brought in $21,312,070 with 655 average employees (U.S. Bureau of Labor Statistics 2019).

Table 3.11-4 Employment of Residents, by Industry (2019)

Industry	New Jersey	Atlantic County	Cape May County	Cumberland County	Ocean County	Salem County	Gloucester County	Virginia	City of Norfolk	South Carolina	Charleston County
Agriculture, forestry, fishing	0.34%	0.46%	1.01%	4.00%	0.26%	1.98%	0.55%	0.88%	0.13%	0.96%	0.45%
Construction	5.94%	6.48%	9.63%	6.54%	8.16%	8.21%	6.70%	6.65%	6.98%	6.82%	7.43%
Manufacturing	8.15%	4.66%	2.91%	12.66%	5.20%	11.43%	7.32%	7.05%	7.06%	13.66%	6.25%
Wholesale trade	3.33%	2.12%	2.64%	4.17%	2.84%	3.94%	3.60%	1.76%	1.64%	2.40%	2.29%
Retail trade	10.89%	11.57%	10.44%	12.37%	13.60%	10.01%	11.76%	10.35%	11.20%	11.92%	10.21%
Transportation, warehousing, utilities	6.13%	4.36%	3.93%	5.45%	5.23%	10.32%	6.08%	4.41%	4.92%	5.1%	4.29%
Information	2.69%	1.15%	1.14%	0.99%	1.91%	1.02%	1.96%	1.91%	1.72%	1.61%	2.13%
Finance, insurance, real estate	8.48%	4.64%	7.09%	2.87%	6.54%	4.49%	6.65%	6.26%	5.72%	5.80%	6.61%
Professional services	13.50%	8.49%	7.68%	7.98%	10.64%	7.40%	11.23%	15.48%	11.68%	10.22%	15.41%
Educational, health care, social assistance	23.88%	23.85%	25.46%	25.61%	26.63%	25.35%	28.38%	22.22%	23.07%	21.75%	22.60%
Arts, entertainment, recreation, accommodation, food services	8.11%	22.51%	16.41%	6.40%	8.81%	6.51%	7.52%	8.94%	12.78%	10.18%	13.31%
Other services, except public administration	4.33%	4.38%	4.12%	3.70%	4.57%	4.57%	3.64%	5.29%	4.38%	5.16%	4.98%
Public administration	4.23%	5.34%	7.54%	7.24%	5.61%	4.77%	4.60%	8.81%	8.71%	4.42%	4.04%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: U.S. Census Bureau 2021d

Table 3.11-5 At-Place Employment, by Industry (2019)

Industry	New Jersey	Atlantic County	Cape May County	Cumber land County	Ocean County	Salem County	Gloucester County	Virginia	City of Norfolk	South Carolina	Charleston County
Agriculture, forestry, fishing	<0.1%	<0.1%	0.5%	0.1%	<0.1%	<0.1%	<0.1%	0.1%	<0.1%	0.2%	<0.1%
Mining, quarrying, oil and gas	<0.1%	<0.1%	0.2%	0.3%	<0.1%	<0.1%	<0.1%	0.2%	<0.1%	<0.1%	<0.1%
Utilities	0.5%	1.0%	0.4%	0.2%	0.7%	11.5%	0.2%	0.4%	<0.1%	0.6%	0.3%
Construction	4.3%	5.1%	8.6%	4.1%	5.7%	6.4%	7.9%	5.6%	3.6%	4.6%	5.4%
Manufacturing	5.9%	2.0%	2.3%	16.9%	3.3%	13.1%	9.9%	7.0%	6.4%	12.8%	7.4%
Wholesale trade	7.3%	2.2%	3.1%	10.1%	3.3%	7.7%	8.3%	3.1%	3.9%	3.9%	3.2%
Retail trade	11.9%	14.2%	21.7%	14.4%	18.7%	10.3%	17.4%	12.5%	10.7%	12.9%	14.1%
Transportation and warehousing	5.2%	2.0%	1.0%	6.5%	2.4%	6.5%	5.9%	3.3%	6.5%	3.8%	4.8%
Information	2.3%	0.9%	0.9%	1.0%	0.9%	0.3%	1.2%	2.9%	2.1%	1.9%	2.1%
Finance and insurance	5.2%	2.2%	4.1%	2.2%	2.2%	2.3%	1.8%	4.8%	4.1%	3.9%	3.2%
Real estate	1.6%	1.4%	2.9%	1.0%	2.3%	1.6%	17.4%	1.6%	3.3%	1.4%	2.3%
Professional services	8.8%	3.6%	3.7%	2.2%	5.2%	2.7%	3.8%	14.3%	10.4%	5.1%	7.9%
Management	3.4%	1.0%	0.3%	0.2%	0.8%	0.1%	0.5%	2.4%	2.4%	1.6%	1.4%
Administrative, business support, waste management	9.4%	3.2%	4.1%	3.7%	3.8%	2.5%	7.5%	8.1%	8.1%	14.6%	8.7%
Educational services	2.9%	1.1%	0.4%	2.4%	5.1%	0.7%	1.3%	2.4%	1.9%	1.6%	1.9%
Heath care and social assistance	16.4%	17.1%	15.7%	21.9%	26.3%	19.6%	15.8%	13.6%	19.4%	12.8%	12.5%
Arts, entertainment and recreation	1.8%	1.5%	4.1%	1.0%	3.0%	0.8%	1.6%	1.9%	1.4%	1.6%	2.2%

Industry	New Jersey	Atlantic County	Cape May County	Cumber land County	Ocean County	Salem County	Gloucester County	Virginia	City of Norfolk	South Carolina	Charleston County
Accommodation and food services	8.9%	37.4%	19.9%	7.8%	10.2%	10.0%	10.7%	10.8%	11.1%	12.3%	18.0%
Other services (e.g., public administration)	4.2%	3.9%	6.1%	4.0%	6.0%	3.6%	4.8%	5.0%	4.3%	4.3%	4.6%
Industries not classified	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: U.S. Census Bureau 2021e

Cumberland, Gloucester, and Salem Counties

Compared to Atlantic, Cape May, and Ocean Counties that have more ocean-based economies with seasonal work and recreation and tourism, Cumberland, Gloucester, and Salem Counties, which are along the Delaware Bay or on the Delaware River, in the case of Gloucester County, are less reliant on coastal industries. The population of Gloucester County grew 2.1 percent from 2010 to 2019 while the population of Cumberland and Salem Counties decreased by 2.3 percent and 4.5 percent, respectively. The share of New Jersey's population in Cumberland, Gloucester, and Salem Counties is 5.7 percent. Median age in Gloucester and Salem Counties (40.5 and 42.1 years, respectively) is older than New Jersey as a whole (39.9 years) while the median resident of Cumberland County (37.6 years) is younger than the median New Jersey resident (U.S. Census Bureau 2021f).

Cumberland, Gloucester, and Salem Counties are also less dependent on tourism than their coastal counterparts. The percentage of housing units that are seasonally occupied in these counties are 7.3, 12.6, and 5.8 percent, respectively (U.S. Census Bureau 2021b). Tourism and recreation likewise compose a smaller portion of Cumberland, Gloucester, and Salem Counties' Ocean Economies (19.0, 21.3, and 10.3 percent, respectively) (NOAA 2021a). Transportation and warehousing, utilities, and manufacturing are more important to the economies of Salem County, as a larger portion of the workers in this county works in those sectors than those in New Jersey. Manufacturing, retail trade, and education, health care, and social assistance have greater representation in Cumberland County than in New Jersey (U.S. Census Bureau 2021d).

City of Norfolk

The city of Norfolk is in southeastern Virginia, 220 miles south of Washington, DC, and is home to miles of coastline, including beaches on Chesapeake Bay. Norfolk is a key contributor to the Port of Virginia. From 2010 to 2019, Norfolk's population grew by 1.0 percent while the population of Virginia grew by 7.8 percent. Norfolk's population is also much younger than Virginia's. The median age of Norfolk residents is 30.7 years while the median Virginia resident is 38.2 years old. Residents aged 65 or older are underrepresented in Norfolk relative to Virginia (10.9 percent of the population as opposed to 15.0 percent) while residents aged 18–64 are overrepresented (76.0 percent as opposed to 68.9 percent) (U.S. Census Bureau 2021f). Compared to Virginia as a whole, Norfolk has a higher portion of residents who work in arts, entertainment, and recreation; and accommodation and food services (12.8 percent) than Virginia as a whole (8.9 percent) (U.S. Census Bureau 2021d). Norfolk's more service-based economy experienced a greater unemployment rate (8.7 percent) than the Commonwealth of Virginia as a whole (6.2 percent) (U.S. Bureau of Labor Statistics 2021). Because of its coastal location and amenities, 9.0 percent of housing units in Norfolk are seasonally occupied, compared to 2.5 percent in Virginia (U.S. Census Bureau 2021c).

Charleston County

Charleston County is in eastern South Carolina and is bordered on the east by the Atlantic Ocean. Since 2010, Charleston County's population growth (17.2 percent) has outpaced that of South Carolina (11.3 percent) and the county represents 8 percent of South Carolina's total population. Charleston County's population is younger than the state average. The median age in Charleston County is 37.8 years while it is 39.4 years in South Carolina. The portion of Charleston County's population 65 years or older (15.9 percent) is smaller than that of South Carolina (17.2 percent) while the portion of the population between 18 and 64 (70.2 percent) is larger than that of South Carolina (66.6 percent). A greater portion of residents in Charleston County work in arts, entertainment, and recreation; and accommodation and food services (13.3 percent) than in all of South Carolina (10.2 percent). Charleston County also has a disproportionate number of residents who work in professional services (15.4 percent) compared to South Carolina (10.2

percent). Moreover, 9.4 percent of housing units in Charleston County are seasonally occupied while 5.6 percent of housing units in South Carolina are seasonal (U.S. Census Bureau 2021b).

3.11.2 Environmental Consequences

3.11.2.1. Impact Level Definitions for Demographics, Employment, and Economics

Definitions of impact levels are provided in Table 3.11-6.

Table 3.11-6 Impact Level Definitions for Demographics, Employment, and Economics

Impact Level	Impact Type	Definition
Negligible	Adverse	No impacts would occur, or impacts would be so small as to be unmeasurable.
	Beneficial	Either no effect or no measurable benefit.
Minor	Adverse	Impacts on the affected activity or geographic place would be avoided and would not disrupt the normal or routine functions of the affected activity or geographic place. Once the affecting agent is eliminated, the affected activity or geographic place would return to a condition with no measurable effects.
	Beneficial	Small but measurable benefit on demographics, employment, or economic activity.
Moderate	Adverse	Impacts on the affected activity or geographic place would be unavoidable. The affected activity or geographic place would have to adjust somewhat to account for disruptions due to impacts of the Project, or, once the affecting agent is eliminated, the affected activity or geographic place would return to a condition with no measurable effects if proper remedial action is taken.
	Beneficial	Notable and measurable benefit on demographics, employment, or economic activity.
Major	Adverse	The affected activity or geographic place would experience unavoidable disruptions to a degree beyond what is normally acceptable, and, once the affecting agent is eliminated, the affected activity or geographic place could retain measurable effects indefinitely, even if remedial action is taken.
	Beneficial	Large local or notable regional benefit to the economy as a whole.

3.11.3 Impacts of the No Action Alternative on Demographics, Employment, and Economics

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on demographics, employment, and economics, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for demographics, employment, and economics. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.11.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, the demographics, employment, and economics of the geographic analysis area described in Section 3.11.1, *Description of the Affected Environment for Demographics, Employment, and Economics*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind activities. Tourism, recreation, and marine industries (e.g., fishing) would continue to be important components of the regional economy. Ongoing activities within the geographic analysis area that will contribute to impacts on demographics, employment, and economics include continued commercial shipping and commercial fishing; ongoing port maintenance and upgrades; periodic channel dredging; maintenance of piers, pilings, seawalls, and buoys; and climate change. Coasts are sensitive to sea level rise, changes in the frequency and intensity of storms, increases in precipitation, and warmer ocean temperatures. Sea level rise and increased storm frequency and severity could result in property or infrastructure damage, increase insurance cost, and reduce the economic viability of coastal communities. Impacts on marine life due to ocean acidification, altered habitats and migration patterns, and disease frequency would affect industries that rely on these species. The impacts of climate change are likely to, over time, worsen problems that coastal areas already face (Moser et al. 2014). The socioeconomic impact of ongoing activities varies depending upon each activity. Activities that generate economic activity, such as port maintenance and channel dredging, would generally benefit the local economy by providing job opportunities and generating indirect economic activity from suppliers and other businesses that support activity along the New Jersey coast. Conversely, ongoing activities that disrupt economic activity, such as climate change, may adversely affect businesses, resulting in impacts on employment and wages. There are no ongoing offshore wind activities within the geographic analysis area for demographics, employment, and economics.

3.11.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned activities (without the Proposed Action). Planned activities for coastal and marine activity include development of diversified, small-scale, onshore renewable energy sources; ongoing onshore development at or near current rates; continued increases in the size of commercial vessels; potential port expansion and channel-deepening activities; and efforts to protect against potential increased storm damage and sea level rise (see Section F.2 in Appendix F for a description of ongoing and planned activities). Similar to ongoing activities, other planned non-offshore wind activities may result in beneficial socioeconomic impacts by generating economic activity that boosts employment but there is also the potential for some adverse impacts. See Table F1-9 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for demographics, employment, and economics.

Offshore wind could become a new industry for the Atlantic states and the nation. Although most offshore wind component manufacturing and installation capacity exists outside of the U.S., some studies acknowledge that domestic capacity is poised to increase. This EIS uses available data, analysis, and projections to make informed conclusions on offshore wind’s potential economic and employment impacts within the geographic analysis area.

The BVG Associates Limited (2017) study estimated that the percentage of jobs sourced in the U.S. during the initial implementation of offshore wind projects along the U.S. northeast coast would range from 35 percent to 55 percent of jobs. As the offshore wind energy industry grows in the United States, this proportion of jobs would increase because of growth of a supply chain in the East Coast along with a growing number of maintenance and local operations jobs for established wind facilities. The proportion of jobs associated with offshore wind projected to be within the U.S. will be approximately 65 to 75 percent from 2030 through 2056. The high-energy production scenario for 30 GW of offshore wind energy by the year 2030 will make additional jobs more likely. Overseas manufacturers of components and specialized ships based overseas that are contracted for installation of foundations and WTGs would compose the rest of the jobs outside the U.S. (BVG Associates Limited 2017).

The American Wind Energy Association (AWEA) estimates that the offshore wind industry will invest between $80 and $106 billion in U.S. offshore wind development by 2030, of which $28 to $57 billion will be invested within the United States. This figure depends on installation levels and supply chain growth, as other investment would occur in countries manufacturing or assembling wind energy components for U.S.-based projects. While most economic and employment impacts would be concentrated in Atlantic coastal states where offshore wind development will occur—there are over $1.3 billion of announced domestic investments in wind energy manufacturing facilities, ports, and vessel construction—there would be nationwide effects as well (AWEA 2020). The AWEA report analyzes base and high scenarios for offshore wind direct impacts, turbine and supply chain impacts, and induced impacts. The base scenario assumes 20 GW of offshore wind power by 2030 and domestic content increasing to 30 percent in 2025 and 50 percent in 2030, while the high scenario assumes 30 GW of offshore wind power by 2030 and domestic content increasing to 40 percent in 2025 and 60 percent in 2030. Offshore wind energy development will support $14.2 billion in economic output and $7 billion in value added by 2030 under the base scenario. Offshore wind energy development will support $25.4 billion in economic output and $12.5 billion in value added under the high scenario. It is unclear where in the U.S. supply chain growth would occur.

The University of Delaware projects that offshore wind power will generate 30 GW along the Atlantic coast through 2030. This initiative would require capital expenditures of $100 billion over the next 10 years (University of Delaware 2021). Although the industry supply chain is global and foreign sources would be responsible for some expenditures, more U.S. suppliers are expected to enter the industry.

Compared to the $14.2 to $25.4 billion in offshore wind economic output (AWEA 2020), the 2020 annual GDP for states with offshore wind projects (Connecticut, Massachusetts, Rhode Island, New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina) ranged from $60.6 billion in Rhode Island to $1.72 trillion in New York (U.S. Bureau of Economic Analysis 2020) and totaled nearly $4.3 trillion. The $14.2 to $25.4 billion in offshore wind industry output would represent 0.3 to 0.6 percent of the combined GDP of these states.

The AWEA estimates that in 2030, offshore wind would support 45,500 (base scenario) to 82,500 (high scenario) full-time equivalent (FTE) jobs nationwide, including direct, supply chain, and induced jobs. Most offshore wind jobs (about 60 percent) are created during the temporary construction phase while the remaining 40 percent would be long-term O&M jobs. RODA in 2020 estimated that offshore wind projects would create 55,989 to 86,138 job years through 2030 in construction and 5,003 to 6,994 long-term jobs in O&M (Georgetown Economic Services 2020). These estimates are generally consistent with the AWEA study in total jobs supported, although the RODA study concludes that a greater proportion of jobs would be in the construction phase. The two studies conclude that states hosting offshore wind projects would have more offshore wind energy jobs while states with manufacturing and other supply chain activities may generate additional jobs.

The New Jersey Economic Development Authority is providing $4.5 million in funds to support the wind energy work force, specifically the New Jersey Wind Turbine Technician Training Challenge and New Jersey Offshore Wind Safety Training Challenge. Recent solicitations in New Jersey contained equity provisions that support the development of a local workforce by requiring developers to provide workforce training and support minority-owned businesses (NREL 2022).

In 2020, employment in New Jersey was 4.1 million (Table 3.11-2). While the extent to which there will be impacts on the geographic analysis area is unclear due to the geographic versatility of offshore wind jobs, a substantial portion of the planned offshore wind projects in New Jersey would likely be within commuting distance of ports in Atlantic City, Paulsboro, Hope Creek, and Port Elizabeth in New Jersey; Norfolk, Virginia; Charleston, South Carolina; and other ports that would be used for offshore wind staging, construction, and operations.

In addition to the regional economic impact of a growing offshore wind industry, BOEM expects offshore wind development to affect demographics, employment, and economics through the following primary IPFs.

Energy generation and security: Once built, offshore wind energy projects could produce energy at long-term fixed costs. These projects could provide reliable prices once built compared to the volatility of fossil fuel prices. Approximately 16 GW of capacity is estimated to occur in the New York/New Jersey offshore areas. The economic impacts of offshore wind activities (including associated energy storage and capacity projects) on energy generation and energy security could be long term, minor, and beneficial.

Lighting: Offshore WTGs require aviation warning lighting that could have economic impacts in certain locations. Aviation hazard lighting from up to 1,211 WTGs could be visible from some beaches, coastlines, and elevated inland areas, depending on vegetation, topography, weather, and atmospheric conditions. Visitors may make different decisions on coastal locations to visit and potential residents may choose to select different residences because of nighttime views of lights on offshore wind energy structures. As described in Section 3.20, at a height of 531 feet, the navigation light on a WTG would be visible out to 31 miles. A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 miles from the viewer would have negligible impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018). In a subsequent study, 1,723 beachgoers were surveyed to determine the impact of WTGs and the conclusion was that the farther away the WTGs, the less of an impact occurred. Nearly 70 percent of beachgoers said that WTGs 15 miles offshore would neither worsen nor increase their experience (Parsons et al. 2020). The vast majority of the WTG positions envisioned offshore of the geographic analysis area would be more than 15 miles (24.1 kilometers) from coastal locations with views of the WTGs, so impacts are anticipated to be negligible. These lights would be incrementally added over the construction period and would be visible for the operating lives of offshore wind activities. Distance from shore, topography, and atmospheric conditions would affect light visibility.

If implemented, ADLS would reduce the amount of time that WTG lighting is visible. Visibility would depend on distance from shore, topography, and atmospheric conditions. Such systems would likely reduce impacts on demographics, employment, and economics associated with lighting. Lighting for transit or construction could occur during nighttime transit or work activities. Construction of 13 offshore wind projects would occur within the New York and New Jersey lease areas between 2023 and 2030, with a maximum of 10 projects under construction concurrently during 2026 (Appendix F, Table F2-1). Vessel lights would be visible from coastal businesses, especially near the ports used to support offshore wind construction (COP Volume II, Section 2.2.5.2.1; Ocean Wind 2023).

Cable emplacement and maintenance: Cable installation for each project could temporarily cause commercial fishing vessels, static gear fishing vessels, and recreational vessels to relocate away from work areas and disrupt fish stocks, thereby reducing income and increasing costs during installation. Fishing vessels are not likely to access affected areas during active construction, as about 5,235 acres (21.2 km^2) of seafloor disturbance would occur associated with offshore cable and inter-array cable installation (Appendix F, Table F2-2). In the long term, concrete mattresses covering cables in hard-bottom areas could hinder commercial trawlers and dredgers (COP Volume II, Section 2.2.6.2.1; Ocean Wind 2023). Assuming similar installation procedures as under the Proposed Action, the duration and range of impacts would be limited, and the disturbance to marine species important to recreational fishing and sightseeing would recover following the disturbance (COP Volume II, Section 2.3.3.2; Ocean Wind 2023). Impacts of onshore cable installation would depend upon the specific location but could temporarily disrupt beaches and other recreational coastal areas. Disruptions may result in conflict over other fishing grounds, increased operating costs for vessels, and lower revenue. Seafood processing and wholesaling businesses could also experience short-term reductions in productivity. Disruptions from new cable emplacement would have localized, short-term, and minor impacts on demographics, employment, and economics. Maintenance is anticipated to have long-term intermittent and negligible impacts on demographics, employment, and economics.

Noise: Noise from O&M, pile driving, cable laying and trenching, and vessel traffic could result in temporary impacts on demographics, employment, and economics due to impacts on commercial/for-hire fishing businesses, recreational businesses, and marine sightseeing activities.

Assuming other offshore wind facilities generate vessel traffic similar to the projected Proposed Action vessel trips, construction of each offshore wind project would generate between 20 and 65 vessels operating at any given time (Section 3.16). Noise from vessel traffic during the maintenance and construction phases could affect species important to commercial/for-hire fishing, recreational fishing, and marine sightseeing activities (COP Volume II, Section 2.3.4.2; Ocean Wind 2023). This noise may also make these facilities less attractive to fishing operators and recreational boaters (COP Volume II, Section 2.3.3.1.2; Ocean Wind 2023). Similarly, noise from pile driving from offshore wind activities would affect fish populations that are crucial to commercial fishing and marine recreational businesses (COP Volume II, Section 2.1.2.2.1; Ocean Wind 2023). These impacts would be greater if multiple construction activities occur in close spatial and temporal proximity. An estimated 2,447 foundations (WTGs and substations) would be installed within the New York and New Jersey lease areas between 2023 and 2030.

Onshore construction noise could possibly result in a short-term reduction of economic activity for businesses near installation sites for onshore cables or substations, temporarily inconveniencing workers, residents, and visitors. Noise would have intermittent, short-term, and negligible impacts on demographics, employment, and economics.

Port utilization: Offshore wind installation would require port facilities for berthing, staging, and loadout. Development activities would bolster port investment and employment while also supporting jobs and businesses in supporting industries. Offshore wind development would also support planned expansions and modifications at ports in the geographic analysis area, including the ports of Atlantic City, New Jersey; Norfolk, Virginia; and Paulsboro and Hope Creek, New Jersey. While simultaneous construction or decommissioning (and, to a lesser degree, operation) activities for multiple offshore wind projects in the geographic analysis area could stress port capacity, it would also generate considerable economic activity and benefit the regional economy and infrastructure investment. The White House 2021 states that investments in ports build up the resilience and sustainability of the economy.

Port utilization would require a trained workforce for the offshore wind industry including additional shore-based and marine workers that would contribute to local and regional economic activity. Improvements to existing ports and channels would be beneficial to other port activity. Port utilization in the geographic analysis area would occur primarily during development and construction projects, anticipated to occur primarily between 2023 and 2030. Ongoing O&M activities would sustain port activity and employment at a lower level after construction.

Offshore wind activities and associated port investment and usage would have long-term, moderate beneficial impacts on employment and economic activity by providing employment and industries such as marine construction, ship construction and servicing, and related manufacturing. The greatest benefits would occur during offshore wind project construction between 2023 and 2030. If offshore wind construction results in competition for scarce berthing space and port service, port usage could potentially have short- to medium-term adverse impacts on commercial shipping.

Presence of structures: Under the No Action Alternative, the addition of up to 2,447 offshore wind structures (WTGs and substations) with 995 acres (4 km^2) of foundation and scour protection and 370 acres (1.5 km^2) of offshore export cable hard protection would increase the risk of gear loss connected with cable mattresses and structures along the East Coast (Appendix F, Table F2-2). Fisheries using bottom gear may be permanently disrupted, which would increase economic impacts on the commercial/for-hire recreational fishing industries (COP Volume II, Section 2.3.4.2.1; Ocean Wind 2023). These offshore facilities would also pose allision and height hazard risks, creating obstructions and navigational complexity for marine vehicles, which would impose fuel costs, time, and risk and require adequate technological aids and trained personnel for safe navigation (Appendix F, Table F2-1 and Table F2-2). In the event of an allision, vessel damage and spills could result in both direct and indirect costs for commercial/for-hire recreational fishing.

Due to the locations of offshore wind lease areas, it is possible that some commercial fishing areas would be displaced. Because of this, fishermen are likely to switch to their next best fishing location. These locations may involve lower catches per unit, catches of alternative species with different prices, or increased congestion, which would have its own effects, such as increased fishing costs among fishing fleets. In a study on the socioeconomic effects of offshore wind off the coast of Rhode Island and Massachusetts, Hoagland et al. (2015) found that losses associated with reduction to commercial fishing may be distributed in unexpected ways across the coastal economy. Regional coastal economies are linked across onshore industry sectors and offshore activities, and impacts on commercial fishing would not just affect fishing fleets and related coastal businesses. The study's authors found that impacts may be most pronounced in areas that are not close to the coastline (Hoagland et al. 2015), highlighting the potential for broad, regional socioeconomic impacts.

The potential for 2,447 offshore wind energy structures within the geographic analysis area could encourage fish aggregation and generate reef effects that attract recreational fishing vessels (COP Volume II, Section 2.2.7.2; Ocean Wind 2023). Fish aggregation could increase human fishing activities, but this attraction would likely be limited to the minority of recreational fishing vessels that already travel as far from the shore as the wind energy facilities. Fish aggregation could potentially result in broad changes in recreational fishing practices if these effects are widespread enough to encourage more participants to travel farther from shore.

The 995 acres (4 km^2) of hard coverage for offshore wind foundations could create foraging opportunities for harbor and gray seals, sea turtles, bats, northern gannets, loons, and peregrine falcons, possibly attracting private or commercial recreational sightseeing vessels. As a result, the presence of new habitat could increase economic activity associated with offshore sightseeing. New structures would be added intermittently between 2023 and 2030 and could benefit structure-oriented species as long as the structures remain (COP Volume II, Section 2.2.3.2.2; Ocean Wind 2023).

As a result of fish aggregation and reef effects associated with the presence of offshore wind structures, there would be long-term impacts on commercial fishing operations and support businesses such as seafood processing. The fishing industry is expected to be able to adapt its fishing practices over time in response to these changes. These effects could simultaneously provide new business opportunities such as fishing and tourism. Overall, the presence of offshore wind structures would have continuous, long-term, moderate impacts on demographics, employment, and economics.

Traffic: Offshore wind construction and decommissioning and, to a lesser extent, offshore wind operations would generate increased vessel traffic. This additional traffic would support increased employment and economic activity for marine transportation and supporting businesses and investment in ports. Assuming other offshore wind facilities generate vessel traffic similar to the projected Proposed Action vessel trips, construction of each offshore wind project would generate between 20 and 65 vessels operating at any given time (Section 3.16). Construction of 13 offshore wind projects could occur within the New York and New Jersey lease areas between 2023 and 2030, with a maximum of 13 projects under construction concurrently during 2026 (Appendix F, Table F2-1). Increased vessel traffic would have continuous, beneficial impacts during all project phases, with moderate impacts during construction and decommissioning.

Impacts of short-term, increased vessel traffic during construction could include increased vessel traffic congestion, delays at ports, and a risk for collisions between vessels. Increased vessel traffic would be localized near affected ports and offshore construction areas. Congestion and delays could increase fuel costs (i.e., for vessels forced to wait for port traffic to pass) and decrease productivity for commercial shipping, fishing, and recreational vessel businesses, whose income depends on the ability to spend time out of port. Collisions could lead to vessel damage and spills, which could have direct costs (i.e., vessel repairs and spill cleanup) as well as indirect costs from damage caused by spills. As a result of potential delays from increased congestion and increased risk of damage from collisions, vessel traffic is anticipated to have continuous, short-term, and minor impacts during construction and negligible impacts during operations.

Vessel traffic would occur among ports (outside the demographics, employment, and economic geographic analysis area) and offshore wind work areas. Most vessel traffic would travel to the WTG installation area with fewer vessels needed along the cable installation routes (COP Volume II, Section 2.3.6.2.2; Ocean Wind 2023).

Land disturbance: Land disturbance could result in localized, temporary disturbances of businesses near cable routes and construction sites for substations and other electrical infrastructure, due to typical construction impacts such as increased noise, traffic, and road disturbances. These impacts would be similar in character and duration to other common construction projects, such as utility installations, road repairs, and industrial site construction. Impacts on employment would be localized, temporary, and both beneficial (jobs and revenues to local businesses that participate in onshore construction) and adverse (lost revenue due to construction disturbances). Land disturbance impacts on demographics, employment, and economics would be minor.

3.11.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, the geographic analysis area would continue to be influenced by regional demographic and economic trends. Ongoing non-offshore wind activities would continue to sustain and support economic activity and growth within the geographic analysis area based on anticipated population growth and ongoing development of businesses and industry. Tourism and recreation would continue to be important to the economies of the coastal areas, especially Atlantic, Cape May, and Ocean Counties. Marine industries such as commercial fishing and shipping would continue to be active and important components of the regional economy. Counties in the geographic analysis area would continue to seek to diversify their economies—including maintaining or increasing their year-round population—and protect environmental resources.

BOEM anticipates that ongoing activities in the geographic analysis area (continued commercial shipping and commercial fishing; ongoing port maintenance and upgrades; periodic channel dredging; maintenance of piers, pilings, seawalls, and buoys; and the use of small-scale, onshore renewable energy) would have minor adverse and minor beneficial impacts on demographics, employment, and economics.

The No Action Alternative would result in **minor** adverse and **minor beneficial** impacts on demographics, employment, and economics.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and activities would continue, and demographics, employment, and economics would continue to be affected by natural and human-caused IPFs. Planned activities for coastal and marine activity, other than offshore wind, include development of diversified, small-scale, onshore renewable energy sources; ongoing onshore development at or near current rates; continued increases in the size of commercial vessels; potential port expansion and channel-deepening activities; and efforts to protect against potential increased storm damage and sea level rise. BOEM anticipates that there would be minor adverse and minor beneficial impacts on demographic, employment, and economics from these planned activities, driven primarily by the continued operation of existing marine industries, especially commercial fishing, recreation/tourism, and shipping; increased pressure for environmental protection of coastal resources; the need for port maintenance and upgrades; and the risks of storm damage and sea level rise. Increased investment in land and marine ports, shipping, and logistics capability is expected to result along with component laydown and assembly facilities, job training, and other services and infrastructure necessary for offshore wind construction and operations. Additional manufacturing and servicing businesses would result either in the geographic analysis area or other locations in the United States if supply chains develop as expected. While it is not possible to estimate the extent of job growth and economic output within the geographic analysis area specifically, there will be notable and measurable benefits to employment, economic output, infrastructure improvements, and community services, especially job training, because of offshore wind development.

Offshore wind activities are expected to affect commercial and for-hire fishing businesses and marine recreational businesses (tour boats, marine suppliers) primarily through cable emplacement, noise and vessel traffic during construction, and the presence of offshore structures during operations. These IPFs would temporarily disturb marine species and displace commercial or for-hire fishing vessels, which could cause conflicts over other fishing grounds, increased operating costs, and lower revenue for marine industries and supporting businesses. The long-term presence of offshore wind structures would also lead to increased navigational constraints and risks and potential gear entanglement and loss. Many jobs generated by offshore wind are temporary construction jobs, lasting for a year or less. The long-term benefit of offshore wind projects is the medium-term (10 to 20 years) job market for offshore wind construction; long-term O&M jobs (25 to 35 years); long-term tax revenues; long-term economic benefits of improved ports and other industrial land areas; diversification of marine industries, especially in areas currently dominated by recreation and tourism; and growth in a skilled marine construction workforce. BOEM anticipates that there will be minor adverse and moderate beneficial impacts from offshore wind activities in the geographic analysis area.

BOEM anticipates that the cumulative impacts of the No Action Alternative would be **minor** adverse and **moderate beneficial** due primarily to the impacts on commercial fishing and marine recreational businesses. Beneficial impacts would result from increased employment and economic activity associated with multiple offshore wind projects being developed and operated in the region.

3.11.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix E) would influence the magnitude of the impacts on demographic, employment, or economic characteristics:

- Overall size of project (approximately 1,100 MW) and number of WTGs;
- The extent to which Ocean Wind hires local residents and obtains supplies and services from local vendors;
- The port(s) selected to support construction, installation, and decommissioning and the port(s) selected to support O&M; and

- The design parameters that could affect commercial fishing and recreation and tourism because impacts on these activities affect employment and economic activity.

The size of the Project would affect the overall investment and economic impacts; fewer WTGs would mean less materials purchased, fewer vessels, and less labor and equipment required. Beneficial economic impacts within the geographic analysis area would depend on the proportion of workers, materials, vessels, equipment, and services that can be locally sourced and the specific ports used by the Project.

Ocean Wind has committed to measures to minimize impacts on demographics, employment, and economics, which include complying with NJDEP noise regulations (SOC-01), developing a construction schedule to minimize onshore construction activities during the peak summer recreation and tourism season (REC-01), and working cooperatively with commercial/recreational fishing entities and interests to ensure that construction and operation of the Project will minimize potential conflicts with commercial and recreational fishing (CFHFISH-01) (COP Volume II, Table 1.1-2; Ocean Wind 2023).

3.11.5 Impacts of the Proposed Action on Demographics, Employment, and Economics

3.11.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.11.9, *Impacts of Alternative E on Demographics, Employment, and Economics*.

The Proposed Action's beneficial impacts on demographics, employment, and economics depend on what proportion of workers, materials, vessels, equipment, and services can be locally sourced. In a study conducted by BW Research Partnership on behalf of E2, a national, nonpartisan group of advocates for policies that benefit both the economy and environment, every $1.00 spent building an offshore wind farm is estimated to generate $1.83 for New Jersey's economy (E2 2018). Ocean Wind's economic impact study estimates that the Proposed Action would support the following employment in New Jersey alone in direct, indirect, and induced job-years[1]: an estimated 663 FTE job-years during development, 6,598 FTE job-years during construction, 6,114 FTE job-years during operations, and 1,202 FTE job-years during decommissioning (COP Volume II, Table 2.3.1-4; Ocean Wind 2023).

The Proposed Action would generate employment during construction and installation, O&M, and decommissioning of the Project. The Proposed Action would support a range of positions for professionals such as engineers, environmental scientists, financial analysts, administrative personnel; trade workers such as electricians, technicians, steel workers, welders, and ship workers; and other construction jobs during construction and installation of the Proposed Action. O&M would create jobs for maintenance crews, substation and turbine technicians, and other support roles. The decommissioning phase would also generate professional and trade jobs and support roles. Therefore, all phases of the Proposed Action would lead to local employment and economic activity.

Most of the Project's employment impacts would occur during the construction and operations phases. The Proposed Action is expected to create 6,598 job-years during construction (3,103 direct, 1,111

[1] Direct employment refers to jobs created by the direct hiring of workers. Indirect employment refers to jobs created through increased demand for materials, equipment, and services. Induced employment refers to jobs created at businesses where offshore wind industry workers would spend their incomes.
Job-years is an economic term that converts dollars spent into job equivalents based upon historical multipliers that consider factors such as salary, overhead, and hours worked.

indirect, and 2,384 induced), 6,114 job-years during operations (2,780 direct, 1,116 indirect, and 2,218 induced), and 1,202 job-years during decommissioning (289 direct, 468 indirect, and 446 induced). The 2,780 O&M direct job-years over the Project lifetime equate to approximately 79 per year over the 35-year operational life for the Proposed Action (COP Volume II, Table 2.3.1-4; Ocean Wind 2023).

Assuming that conditions are similar to those of the Vineyard Wind 1 project, job compensation (including benefits) is estimated to average between $88,000 and $96,000 for the construction phase, with occupations including engineers, construction managers, trade workers, and construction technicians. O&M occupations would consist of turbine technicians, plant managers, water transportation workers, and engineers, with average annual compensation of approximately $99,000 (BOEM 2021a). A study from the New York Workforce Development Institute provided estimates of salaries for jobs in the wind energy industry that concur with Vineyard Wind 1's projections. The expected salary range for trade workers and technicians ranges from $43,000 to $96,000, $65,000 to $73,000 for ships' crew and officers, and $64,000 to $150,000 for managers and engineers (Gould and Cresswell 2017).

The hiring of local workers would stimulate economic activity through increased demand on housing, food, transportation, entertainment, and other goods and services. A large number of seasonal housing units are available in the vicinity of the Project. During the summer, competition for temporary accommodations may arise, leading to higher rents (COP Volume II, Section 2.3.1.2; Ocean Wind 2023). However, this effect would be temporary during the active construction period and could be reduced if construction is scheduled outside the busy summer season. Permanent workers are expected to reside locally; there is adequate housing supply to accommodate the increase in the local workforce (Table 3.11-3).

Tax revenues for state and local governments would increase as a result of the Project. Equipment, fuel, and some construction materials would likely be purchased from local or regional vendors. These purchases would result in short-term impacts on local businesses by generating additional revenues and contributing to the tax base. Ocean Wind's economic impact study estimated total state and local taxes generated would be $39,858,672 during construction and $1,215,506 during operations (COP Volume II, Table 2.3.1-6; Ocean Wind 2023). Once the Project is operational, property taxes would be assessed on the value of the Ocean Wind 1 facilities. The increased tax base during operations would be a long-term, beneficial impact on local governments in the Project area.

The reasonably foreseeable environmental trends and impacts of the Proposed Action in addition to ongoing non-offshore wind activities, planned non-offshore wind activities, and offshore wind activities are described by IPF below.

Energy generation and security: The Proposed Action would produce up to 1,100 MW of electricity, or 3 percent of the estimated 35 GW of reasonably foreseeable offshore wind generation potential for the U.S. East Coast. Based on Ocean Wind's OREC allowance, the expected annual energy production would be up to 4,851 GW-hours per year (Ocean Wind 2021). According to the BPU OREC Award, ratepayers could see an increase in their monthly energy bill of $1.46 for residential customers, $13.05 for commercial customers, and $110.10 for industrial customers (New Jersey Office of the Governor 2019). Offshore wind energy projects could produce energy at long-term fixed costs, which could provide stability against fossil fuel price volatility once built, resulting in a minor beneficial impact.

Lighting: Both onshore and offshore structures emit light that could be visible from some beaches, coastlines, and elevated inland areas, depending on vegetation, topography, weather, and atmospheric conditions. Offshore, aviation hazard lighting on WTGs could affect employment and economics in these areas if the lighting discourages visits or vacation home rentals or purchases in coastal locations where the Proposed Action's WTG lighting is visible. Ocean Wind proposes to implement an ADLS to automatically turn the aviation obstruction lights on and off in response to the presence of aircraft in proximity to the wind farm. Such a system will reduce the amount of time that the lights are on, thereby potentially minimizing the visibility of the WTGs from shore and related effects on the local economy. Impacts related to structure lighting would have localized, long-term, and negligible impacts on demographics, employment, and economics.

The anticipated increase in vessel traffic would result in growth in the nighttime traffic of vessels with lighting. Lighting from vessels would occur during nighttime Project construction or maintenance. This lighting would be visible from coastal businesses, especially near the ports used to support Proposed Action construction. Short-term vessel lighting is not anticipated to discourage tourist-related business activities and would not affect other businesses; therefore, the impact of vessel lighting would be short term and negligible.

Cable emplacement and maintenance: The Proposed Action's cable emplacement would generate vessel anchoring and dredging at the worksite, requiring recreational vessels to avoid and navigate around the worksites and resulting in short-term disturbance to species important to recreation and tourism, with potential adverse effects on employment and income. Array cable installation would require a maximum of 18 vessels (3 main laying, 3 burial, and 12 support vessels) (COP Volume I, Table 6.1.2-3; Ocean Wind 2023). Offshore export cable installation would require a maximum of 24 vessels (3 main laying, 3 main cable jointing, 3 burial, and 15 support vessels) (COP Volume I, Table 6.1.2-5; Ocean Wind 2023). While it is not specified how long vessels would be present at a given location, there would be at least one location where cable splicing is necessary, which could require a vessel to remain at the same location for several days (COP Volume I, Table 4.4-1; Ocean Wind 2023).

The approximately 3,785 acres of seafloor disturbance (associated with offshore cable and inter-array cable installation), disruption of fish stocks, and concrete mattresses covering cables in hard-bottom areas could hinder commercial trawlers/dredgers, potentially reducing income and increasing costs for affected businesses over the long term. Cable installation would have localized, short-term, minor impacts on demographics, employment, and economics, while maintenance of the Proposed Action and other existing submarine cables would have intermittent, long-term, negligible impacts.

Noise: Noise from vessel traffic would affect commercial fishing businesses and recreational businesses due to impacts on species important to commercial/for-hire fishing, recreational fishing, and marine sightseeing activities (COP Volume II, Section 2.3.4.2; Ocean Wind 2023); and noise from maintenance and repair operations that make the wind energy facilities less attractive to fishing operators and recreational boaters (COP Volume II, Section 2.3.3.1.2; Ocean Wind 2023). Noise from O&M activities would have localized, intermittent, long-term, negligible impacts on demographics, employment, and economics.

The estimated 101 foundations (WTGs and substations) would generate noise from pile driving, one of the most impactful noises on marine species, especially if multiple project construction activities occur in close spatial and temporal proximity (COP Volume III, Appendix R-2; Section C.6; Ocean Wind 2023). These disturbances would be temporary and localized, and extend only a short distance beyond the work area. Pile driving could harm marine species or cause avoidance by commercial fish populations, which would in turn affect commercial and for-hire fishing as well as recreational vessels that depend on these animals (COP Volume II, Section 2.2.7.2.1; Ocean Wind 2023). Pile driving and associated noise would have localized, short-term, and minor impacts on demographics, employment, and economics.

Infrequent trenching from pipeline and cable-laying activities emit noise. This noise could temporarily disrupt commercial fishing, marine recreational businesses, and onshore recreational businesses. Noise from trenching and trenchless technology would affect marine life populations, which would in turn affect commercial and recreational fishing businesses. Impacts on marine life would also affect onshore recreational businesses due to noise near public beaches, parks, residences, and offices. The use of trenchless technology at natural and sensitive landfall locations where possible would minimize direct impacts (COP Volume II, Section 2.2.2.2.1; Ocean Wind 2023). Cable laying and trenching would have localized, intermittent, short-term, and negligible impacts on demographics, employment, and economics.

Vessel noise could affect marine species relied upon by commercial fishing businesses, marine recreational businesses, recreational boaters, and marine sightseeing activities. Vessel traffic would occur between ports (outside the recreational and tourism geographic analysis area) and offshore wind work areas. Most vessel traffic would travel to the WTG installation area, with fewer vessels needed along the cable installation routes (COP Volume II, Section 2.3.6.2.2; Ocean Wind 2023). Noise from vessels would have short-term, intermittent, negligible impacts on demographics, employment, and economics.

Port utilization: Proposed Action activities at ports would support port investment and employment and would also support jobs and businesses in supporting industries and commerce. Several ports are indicated as possibly supporting proposed Project construction: the ports of Atlantic City, Hope Creek, Paulsboro, and Port Elizabeth in New Jersey; the port of Norfolk in Virginia; and the port of Charleston in South Carolina (COP Volume II, Section 2.3.6.2.1; Ocean Wind 2023). These ports would require a trained workforce for the offshore wind industry including additional shore-based and marine workers that would contribute to local and regional economic activity.

The economic benefits would be greatest during construction when the most jobs and most economic activity at ports supporting the Proposed Action would occur. During operations, activities would be concentrated in Atlantic City, New Jersey where the Project’s onshore O&M facility would be located and in other ports that may support Project-related vessel traffic, including Norfolk, Virginia. Ocean Wind estimated that 69 permanent jobs would support operations in Atlantic City. The O&M facility would help to diversify the local economy by providing a source of skilled, year-round jobs. In addition, the facility would undergo dredging in the marina and at Absecon Inlet, which would benefit multiple marina users (COP Volume II, Section 2.4.1; Ocean Wind 2023). Overall, operation of the Proposed Action would generate 2,780 job-years of skilled permanent labor (direct job-years) and over 6,000 total job-years created (direct job-years plus indirect and induced job creation) (COP Volume II, Section 2.3.1.2.2; Ocean Wind 2023). The Proposed Action would have a moderate beneficial impact on demographics, employment, and economics from port utilization due to greater economic activity and increased employment at ports used by the Proposed Action.

Presence of structures: The Proposed Action would add up to 101 offshore wind structures (98 WTGs and 3 substations), with 84 acres (0.3 km^2) of foundation and scour protection and 94 acres (0.4 km^2) of offshore export cable hard protection, which could affect marine-based businesses (i.e., commercial and for-hire recreational fishing businesses, offshore recreational businesses, and related businesses) through impacts such as entanglement and gear loss/damage, navigational hazard and risk of allisions, fish aggregation, habitat alteration, and space use conflicts. These structures may cause vessel operators to reroute, which would affect their fuel costs, operating time, and revenue. Due to the risk of gear entanglement, fisheries using bottom gear may be permanently disrupted, which would increase economic impacts on the commercial and for-hire recreational fishing industries. Marine-based businesses may be adversely affected due to the possible displacement of mobile species and potential for WTGs to become an exclusion area for fishing. Shoreside support services, such as bait and ice shops, vessels and infrastructure, insurance and maintenance services, processing, markets, and domestic/international shipping services, are anticipated to experience the same impacts as the fishing industry itself (BOEM 2017). As described in Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, considering the small number of vessels and fishing activity that would be affected, the impacts on other fishing industry sectors, including seafood processors and distributers and shoreside support services, would be adverse, with the level of impact depending on the fishery in question. The presence of structures would have continuous, long-term, and negligible to moderate impacts on demographics, employment, and economics.

Offshore wind structures could encourage fish aggregation and generate reef effects that attract recreational fishing vessels. These effects would only affect the minority of recreational fishing vessels that reach the wind energy facilities. This would have long-term, negligible benefits on demographics, employment, and economics. Proposed Action structures could increase economic activity associated with offshore sightseeing because these structures create foraging opportunities for harbor and gray seals, sea turtles, bats, northern gannets, loons, and peregrine falcons. These forms of marine life could attract private or commercial recreational sightseeing vessels (COP Volume II, Section 2.2.3.2.2; Ocean Wind 2023). This would have long-term, negligible beneficial impacts on demographics, employment, and economics.

Views of WTGs could have impacts on businesses serving the recreation and tourism industry. The presence of offshore wind structures could affect shore-based activities, surface water activities, wildlife and sightseeing activities, diving/snorkeling, and recreational boating routes (COP Volume II, Section 2.3.3.1.2; Ocean Wind 2023). As described in Section 3.18, during construction, viewers on the Jersey Shore would see the upper portions of tall equipment such as mobile cranes. These cranes would move from turbine to turbine as construction progresses, and thus would not be long-term fixtures. Based on the duration of construction activity, visual contrast associated with construction of the Proposed Action would have a temporary, negligible impact on recreation and tourism. The WTGs would be in open ocean approximately 15 miles east of Atlantic City, New Jersey. At maximum vertical extension, the blade tips of the WTGs would be theoretically visible to a viewer at the ocean surface or at beach elevations at distances up to 39.6 miles with clear-day conditions. Between 39.6 miles and 31 miles, only the WTG blades would be potentially visible above the horizon from the perspective of a beach-elevation viewer. Ocean Wind has voluntarily committed to use ADLS and non-reflective pure white (RAL Number 9010) or light gray (RAL Number 7035) paint colors as described in Appendix H to reduce impacts. Additionally, the lower sections of each WTG would be marked with high-visibility (RAL Number 1023) yellow paint from the water line to a minimum height of 50 feet (15.2 meters). Due to EC, the yellow paint would be below the horizon beyond approximately 11.4 miles (18.3 kilometers) from eye levels of 5 feet (1.5 meters). Portions of 949 WTGs from the Proposed Action combined with offshore wind projects could potentially be visible from coastal and elevated locations in the geographic analysis area. The simulations prepared by Ocean Wind show anticipated views in clear conditions of offshore wind projects associated with the No Action Alternative combined with the Proposed Action (Appendix M). The WTGs would be discernable on a clear day, with the color and irregular forms of the WTGs contrasting with the uninterrupted horizontal horizon line associated with the open ocean. As shown in the simulations, the Proposed Action WTGs would contribute the most from the closest locations, the northernmost coast of Cape May County and the coast of Atlantic County. The Proposed Action would be visually subordinate to offshore wind projects along the shore of Ocean County. Atmospheric conditions could limit the number of WTGs discernable during daylight hours for a significant portion of the year (COP Volume III, Appendix L; Ocean Wind 2023).

Traffic: The Proposed Action would generate vessel traffic in the Project area and to and from the ports supporting project construction, O&M, and decommissioning. Ocean Wind estimates that construction activity would generate between 20 and 65 vessels operating at any given time. During operations, the Proposed Action would generate approximately 10 vessel trips per day (refer to Section 3.16 for additional information regarding anticipated vessel traffic). Increased vessel traffic would increase the use of port and marine businesses, including tug services, dockage, fueling, inspection/repairs, and provisioning. The vessel traffic generated by the Proposed Action alone would result in increased business for marine transportation and supporting services in the geographic analysis area with continuous, short-term, and minor beneficial impacts during construction and decommissioning, and negligible beneficial impacts during operations. Vessel traffic associated with the Proposed Action could also result in temporary, periodic congestion within and near ports, leading to potential delays and an increased risk for collisions between vessels, which would result in economic costs for vessel owners. As a result of potential delays from increased congestion and increased risk of damage from collisions, the Proposed Action would have continuous, short-term, and minor impacts during construction and negligible impacts during operations.

Land disturbance: Construction of the Proposed Action would require onshore cable installation and substation construction. Installation of the cables would occur within a 50-foot-wide temporary construction corridor. Based on the landfall options with the longest onshore cable routes, construction of the Oyster Creek onshore export cable could result in up to 32 acres of temporary disturbance, and construction of the BL England onshore export cable could result in up to 48 acres of temporary disturbance (COP Volume I, Table 6.2.1-1; Ocean Wind 2023). The employment and economic impact of the Proposed Action caused by disturbance of businesses near the onshore cable route and substation construction site would result in localized, short-term, minor impacts.

3.11.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities.

Energy generation and security: The Proposed Action would contribute a noticeable increment to the combined energy security and resilience impacts from ongoing and planned activities including offshore wind. Impacts related to energy generation and security would have long-term, regional, and minor beneficial impacts on demographics, employment, and economics.

Lighting: Between 2023 and 2030, there may be 12 offshore wind projects within the New York and New Jersey lease areas. WTG lighting in offshore wind activities would be visible from the same locations as the Proposed Action in addition to New Jersey coastal locations. The Proposed Action would contribute a noticeable increment to the combined lighting impacts from ongoing and planned activities including offshore wind, which would be negligible.

Cable emplacement and maintenance: The Proposed Action would contribute a noticeable increment to the combined cable emplacement and maintenance impacts on demographics, employment, and economics from ongoing and planned activities including offshore wind, which would be short term and minor.

Noise: Of the adjacent offshore wind projects, construction of the Proposed Action is anticipated to overlap with construction of the Atlantic Shores South offshore wind project for up to 1 year, potentially contributing to increased noise impacts during simultaneous construction activity (Appendix F, Table F2-1). While operational activity would overlap, noise impacts during operations would be far less than during construction. Therefore, the Proposed Action would contribute a noticeable increment to the combined noise impacts on demographics, employment, and economics from ongoing and planned activities including offshore wind, which would be short term and negligible.

Port utilization: Other offshore wind energy activity would provide business activities at the same ports as the Proposed Action as well as other ports within the geographic analysis area. Port investments are ongoing and planned in response to offshore wind activity. Maintenance and dredging of shipping channels are expected to increase, which would benefit other port users. The Proposed Action would contribute a noticeable increment to the impacts from other ongoing and planned activities, which would be long term, moderate, and beneficial on port utilization and the associated trained and skilled offshore wind workforce that would contribute economic activity in port communities and the region as a whole.

Presence of structures: Across the New York and New Jersey lease areas, up to 2,646 offshore structures, including those of the Proposed Action, would affect employment and economics by affecting marine-based businesses. Presence of structures would have both beneficial impacts, such as by providing sightseeing opportunities and fish aggregation that benefit recreational businesses, and adverse effects, such as by causing fishing gear loss, navigational hazards, and viewshed impacts that could affect business operations and income. The Proposed Action would contribute an undetectable increment to the combined impacts on demographics, employment, and economics from other ongoing and planned activities including offshore wind, which would be long term and moderate due to impacts on commercial and for-hire recreational fishing, for-hire recreational boating, and associated businesses.

Traffic: The Proposed Action would contribute a noticeable increment to the combined impacts from ongoing and planned activities including offshore wind, which would be minor during construction and decommissioning and negligible during operations. Increased vessel traffic would produce demand for supporting marine services, with beneficial impacts on employment and economics during all project phases, including minor to moderate beneficial impacts during construction and decommissioning and negligible beneficial impacts during operations. The increased vessel traffic congestion and collision risk would also have long-term, continuous impacts on marine businesses during all project phases, with minor impacts during construction and decommissioning and negligible impacts during operations.

Land disturbance: The exact extent of land disturbance associated with other projects would depend on the locations of landfall, onshore transmission cable routes, and onshore substations for offshore wind energy projects. Therefore, the incremental impacts contributed by the Proposed Action to the combined land disturbance impacts from ongoing and planned activities including offshore wind would be short term and noticeable due to the short-term and localized disruption of onshore businesses.

3.11.5.3. Conclusions

Impacts of the Proposed Action. BOEM anticipates that the Proposed Action would have negligible impacts on demographics within the analysis area. While it is likely that some workers would relocate to the area due to the Proposed Action, this volume of workers would not be substantial compared to the current population and housing supply. The Proposed Action alone would affect employment and economics through job creation, expenditures on local businesses, tax revenues, grant funds, and support for additional regional offshore wind development, which would have minor beneficial impacts. Construction would have a minor beneficial impact on employment and economics due to jobs and revenue creation over the short duration of the construction period. The beneficial impact of employment and expenditures during O&M would have a modest magnitude over the 35-year duration of the Project. Although tax revenues and grant funds would be modest in magnitude, they also would provide a beneficial impact on public expenditures and local workforce and supply chain development for offshore wind. If the Proposed Action becomes decommissioned, the impacts on demographics, employment, and economics would be minor and beneficial due to the construction activity necessary to remove wind facility structures and equipment. After decommissioning, the Proposed Action would no longer affect employment or produce other offshore wind-related revenues.

While the Proposed Action’s investments in wind energy would largely benefit the local and regional economies through job creation, workforce development, and income and tax revenue, adverse impacts on individual businesses and communities would also occur. Short-term increases in noise during construction, cable emplacement, land disturbance, and the long-term presence of offshore lighting and structures would have negligible to minor adverse impacts on demographics, employment, and economics. The commercial fishing industry and other businesses that depend on local seafood production would experience impacts during construction. Overall, the impacts on commercial fishing and onshore seafood businesses would have minor impacts on demographics, employment, and economics for this component of the geographic analysis area’s economy. Although commercial fishing is a small component of the regional economy, it is important to the identity of local communities within the region. The IPFs associated with the Proposed Action alone would also result in impacts on certain recreation and tourism businesses that range from negligible to minor, with an overall minor impact on employment and economic activity for this component of the analysis area's economy. In summary, the Proposed Action would have **minor adverse** and **moderate beneficial** impacts on demographics, employment, and economics.

Cumulative Impacts of the Proposed Action. The incremental impacts contributed by the Proposed Action to the overall impacts on demographics, employment, and economics would range from undetectable to noticeable. BOEM anticipates that cumulative impacts on demographics, employment, and economics in the geographic analysis area associated with the Proposed Action would be **minor** adverse and **moderate beneficial**. The moderate beneficial impacts primarily would be associated with the investment in offshore wind, job creation and workforce development, income and tax revenue, and infrastructure improvements, while the minor adverse effects would result from aviation hazard lighting on WTGs, new cable emplacement and maintenance, the presence of structures, vessel traffic and collisions during construction, and land disturbance. Impacts on commercial and for-hire recreational fishing are anticipated to be moderate but only one component of the overall impacts. Because they are not expected to disrupt normal demographic, employment, and economic trends, the overall impacts in the geographical analysis area likely would be minor.

3.11.6 Impacts of Alternative B on Demographics, Employment, and Economics

Impacts of Alternative B. Alternatives B-1 and B-2 would result in a slight reduction in both adverse and beneficial impacts on demographics, employment, and economics compared to the Proposed Action, but the overall impact magnitudes would be the same. Alternatives B-1 and B-2 would install fewer WTGs (up to 9 fewer WTGs for B-1; up to 19 fewer WTGs for B-2) and associated inter-array cables, which would slightly reduce the construction impact footprint and installation period. Construction of fewer WTGs would result in a shorter duration of noise impacts and less vessel traffic, which could reduce impacts on commercial and for-hire recreational fishing. Conversely, the reduced number of WTGs would also mean that the Project would generate less energy—with the removal of 9 WTGs, Alternative B-1 would result in an expected annual energy production of 4,178 GW-hours per year compared to 4,851 GW-hours per year under the Proposed Action (Ocean Wind 2021)—and would therefore result in slightly lower beneficial impacts associated with delivering a reliable supply of energy. The removal of 19 WTGs under Alternative B-2 would result in even less energy generation but selection of the alternative would be contingent on a larger turbine being commercially available, which would offset some of these potential energy losses. Because Alternative B would produce less energy, it would also offset fewer GHG emissions from fossil-fueled power generation compared to the Proposed Action, further reducing beneficial impacts. A reduced number of WTGs would also generate less economic activity, which would reduce port utilization and result in lower expenditures in general. However, the change in these impacts would all be slight and would not change the overall impact rating compared to the Proposed Action.

Alternatives B-1 and B-2 could potentially reduce visual impacts by removing the 9 and 19 WTGs, respectively, closest to the shore, thereby reducing potential impacts on the tourism, recreation, and real estate businesses that are sensitive to viewshed impacts from WTGs. However, because most of the WTGs would still be visible, localized, long-term, minor impacts are still anticipated. Fewer WTGs would reduce reef effects and fish aggregation, which would have unclear impacts on the commercial and for-hire and recreational fisheries that rely on marine species. Fewer WTGs would reduce the risk of allisions and the need for vessels to reroute, which would reduce travel time, fuel costs, and other associated costs.

Cumulative Impacts of Alternative B. The incremental impacts contributed by Alternatives B-1 and B-2 to the impacts from ongoing and planned activities including offshore wind would be similar to those described under the Proposed Action.

3.11.6.1. Conclusions

Impacts of Alternative B. Alternatives B-1 and B-2 would result in slightly lower adverse impacts and slightly lower beneficial impacts compared to the Proposed Action, but would not change the overall impact levels, which are anticipated to range from **minor** adverse impacts and **moderate beneficial** impacts on demographics, employment, and economics.

Cumulative Impacts of Alternative B. The incremental impacts contributed by Alternatives B-1 and B-2 to the overall impacts on demographics, employment, and economics would be the same as under the Proposed Action and would range from undetectable to noticeable. Considering all the IPFs together, BOEM anticipates that the overall impacts on demographics, employment, and economics associated with Alternatives B-1 and B-2 when combined with impacts from ongoing and planned activities including offshore wind would be **minor** adverse and **moderate beneficial**.

3.11.7 Impacts of Alternative C on Demographics, Employment, and Economics

Impacts of Alternative C. Impacts of Alternatives C-1 and C-2 would be similar to those of the Proposed Action for demographics, employment, and economics. The 0.81- to 1.08-nm buffer between WTGs in the Ocean Wind 1 Lease Area and WTGS in the Atlantic Shores South Lease Area, as described in Section 3.16, would allow for the transit of larger fishing vessels or survey vessels through the Wind Farm Area. The buffer could improve safety for commercial and recreational fishing vessels in the Wind Farm Area (Sections 3.9 and 3.18).

Alternative C-1 would relocate eight WTG positions to attain the buffer while Alternative C-2 would compress the WTG layout from 1 nm between rows to no less than 0.99 nm between rows. At the distance of 15.3 miles from the shore, relocation of one row of WTGs under Alternative C-1 and compression of the WTG array under Alternative C-2 may be unnoticeable to the casual viewer and would not change visual-related impacts compared to the Proposed Action. Regarding footprint disturbance, BOEM does not expect relocation of the eight WTGs and compression of the 98 WTGs under Alternatives C-1 and C-2, respectively, to significantly change the potential impacts compared to the Proposed Action, as the number of WTGs would remain the same and the overall footprint would remain the same or slightly less (Section 3.13). All other design parameters and potential variability in the design would be the same as under the Proposed Action.

Cumulative Impacts of Alternative C. The incremental impacts contributed by Alternative C to the impacts from ongoing and planned activities including offshore wind would be similar to those described under the Proposed Action.

3.11.7.1. Conclusions

Impacts of Alternative C. The impacts on demographics, employment, and economics resulting from Alternatives C-1 and C-2 are anticipated to range from **minor** adverse and **moderate beneficial**. The 0.81- to 1.08-nm buffer would marginally improve safety of vessel transit, so the impacts resulting from individual IPFs associated with Alternatives C-1 and C-2 would be slightly less adverse than the Proposed Action's impacts but the overall impact magnitudes would not change.

Cumulative Impacts of Alternative C. The impacts contributed by Alternatives C-1 and C-2 to the overall impacts on demographics, employment, and economics would be the same as under the Proposed Action and would range from undetectable to noticeable. Considering all the IPFs together, BOEM anticipates that the overall impacts on demographics, employment, and economics associated with Alternatives C-1 and C-2 when combined with impacts from ongoing and planned activities including offshore wind would be **minor** adverse and **moderate beneficial**.

3.11.8 Impacts of Alternative D on Demographics, Employment, and Economics

Impacts of Alternative D. Alternative D would install up to 15 fewer WTGs and associated inter-array cables, which would slightly reduce the construction impact footprint and installation period. Alternative D could potentially reduce localized impacts on marine species that local commercial/for-hire and recreational fishing use for seafood production compared to the Proposed Action but the overall impact magnitudes would not change. Alternative D would allow commercial fishing vessels to operate and fish without potential impacts from structures in the locations where the WTGs would be removed. In addition, reduced underwater noise from pile driving and vessels during construction activities, and reduced habitat alteration, vessel strikes, artificial lighting, and decommissioning activities, would lessen the potential for displacement of marine species and associated impacts on commercial and recreational vessels.

Construction of fewer WTGs would result in a shorter duration of noise impacts and less vessel traffic, which could reduce impacts on commercial and for-hire recreational fishing. The reduced number of WTGs would also mean that the Project would generate less energy—with the removal of 15 WTGs, Alternative D would result in an expected annual energy production of 3,922 GW-hours per year compared to 4,851 GW-hours per year under the Proposed Action (Ocean Wind 2021)—and would therefore result in slightly lower beneficial impacts associated with delivering a reliable supply of energy and reduced GHG emissions from offsetting fossil-fueled power generation. However, selection of the alternative would be contingent on a larger turbine being commercially available, which would offset some of these potential energy losses. A reduced number of WTGs would also generate less economic activity, which would reduce port utilization and result in lower expenditures in general. However, the change in these impacts would all be slight and would not change the overall impact rating compared to the Proposed Action.

Cumulative Impacts of Alternative D. The incremental impacts contributed by Alternative D to the impacts from ongoing and planned activities including offshore wind would be similar to those described under the Proposed Action.

3.11.8.1. Conclusions

Impacts of Alternative D. Alternative D would result in slightly reduced impacts on demographics, employment, and economics compared to the Proposed Action, but the overall impact magnitude would not change. The removal of 15 WTGs under Alternative D would result in fewer impacts on marine species and, by extension, fewer impacts on commercial and for-hire recreational fisheries. Energy generation and associated beneficial impacts would be reduced under Alternative D because there would be fewer WTGs. Impacts on demographics, employment, and economics under Alternative D are anticipated to be **minor** adverse and **moderate beneficial**.

Cumulative Impacts of Alternative D. The impacts resulting from individual IPFs would be the same as those of the Proposed Action: **minor** adverse impacts and **moderate beneficial** impacts. Considering all the IPFs together, BOEM anticipates that the overall impacts on demographics, employment, and economics associated with Alternative D when combined with the impacts from ongoing and planned activities including offshore wind would be **minor** adverse and **moderate beneficial**.

3.11.9 Impacts of Alternative E on Demographics, Employment, and Economics

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. The impacts of Alternative E on demographics, employment, and economics would be the same as those of the Proposed Action. Increased onshore construction activity on Island Beach State Park may potentially disturb and restrict park operations and visitation due to typical construction impacts such as increased noise, traffic, and road disturbances. However, impacts would remain localized and short term while the cables are being installed and BOEM does not anticipate impacts to be materially different than those described under the Proposed Action.

Cumulative Impacts of Alternative E. The incremental impacts resulting from individual IPFs would be similar to those described under the Proposed Action.

3.11.9.1. Conclusions

Impacts of Alternative E. The increased length of the onshore cable route under Alternative E would slightly increase the potential for onshore impacts related to noise and traffic that could affect local businesses. However, the overall impact magnitudes are anticipated to be the same as those of the Proposed Action, ranging from **minor** adverse impacts to **moderate beneficial** impacts on demographics, employment, and economics.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the overall impacts on demographics, employment, and economics would be the same as those of the Proposed Action, ranging from undetectable to noticeable. Considering all the IPFs together, BOEM anticipates that the overall impacts on demographics, employment, and economics associated with Alternative E when combined with the impacts from ongoing and planned activities including offshore wind would be **minor** adverse and **moderate beneficial**.

3.11.10 Proposed Mitigation Measures

No additional measures to mitigate impacts on demographics, employment, and economics have been proposed for analysis.

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3.14. Land Use and Coastal Infrastructure

This section discusses potential impacts on land use and coastal infrastructure from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area, as shown on Figure 3.14-1, includes Ocean City, Upper Township, Berkeley Township, Lacey Township, and Ocean Township, and municipal boundaries surrounding the ports that may be used for the Project. Ocean Wind proposes the use of ports in Paulsboro, Hope Creek, and Port Elizabeth, New Jersey; Charleston, South Carolina; and Norfolk, Virginia. In addition, Ocean Wind proposes to use an O&M facility that would be in Atlantic City, New Jersey. These areas encompass locations where BOEM anticipates impacts associated with proposed onshore facilities and ports.

3.14.1 Description of the Affected Environment for Land Use and Coastal Infrastructure

Within the geographic analysis area, land use is diverse, including water, wetlands, barren land, forest, urban, and agricultural land uses. The proposed Project includes two interconnection points with the PJM electric transmission system at the BL England in Upper Township, New Jersey and at the Oyster Creek onshore substation in Lacey Township, New Jersey. Commercial development in northern Cape May County, which includes Ocean City, Upper Township, and Marmora and Beesley's Point, primarily serves local needs with minimal large manufacturing or production, so has minimal, if any, large distribution facilities, and the county includes a variety of residential development types such as single family, townhouses, and over-55 communities. In Ocean City, New Jersey the dominant land use is urban, while wetlands, forest, and urban uses are found primarily on the mainland in Upper Township, New Jersey (COP, Volume II, Section 2.3.5; Ocean Wind 2023).

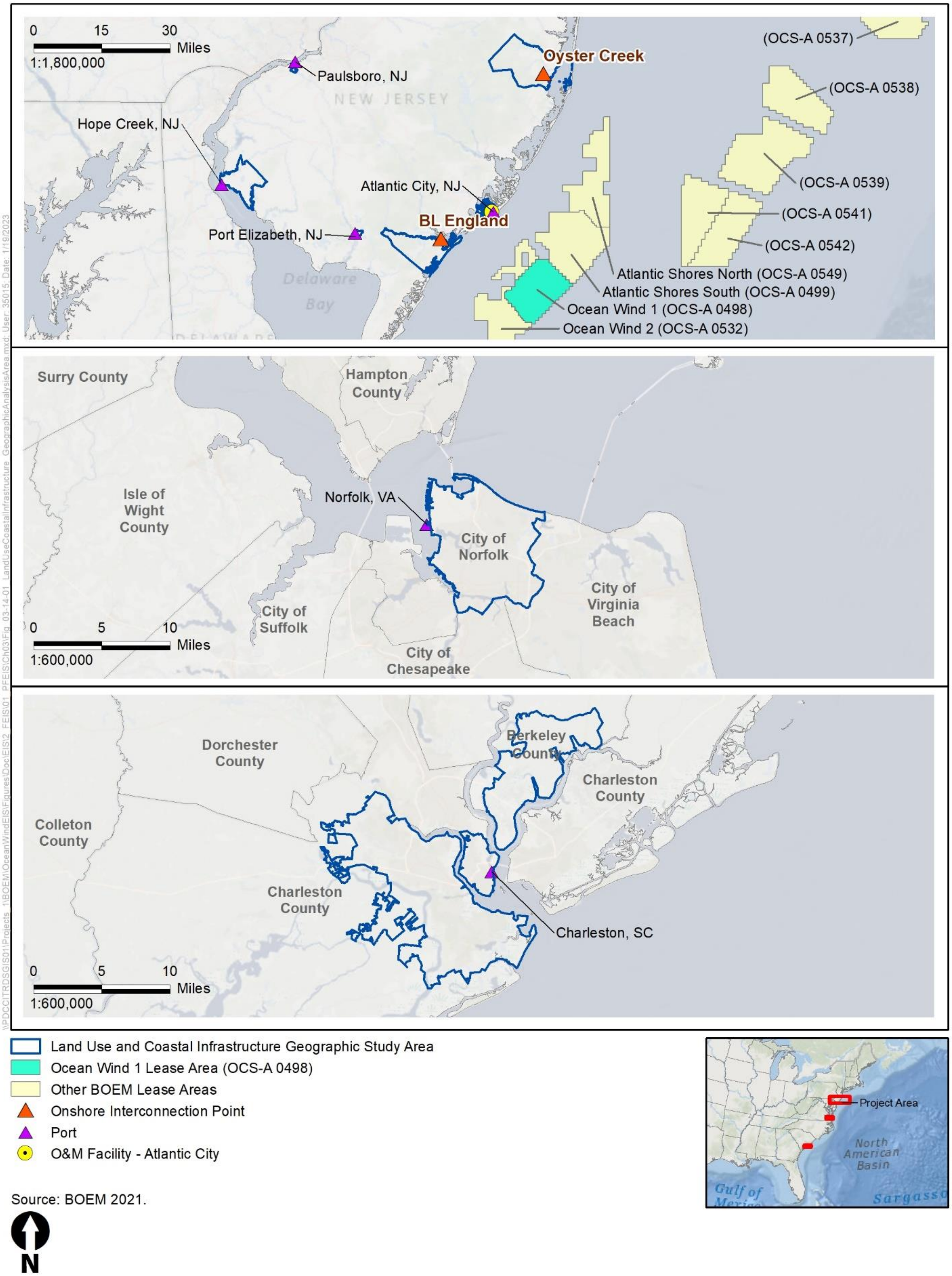
The proposed BL England onshore substation would be sited on a former coal, oil, and diesel plant in Upper Township, New Jersey. Land surrounding the proposed BL England onshore substation has an urban land use classification and in the Waterfront Town Center zoning district (NJDEP 2015; Township of Upper 2021). The BL England onshore export cable route has four landfall options within the PDE; three proposed landfall locations on the barrier island of Ocean City and one possible landfall location west of the Garden State Parkway in Upper Township, New Jersey. Based on NJDEP land use cover data, land use is classified as urban at all four landfall sites considered and the area surrounding those sites, with the land bordering the potential landfall location at 35th Street in Ocean City, New Jersey classified as barren land (NJDEP 2015). Along the proposed BL England onshore export cable routes, land use is classified as water, wetlands, barren lands, forest, urban, and agriculture (NJDEP 2015). Land along the proposed BL England onshore export cable route is zoned for residential use, including one-, two-, and multifamily, business, gateway/mixed use, and public use (Ocean City 2014).

The proposed Oyster Creek onshore substation would be sited on the former Oyster Creek nuclear plant in Lacey Township, New Jersey. Land surrounding the proposed Oyster Creek onshore substation has an urban land use classification and is within an industrial zoning district (NJDEP 2015; Township of Lacey 2009). Onshore export cable corridors near Oyster Creek are in Berkeley Township, Lacey Township, and Ocean Township. Land use in the vicinity of the Oyster Creek route is classified into five different land use groups: water, wetlands, barren land, forest, and urban (NJDEP 2015). The primary uses along the Oyster Creek onshore export cable corridor are a combination of wetlands, urban development, and forest land, with urban development primarily east of U.S. Route 9. Portions of the Oyster Creek onshore export cable corridor is within lands approved for acquisition by USFWS as part of the Edwin B. Forsythe National Wildlife Refuge; however, as they have yet to be acquired by USFWS, these lands do not need to be evaluated for impacts relative to the refuge (USFWS 2021).

The Oyster Creek export cable corridor would also cross Island Beach State Park, where there are many tidal rivers, waters, beaches, and wetlands (COP, Volume II, Section 2.3.5; Ocean Wind 2023). Island Beach State Park is managed pursuant to the Coastal Barrier Resources Act, enacted to minimize the loss of human life, wasteful federal expenditures, and damage to natural resources associated with the development of coastal barriers. Under the Coastal Barrier Resources Act, Island Beach State Park is listed as an "Otherwise Protected Area," a categorization used for national wildlife refuges, state and national parks, and local and private conservation areas on coastal barriers that are held for conservation or recreation purposes (USFWS 2014). Because it is listed as an otherwise protected area, Coastal Barrier Resources Act consultation with USFWS is not required and the only federal spending restriction is a prohibition on federal flood insurance.

Important landscape features near BL England and Oyster Creek include a combination of natural views such as beaches, shorelines, and scenic vistas, and man-made views such as unique buildings, landscaping, parks, and other cultural features. The New Jersey Pinelands feature some of the largest unbroken tracts of Atlantic coastal pine forests in the eastern U.S., stretching across more than seven counties of New Jersey. While the entirety of the Onshore Project area is outside of the state-designated Pinelands Area (development in this area is regulated by the State of New Jersey Pinelands Commission), portions of the BL England export cable corridors are within the federally designated Pinelands National Reserve in the Forest Area and Regional Growth area Pineland Management Areas (New Jersey Pinelands Commission 2021). All future land use in Pineland Management Areas is subject to guidelines and regulations established in the Pinelands Comprehensive Management Plan. Proposed onshore export cable corridors in Marmora and Beesley's Point are within the Regional Growth Area Pineland Management Area, where sewered and industrial uses are permitted (New Jersey Pinelands Commission 2022). Within the Forest Area Pineland Management Area, roadside retail within 300 feet of pre-existing commercial uses is permitted, as are low-intensity recreational uses. Proposed onshore export cable corridors on Island Beach State Park do not fall within the Pinelands National Reserve. The Great Egg Harbor River is a 129-mile river system and was designated as a Wild and Scenic River by Congress in 1992 (USNPS 2016). It is almost entirely within the Pinelands National Reserve and drains into wetlands within the reserve.

In addition to the landfall locations and onshore substations, the Project would use various ports for construction and O&M. The ports under consideration include Paulsboro, Hope Creek, and Port Elizabeth, New Jersey; Charleston, South Carolina; and Norfolk, Virginia. The O&M facility would be in Atlantic City on two parcels adjacent to Clam Creek that had previously served as a marine terminal. The area is currently zoned for commercial marine use (Atlantic City 2006). The Port of Paulsboro is surrounded by land zoned as the marina industrial business park (Borough of Paulsboro 2010). Hope Creek and Port Elizabeth are within areas zoned for industrial use (Township of Lower Alloways Creek 2014; City of Elizabeth 2000). Land use surrounding the Port of Charleston includes light industry, where uses compatible with surrounding commercial districts are permitted (City of Charleston 2012). The port in Norfolk, Virginia is within marine industrial land use (City of Norfolk 2021).



Source: BOEM 2021.

Figure 3.14-1 Land Use and Coastal Infrastructure Geographic Analysis Area

3.14.2 Environmental Consequences

3.14.2.1. Impact Level Definitions for Land Use and Coastal Infrastructure

Definitions of potential impact levels are provided in Table 3.14-1.

Table 3.14-1 Impact Level Definitions for Land Use and Coastal Infrastructure

Impact Level	Impact Type	Definition
Negligible	Adverse	Adverse impacts on area land use would not be detectable.
	Beneficial	Beneficial impacts on area land use would not be detectable.
Minor	Adverse	Adverse impacts would be detectable but would be short term and localized.
	Beneficial	Beneficial impacts would be detectable but would be short term and localized.
Moderate	Adverse	Adverse impacts would be detectable and broad based, affecting a variety of land uses, but would be short term and would not result in long-term change.
	Beneficial	Beneficial impacts would be detectable and broad based, affecting a variety of land uses, but would be short term and would not result in long-term change.
Major	Adverse	Adverse impacts would be detectable, long term, and extensive, and result in permanent land use change.
	Beneficial	Beneficial impacts would be detectable, long term, and extensive, and result in permanent land use change.

3.14.3 Impacts of the No Action Alternative on Land Use and Coastal Infrastructure

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on land use and coastal infrastructure, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for land use and coastal infrastructure. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.14.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, land use and coastal infrastructure in the geographic analysis area described in Section 3.14.1, *Description of the Affected Environment for Land Use and Coastal Infrastructure*, would continue to be affected by ongoing non-offshore wind and offshore wind activities, especially onshore and coastal regional trends, development projects, and port expansion.

The geographic analysis area lies within developed communities that would experience continued commerce and development activity in accordance with established land use patterns and regulations. The geographic analysis area is highly developed and most construction projects would likely affect land that has already been disturbed from past development, although some development on undeveloped land may also occur. Ports in the geographic analysis area would continue to serve marine traffic and industries and experience periodic dredging and improvement projects to meet ongoing needs. A channel-deepening project at the Port of Virginia is currently underway and is anticipated to be completed in 2024 (Virginia Port Authority 2021). Dredging and port improvements would allow larger vessels to use the port and may result in increased port use and conversion of surrounding land use if the ports are expanded. See Table F1-12 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for land use and coastal infrastructure. There are no ongoing offshore wind activities within the geographic analysis area for land use and coastal infrastructure.

3.14.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other activities (without the Proposed Action). BOEM has reviewed available information regarding the potential for other offshore wind activities to occur within the geographic analysis area for land use and coastal infrastructure. Atlantic Shores South proposes points of interconnection at the Cardiff Substation and Larrabee Substation (Atlantic Shores 2021). Transmission lines rated at 138 kV and higher have sufficient thermal capability to deliver power from an offshore wind project to the utility's load center. The *New Jersey Offshore Wind Energy: Feasibility Study* identified existing transmission lines and substations rated at 138 kV and above. These substations would be likely potential points of interconnection for future offshore wind activities but are outside of the geographic analysis area.

The geographic analysis area also includes municipal boundaries surrounding the ports that may be used for the Project. Atlantic Shores South has proposed use of an O&M facility in Atlantic City and identified that the Ports of Paulsboro and Charleston may be used during construction. Furthermore, the potential exists for other offshore wind activities to occur within the municipal boundaries surrounding the ports.

Therefore, BOEM expects planned offshore wind development activities to affect land use and coastal infrastructure through the following primary IPFs.

Accidental releases: Accidental releases of fuel/fluids/hazardous materials may increase due to onshore construction for the landfalls and onshore export cable routes of offshore wind activities. Accidental release risks would be highest during construction, but still pose a risk during operation and decommissioning of offshore wind facilities. BOEM assumes all projects and activities would comply with laws and regulations to minimize releases. Accidental releases could result in temporary restrictions on use of adjacent properties and coastal infrastructure during the cleanup process; however, the impacts would be localized and short term. The exact extent of impacts would depend on the locations of landfall, substations, and cable routes, as well as the ports that support offshore wind energy projects. The impacts of accidental releases on land use and coastal infrastructure would be negligible (except in the case of very large spills that affect a large land or coastal area).

Lighting: As described in Section 3.20, aviation hazard lighting on portions of eight offshore wind projects (encompassing 761 WTGs) could potentially be visible from beaches and coastal areas in the geographic analysis area. A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 miles from the viewer would have negligible impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018). The majority of the WTG positions associated with other offshore wind activities would be more than 15 miles (24.1 kilometers) from coastal locations with views of the WTGs.

Nighttime lighting from onshore electrical substations could affect the ability to use nearby properties or decisions about where to establish permanent or temporary residences. Nighttime lighting impacts would be localized, constant, and long term. However, it is likely that other offshore wind projects would expand or construct new substations near existing substations, or would construct new substations in areas where land development regulations (i.e., zoning and land use plan designations) allow such uses. For new or expanded substations in business or industrial areas, lighting would have no adverse impacts on land uses. Lighting impacts would depend on the proposed substation locations, but would generally be negligible.

Port utilization: Offshore wind energy projects would make use of port facilities for shipping, berthing, and staging throughout construction, operations, and decommissioning. This use would be similar to existing activities at ports and is consistent with the zoning and land use plan designations of these areas. Offshore wind would likely increase port utilization, and ports would experience beneficial impacts such as greater economic activity and increased employment due to demand for vessel maintenance services and related supplies, vessel berthing, loading and unloading, warehousing and fabrication facilities for offshore wind components, and other business activity related to offshore wind. For larger ports, such as Charleston and Norfolk, offshore wind-related activities would make up a small portion of the total activities at the port; therefore, offshore wind activities are likely to have a negligible impact on land use through port utilization at these ports. However, for smaller ports within the geographic analysis area, such as Paulsboro and Hope Creek, port expansion may be necessary to accommodate the increased activity, resulting in changes to surrounding land use and coastal infrastructure as described below.

Offshore wind activity would make use of planned dredging and improvement projects at ports in the geographic analysis area, including ports in New Jersey and South Carolina. USACE has proposed maintenance dredging of portions of the Newark Bay, New Jersey federal navigation channel, including the removal of material from the Port Elizabeth Channel to occur between July 2021 and February 2022 (USACE 2021). Additionally, in 2017 USACE Charleston District awarded contracts as part of the Charleston Harbor Deepening Project, which will create a 52-foot depth at the entrance channel to Charleston Harbor in South Carolina (USACE n.d.). Dredging at ports is consistent with existing use and would support state strategic plans and local land use goals for the development of waterfront infrastructure. The Atlantic Shores South project would construct an O&M facility in Atlantic City, New Jersey on a shoreside parcel that was formerly used for vessel docking and other port activities. Limited dredging and bulkhead improvements would also be completed for the Atlantic Shores South O&M facility, resulting in minor beneficial impacts on coastal infrastructure (Atlantic Shores 2021). If multiple offshore wind energy projects are constructed at the same time and rely on the same ports, this simultaneous use could stress port resources and could potentially temporarily increase the marine and road traffic, noise, and air pollution in the area during construction activities. Overall, offshore wind projects would have constant, long-term, minor beneficial impacts on port utilization due to the productive use of ports designated for offshore wind activity, as well as localized, short-term, adverse impacts in cases where individual ports are stressed due to simultaneous project activity.

Presence of structures: As described in Section 3.20, portions of eight offshore wind projects (encompassing 761 WTGs) could be visible from some shorelines depending on vegetation, topography, and atmospheric conditions. Visibility would vary with distance from shore, topography, and atmospheric conditions and impacts would generally be localized, constant, and long term. The presence of WTGs would have negligible impacts on land use because while WTGs could be visible from some shoreline locations in the geographic analysis area, WTGs would not result in changes to land use or zoning.

Noise: Noise from offshore wind construction activities is not expected to reach the geographic analysis area, and other offshore wind projects are not anticipated to occur within the geographic analysis area. Therefore, increased noise resulting from other offshore wind activities would not affect land use and coastal infrastructure.

3.14.3.3. Conclusions

Impacts of the No Action Alternative. BOEM expects ongoing non-offshore wind activities to have continuing temporary and permanent impacts on land use and coastal infrastructure. The identified IPFs relevant to land use and coastal infrastructure are accidental releases, nighttime lighting of onshore construction activity and structures, port utilization and expansion, viewshed impacts of offshore structures, presence of onshore infrastructure, and land disturbance, noise, and traffic from construction.

BOEM anticipates that the impacts of ongoing activities, especially onshore and coastal commerce, industry, and construction projects, would have both minor beneficial and negligible adverse impacts in the geographic analysis area. Accidental releases and land disturbance could have temporary adverse impacts on local land uses but, overall, ongoing use and development sustains the region's diverse mix of land uses and provides support for continued maintenance and improvement of coastal infrastructure. Under the No Action Alternative, existing environmental trends and activities would continue, and land use and coastal infrastructure would continue to be affected by natural and human-caused IPFs. The No Action Alternative would result in **negligible** adverse and **minor beneficial** impacts on land use and coastal infrastructure.

Cumulative Impacts of the No Action Alternative. Planned activities other than offshore wind, primarily increased port maintenance and expansion and construction activity, would have impacts similar to those of ongoing activities, with minor beneficial and negligible adverse impacts. BOEM anticipates that the cumulative impacts of the No Action Alternative would be **minor** adverse and **minor beneficial**. Offshore wind would adversely affect land use through land disturbance (during installation of onshore cable and substations) and accidental releases during onshore construction, as well as through the presence of offshore lighting on wind energy structures and views of the structures themselves that could affect the use and value of onshore properties. Beneficial impacts on land use and coastal infrastructure would result because the development of offshore wind would support the productive use of ports and related infrastructure designed or appropriate for offshore wind activity (including construction and installation, O&M, and decommissioning).

3.14.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on land use and coastal infrastructure:

- The time of year during which construction occurs. Tourism and recreational activities in the geographic analysis area tend to be higher from May through September, and especially from June through August (Parsons and Firestone 2018). If Project construction were to occur during this season, impacts on roads and land uses during the busy tourist season would be exacerbated.

Changes to the turbine design capacity would not alter the maximum potential impacts on land use and coastal infrastructure for the Proposed Action and other alternatives because the capacity or number of turbines would not affect onshore infrastructure or port utilization.

Ocean Wind has committed to measures to minimize impacts on land use and coastal infrastructure, which include developing crossing and proximity agreements with utility owners prior to utility crossings (LU-01), complying with NJDEP noise regulations and local noise regulations (SOC-01), and implementing a construction schedule to minimize onshore construction activities during the peak summer recreation and tourism season and to coordinate with local municipalities to minimize impacts on popular events in the area during construction (REC-01 and REC-02) (COP Volume II, Table 1.1-2; Ocean Wind 2023).

3.14.5 Impacts of the Proposed Action on Land Use and Coastal Infrastructure

3.14.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.14.7, *Impacts of Alternative E on Land Use and Coastal Infrastructure*.

The Proposed Action would likely result in localized impacts that would not alter the overall character of land use and coastal infrastructure in the geographic analysis area. The most impactful IPFs would likely include land disturbance during cable installation, the visual impact of offshore WTGs, and the utilization of ports.[1] Other IPFs would likely contribute impacts of lesser intensity and extent and would occur primarily during construction but may also occur during operations and decommissioning.

Accidental releases: Accidental releases from the Proposed Action could include release of fuel/fluids/hazardous materials as a result of port usage, installation of the onshore cables and substation, and substation operation. Potential contamination may occur from unforeseen spills or accidents, and any such occurrence would be reported and addressed in accordance with the local authority. The impact of accidental releases on land use and coastal infrastructure could result in temporary restriction on use of adjacent properties and coastal infrastructure during the cleanup process. Accordingly, accidental releases from the Proposed Action alone would have localized, short-term, negligible to minor impacts on land use.

Lighting: The Proposed Action would include the installation and continuous use of aviation hazard avoidance lighting on WTGs and OSS during low-light and nighttime conditions. During operations, lighting from all the Proposed Action's 98 WTGs could potentially be visible from certain coastal and elevated locations in the geographic analysis area. Ocean Wind proposes to implement an ADLS to automatically turn the aviation obstruction lights on and off in response to the presence of aircraft in proximity of the wind farm. Such a system may reduce the amount of time that the lights are on, thereby potentially minimizing the visibility of the WTGs from shore and related effects on land use. BOEM does not anticipate that intermittent nighttime lighting of the WTGs offshore would affect existing land uses onshore given the use of ADLS and the existing developed areas within the geographic analysis area. At onshore facilities, security lighting would be down shielded to mitigate light pollution (VIS-04; COP Volume II, Table 1.1-2; Ocean Wind 2023). Nighttime lighting from the onshore substations has the potential to affect the use of adjacent properties; however, the proposed onshore substations would be constructed in areas where land development regulations, such as zoning and land use plan designations, allow and would be consistent with such use. As a result, WTG lighting and lighting of onshore infrastructure for the Proposed Action alone would have a long-term, continuous, minor impact on land use and coastal infrastructure in the geographic analysis area.

Port utilization: The Proposed Action does not include port expansion activities, but would use ports that have expanded or would expand to support the wind energy industry generally. For instance, the State of New Jersey is planning to build an offshore wind port on the eastern shore of the Delaware River in Lower Alloways Creek, Salem County, approximately 7.5 miles southwest of the city of Salem (New Jersey Wind Port 2021). Additionally, the State of New Jersey announced a $250 million investment in a

[1] The Proposed Action would not directly require any upgrades to port infrastructure, but would make productive use of existing ports.

manufacturing facility to build steel components for offshore wind turbines at the Port of Paulsboro on the Delaware River in New Jersey (State of New Jersey 2020). Construction on the facility began in January 2021, with production anticipated to begin in 2023. Both of these activities are separate from the Proposed Action and the potential impacts resulting from these port enhancements are evaluated in their own environmental permitting processes.

Land uses and coastal infrastructure affected by construction of offshore components would include temporary construction ports, including Atlantic City, New Jersey for the construction management base; Paulsboro, New Jersey or Europe for foundation scope; Hope Creek, New Jersey or Norfolk, Virginia for WTG scope; and Port Elizabeth, New Jersey, Charleston, South Carolina, or Europe for cable staging. These ports are expected to be used during construction but have independent utility and would not be dedicated to the Project. Proposed uses at existing port facilities would be consistent with the current land uses occurring at these locations and are not expected to result in changes to land use or zoning.

Ocean Wind would use the regional onshore O&M facility in Atlantic City, New Jersey. O&M of the Proposed Action's offshore components would require daily activity at the O&M facility in Atlantic City. The increased activity within Atlantic City's port and nearby areas zoned for business and industrial uses would be consistent with the land use character of Atlantic City's harbor, town center, and business areas, and would provide a source of investment in the coastal infrastructure (COP Volume II, Section 2.4.1; Ocean Wind 2023).

Activities associated with Proposed Action construction would generate noise, vibration, and vehicular traffic at the ports temporarily used for construction described above. These impacts are typical for industrial ports and would not hinder other nearby land uses or use of coastal infrastructure. Overall, the construction and installation of offshore components, O&M, and decommissioning for the Proposed Action alone would have minor beneficial impacts on land use and coastal infrastructure by supporting designated uses and infrastructure improvements at ports.

Presence of structures: Portions of all the Proposed Action WTGs could be visible from certain coastal and elevated areas of the geographic analysis area mainland, depending upon vegetation, topography, and atmospheric conditions. Most WTGs would be approximately 15 miles (24.1 kilometers) from the coastal viewers and the WTGs would not dominate offshore views, even when weather and atmospheric conditions allow views. The Proposed Action alone would have a long-term, continuous, negligible impact on land use and coastal infrastructure in the geographic analysis area because while WTGs would be visible onshore, their presence is not anticipated to result in changes to land use or zoning.

The Proposed Action has two offshore export cable routes, BL England and Oyster Creek, and multiple potential landfall locations in Ocean Township, Lacey Township, Ocean City, and Upper Township. The Oyster Creek export cable is expected to make landfall in either Lacey Township or Ocean Township, and the BL England export cable is expected to make landfall in Ocean City, New Jersey. At the potential landfall sites, the Oyster Creek route would travel west across undeveloped land, taking advantage of previously disturbed areas where possible, before following abandoned roadways associated with an existing confined disposal facility. Land that is currently undeveloped would be permanently affected due to the construction of Project components such as TJBs, duct bank, or substations. These impacts would be minimized by using land zoned for commercial or industrial development, or restoring areas to pre-disturbed conditions following construction and by following existing berms, paths, trails, and roadways where possible (COP Volume II, Section 2.3.5.2; Ocean Wind 2023). After making landfall in Ocean City, the BL England route would follow local roads west, cross Peck Bay at Roosevelt Boulevard Bridge, a currently undeveloped area, via trenchless technology methods, and then continue on existing county road right-of-way to the substation property at the decommissioned BL England Generating Station (COP, Volume III, Appendix L; Ocean Wind 2023). The onshore portion of the Oyster Creek cable route would be up to 5.3 miles, with approximately 200 feet of overhead tie-line to connect into the onshore substation. The onshore portion of the BL England cable route would be up to 8 miles, with approximately 100 feet of overhead tie-line to connect to the onshore substation. Ocean Wind would coordinate and obtain crossing agreements for the crossings of utilities, roadways, bridges, and railroads. Because the export cable routes would follow mostly existing road rights-of-way, there would be minimal impacts on existing land uses. Where the offshore export cables cross currently undeveloped areas, there would be a permanent conversion of land to utility right-of-way or easement.

The proposed Oyster Creek substation would occupy up to 31.5 acres (127,476 m^2) and be sited on the former Oyster Creek nuclear plant in Lacey Township, which was retired in 2018 and is in the process of decommissioning. The proposed BL England substation would occupy up to 13 acres (52,609 m^2) and be sited on a former coal, oil, and diesel plant in Upper Township. Because both Oyster Creek and BL England substations would be sited on previously developed sites, there would be no changes to existing land uses. The new substations would be consistent with the existing industrial uses of the two sites.

Onshore construction is expected to result in temporary or permanent impacts on local residents, businesses, and the community along the proposed onshore export cable routes during the construction period. Landfall construction methods would minimize land use impacts and areas would be restored to their previous condition after construction. Temporarily increased noise levels, lighting, and traffic during construction may affect local sensitive receptors (e.g., schools, medical facilities), but would be minimized through BMPs and would not change existing land uses. Ocean Wind has committed to implementing a construction schedule to minimize activities in the onshore export cable route during the peak summer recreation and tourism season and to coordinate with local municipalities to minimize impacts on popular events in the area during construction, to the extent practicable (REC-01 and REC-02; COP Volume II, Table 1.1-2; Ocean Wind 2023). These APMs would minimize impacts on tourism from construction activities.

Land disturbance: The refined Oyster Creek onshore export cable route is a straightened route that would make landfall and travel west, taking advantage of previously disturbed areas where possible along the Holtec property (Figure 2-2). The crossing of Oyster Creek and Route 9 would be conducted using trenchless technology methods to an existing private road, and the route would continue within the existing private road to the Oyster Creek onshore substation. Additional Oyster Creek onshore export cable route options include a route that would make landfall and travel west across undeveloped land, taking advantage of previously disturbed areas where possible, before following abandoned roadways associated with the existing confined disposal facility and Holtec property. In order to minimize potential impacts on wetlands and vegetation, the route would follow existing berms, paths, and trails where practical; however, where this is not possible and land cannot be returned to previous conditions, permanent conversion from undeveloped land to easement land use would occur. The route would then follow existing roadways, State Route 9, and a private road to the substation parcel. The crossing of Oyster Creek could be conducted using trenchless technology methods or by an independent utility bridge (existing Route 9 bridge or new construction). Under this route option, no impacts on the existing confined disposal facility are expected, as disturbance would be limited to the facility's abandoned roadways.

Depending on the landfall location, the BL England onshore export cable route would follow the existing right-of-way of either 5th Street, 13th Street, or 35th Street in Ocean City to 35th Street, then would travel within existing right-of-way of local roads west, would cross Peck Bay at Roosevelt Boulevard Bridge via trenchless technology methods, then would continue on existing county road right-of-way for Roosevelt Boulevard, turning north on Route 9 to the BL England onshore substation property (Figure 2-3).

The Proposed Action's onshore export cable infrastructure would be installed underground in a duct bank, generally along, under, or adjacent to existing roads or utility right-of-way. Where feasible, trenchless technologies, such as HDD, may be used to minimize impacts on land disturbance, including at the crossing of Island Beach State Park and Route 9 along the Oyster Creek cable route and next to the bridge on Roosevelt Boulevard along the BL England cable route. Installation of the cable landfall sites and underground cable routes would temporarily disturb neighboring land uses through construction noise, vibration, dust, and travel delays along the affected roads. These impacts are anticipated to last for the duration of construction; following construction, the cable route corridors would be returned to their previous condition and use. The corridors would be maintained through regular vegetation trimming and herbicide application. Installation of the cables would occur within a 50-foot-wide temporary construction corridor. Based on the landfall options with the longest onshore cable routes, construction of the Oyster Creek onshore export cable could result in up to 32 acres of temporary disturbance, and construction of the BL England onshore export cable could result in up to 48 acres of temporary disturbance. O&M would not result in land disturbance except in the event that cable maintenance or replacement is required. Land use impacts would be minimized by using existing rights-of-way, co-locating Project components, utilizing land that is primarily zoned for commercial or industrial development, or restoring areas to pre-disturbed conditions following construction (COP Volume II, Section 2.3.5.2.1; Ocean Wind 2023).

The construction of the onshore substations would result in temporary and permanent impacts due to construction and the use of temporary construction workspace. Construction of the onshore substation would require a permanent site, including area for the substation equipment and buildings, equipment yards, energy storage, stormwater management, a parking area, an access road, and landscaping. However, the facilities would be consistent with surrounding land uses. The BL England substation would be in Upper Township, New Jersey in the Waterfront Town Center zoning district. Per the town zoning code, electrical substations are a permitted conditional use, and therefore would be authorized subject to conditions to ensure compatibility of surrounding land uses (Township of Upper 2020, 2021). Oyster Creek substation would be in Lacey Township, New Jersey and would be within an industrial zoning district (Township of Lacey 2009). In combination with federal, state, and local government agencies, academic institutions, non-governmental organizations, and businesses, the Barnegat Bay Partnership has established a Comprehensive Conservation and Management Plan for the Barnegat Bay-Little Egg Harbor Estuary. The plan identifies a land use goal to improve and sustain collaborative regional approaches to responsible land use planning and open space preservation in the watershed that protect and improve soil function(s), water quality, water supply, and living resources. The activities for the Proposed Action are consistent with the plan, as no conversion of open space is anticipated for the Oyster Creek substation. Additional information on potential impacts on water and living resources can be found in Section 3.21, *Water Quality*, and Section 3.8, *Coastal Habitat and Fauna*. Due to the locations and zoning, potential impacts on land use would be minor. Upgrades to the electrical transmission grid may be needed for interconnection; however, those upgrades would be consistent with the existing land use. This would have localized, short-term, minor impacts on land use and coastal infrastructure (COP Volume I, Section 6.2, and Volume II, Section 2.3.5.2.1; Ocean Wind 2023).

Noise: The Proposed Action would comply with NJDEP noise regulations and local noise regulations, to the extent practicable, to minimize impacts on nearby communities (SOC-01; COP Volume II, Table 1.1-2; Ocean Wind 2023). Typical construction equipment ranges from a generator or refrigerator unit at 73 dBA at 50 feet to an impact pile driver at 101 dBA at 50 feet. As the Proposed Action would be built 15 miles offshore, noise effects from offshore construction noise would be temporary and negligible (COP Volume III, Appendix R, Section 2.5; Ocean Wind 2023). New Jersey Administrative Code 7:29 limits noise from industrial facilities at residential property lines to 50 dBA during nighttime and 65 dBA during daytime (COP Volume II, Table 1.1-2; Ocean Wind 2023). Temporarily increased noise levels during construction may affect local sensitive receptors (such as religious locations, recreational areas, schools, and other places that are particularly sensitive to construction) but would be minimized through BMPs and would not change existing land uses.

3.14.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities.

Accidental releases: The Proposed Action would contribute a noticeable increment to the cumulative accidental release impacts on land use and coastal infrastructure. The increased risk of and thus the potential impacts from accidental releases of fuel/fluids/hazardous materials in the geographic analysis area would result in localized, short-term, negligible to minor impacts on land use and coastal infrastructure.

Lighting: As stated in Section 3.20, *Scenic and Visual Resources*, offshore nighttime construction lighting and operational aviation hazard lighting for portions of 859 WTGs associated with the Proposed Action and other offshore wind projects could be visible from some shorelines depending on vegetation, topography, weather, and atmospheric conditions. The land use impacts from the Proposed Action in the context of planned activities (i.e., other offshore wind development) would be similar to, but more extensive than, the impacts for the Proposed Action alone. Nevertheless, the Proposed Action would contribute a noticeable increment to the cumulative WTG lighting impacts on land use and coastal infrastructure, which would be continuous, long term, and negligible to minor.

Port utilization: The cumulative impacts of port utilization from the Proposed Action on land use and coastal infrastructure would be minor beneficial. Offshore wind development, including the Proposed Action, would require port facilities for shipping, berthing, and staging, and development activities would support ongoing or new activity at authorized ports.

Presence of structures: The Proposed Action would contribute a noticeable increment to the cumulative onshore transmission cable infrastructure impacts and the presence of structures on land use and coastal infrastructure, which are anticipated to be minor. Assuming that new substations for offshore wind projects would be in locations designated for industrial or utility uses, and underground cable conduits would primarily be co-located with roads or other utilities, operation of substations and cable conduits would not affect the established and planned land uses for a local area.

Land disturbance: Localized, short-term, and minor cumulative impacts on land use and coastal infrastructure due to construction-related disturbance and access limitations along the export cable routes are expected. Impacts on land use and coastal infrastructure from land disturbance would be additive only if land disturbance associated with one or more other projects occurs in close spatial and temporal proximity.

Noise: Construction of other offshore wind projects is not anticipated to occur within the geographic analysis area. The Proposed Action would contribute a noticeable increment to the cumulative noise impacts on land use and coastal infrastructure, which are anticipated to be localized, short term, and minor.

3.14.5.3. Conclusions

Impacts of the Proposed Action. BOEM anticipates that impacts on land use and coastal infrastructure from the Proposed Action would be **minor** adverse with **minor beneficial** impacts. The Proposed Action would have minor beneficial impacts resulting from port utilization, minor impacts resulting from land disturbance during onshore installation of the cable route and substation, and negligible to minor impacts resulting from accidental spills. Noise and traffic from onshore construction would have localized, short-term, minor impacts on land use and coastal infrastructure.

Cumulative Impacts of the Proposed Action. The incremental contribution by the Proposed Action to the cumulative impacts on land use and coastal infrastructure would be noticeable. BOEM anticipates that the cumulative impacts on land use and coastal infrastructure in the geographic analysis area associated with the Proposed Action would be **minor** adverse and **minor beneficial**. The main drivers for this impact rating are the beneficial impacts of port utilization, minor impacts on the viewshed due to the presence of offshore structures, and minor impacts of land disturbance. The Proposed Action would contribute to the cumulative impact rating primarily through short-term impacts from onshore landfall, cable, and substation installation, as well as beneficial impacts due to the use of port facilities designated for offshore wind activity.

3.14.6 Impacts of Alternatives B, C, and D on Land Use and Coastal Infrastructure

Impacts of Alternatives B, C, and D. The impacts of Alternatives B-1, B-2, C-1, C-2, and D on land use and coastal infrastructure would be the same as those of the Proposed Action for all impacts except for the impact of accidental releases, light, port utilization, and the presence of structures. Alternatives B-1, B-2, and D would install fewer WTGs (up to 9 fewer WTGs for Alternative B-1; up to 19 fewer WTGs for Alternative B-2; up to 15 fewer for Alternative D), which would slightly reduce the construction impact footprint and installation period. Alternative C-1 would relocate eight WTGs, and Alternative C-2 would compress the WTG array layout. Each of these alternatives would slightly modify the visibility of the WTGs from coastal and elevated onshore areas in the geographic analysis area, but there would be an overall negligible difference as compared to the Proposed Action (Section 3.20). Because there would be fewer WTGs under these alternatives, there would be less potential for contamination from unforeseen spills or accidents, less light being omitted from offshore, and less need for port facilities for shipping, berthing, and staging. However, under all of these alternatives, the majority of the WTGs would still be visible and there would be no meaningful difference in impacts on land use and coastal infrastructure.

Cumulative Impacts of Alternatives B, C, and D. The incremental impacts contributed by Alternatives B, C, and D to the cumulative impacts on land use and coastal infrastructure would be similar to those of the Proposed Action and would contribute a noticeable increment.

3.14.6.1. Conclusions

Impacts of Alternatives B, C, and D. Alternatives B-1, B-2, C-1, C-2, and D would result in slightly reduced impacts on land use and coastal infrastructure compared to the Proposed Action, but the overall impact magnitude would remain the same. Alternatives B-1 and B-2 would result in slightly reduced visual impacts of WTGs on coastal communities by removing the WTGs closest to those coastal communities. Alternatives C-1, C-2, and D would relocate and remove WTGs but the visual effects would not be noticeable. Because there would be fewer WTGs constructed, Alternatives, B, C, and D would all result in reduced port utilization compared to the Proposed Action, along with reduced associated noise and traffic impacts, and accidental releases, but there would be no change to the overall impact magnitudes. Impacts on land use and coastal infrastructure would be **minor** adverse with **minor beneficial** impacts. Impact ratings associated with individual IPFs would not change.

Cumulative Impacts of Alternatives B, C, and D. The impacts contributed by Alternatives B-1, B-2, C-1, C-2, and D to the cumulative impacts on land use and coastal infrastructure would be the same as those of the Proposed Action, and would contribute a noticeable increment. BOEM anticipates that the cumulative impacts on land use associated with Alternatives B-1, B-2, C-1, C-2, and D would be very similar to those of the Proposed Action: **minor** adverse impacts and **minor beneficial** impacts. This impact rating is primarily driven by impacts from installation of onshore infrastructure and port utilization, which would not change among alternatives.

3.14.7 Impacts of Alternative E on Land Use and Coastal Infrastructure

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. The impacts of Alternative E on land use and coastal infrastructure would be the same as those of the Proposed Action for all impacts except for land disturbance, traffic, and noise associated with the modifications made to the Oyster Creek export cable route to minimize impacts on SAV in Barnegat Bay.

Land disturbance: Alternative E would limit the onshore portion of the Oyster Creek export cable route on Island Beach State Park to the northern export cable route option. The export cable would make landfall within an auxiliary parking lot of Swimming Area 2 on Island Beach State Park and then continue north within parking lots, then turn northwest under Shore Road before entering Barnegat Bay. Construction of the northern export cable route option would increase the area of temporary disturbance by 2.2 acres compared to the southern export cable route option under the Proposed Action. The land use in the additional temporary disturbance area is characterized as low-intensity developed (Kleiner 2021). The impact of Alternative E would be limited to Island Beach State Park. Trenching and installation activities to bury the cable would temporarily disturb wetlands and vegetation on the barrier island and potentially interfere with recreational activities in the state park. After construction, the right-of-way would be restored to pre-disturbance conditions and long-term effects would not be anticipated.

Traffic: Cable installation on Island Beach State Park within the roadway would result in temporary traffic impacts such as lane closures, shifted traffic patterns, or closed roadways and parking areas. Central Avenue/Shore Road is the only north-south through road on the barrier island, so road closures would restrict access to the southern portion of the island. Roadways would be returned to pre-construction conditions and would not result in changes to the existing land use.

Noise: Alternative E would involve more onshore construction activities such as open trench excavation and trenchless technologies such as HDD or direct pipe for cable installation as a result of the longer onshore export cable route. Under Alternative E as under the Proposed Action, land use impacts would be minimized through the use of existing rights-of-way, co-locating Project components, and restoring some areas to pre-disturbed conditions following construction. While the northern export cable route option would likely result in extended construction with potentially increased impacts on noise and traffic, the overall impacts of construction would be of the same magnitude as those of the Proposed Action.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the impacts on land use and coastal infrastructure from ongoing and planned activities including offshore wind would be noticeable.

3.14.7.1. Conclusions

Impacts of Alternative E. Alternative E would slightly increase the onshore portion of the Oyster Creek export cable route, resulting in increased impacts on land use associated with temporary construction activity compared to the Proposed Action. The overall impact magnitudes would be the same because the cable corridors would follow existing right-of-way and the primary impacts would be limited to the duration of construction. Impacts on land use and coastal infrastructure would be **minor** adverse with **minor beneficial** impacts. Impact ratings associated with individual IPFs would not change.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on land use and coastal infrastructure would be the same as those of the Proposed Action and would be noticeable. BOEM anticipates that the cumulative impacts associated with

Alternative E would be very similar to those of the Proposed Action: **minor** adverse impacts and **minor beneficial** impacts. This impact rating is primarily driven by impacts from installation of onshore infrastructure and port utilization, which would not change among alternatives.

3.14.8 Proposed Mitigation Measures

A measure is proposed to minimize impacts on land use and coastal infrastructure (Appendix H, Table H-3). If the measure analyzed below is adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced.

Table 3.14-2 Additional Proposed Measures (Also Identified in Appendix H, Table H-3): Land Use and Coastal Infrastructure

Measure	Description	Effect
Vibration monitoring/ structure monitoring	Ocean Wind will be required to implement vibration monitoring/structure monitoring for onshore activities including, but not limited to, infrastructure, bridges, businesses, homes, and drainage structures.	While adoption of vibration monitoring would reduce risks to coastal infrastructure and improve accountability under the Proposed Action, it would not alter the impact determination of minor for land disturbance.

3.14.8.1. Measures Incorporated in the Preferred Alternative

BOEM has not identified any additional measures in Table 3.14-2 to be incorporated in the preferred alternative.

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3.19. Sea Turtles

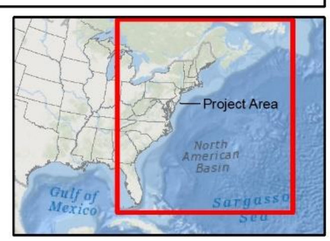
This section discusses potential impacts on sea turtles from the proposed Project, alternatives, and ongoing and planned activities in the sea turtle geographic analysis area. The sea turtle geographic analysis area, as shown on Figure 3.19-1, encompasses two LMEs, namely the Northeast U.S. OCS and Southeast U.S. OCS LMEs. These LMEs capture most of the movement range of sea turtles within the U.S. Atlantic Ocean waters. Due to the size of the geographic analysis area, for analysis purposes in this EIS, the focus is on sea turtles that would likely occur in the proposed Project area and be affected by Project activities. The geographic analysis area does not include all areas that could be transited by Project vessels (e.g., it does not consider vessel transits from Europe).

3.19.1 Description of the Affected Environment for Sea Turtles

Four species of sea turtles are known to occur in or near the Ocean Wind Project area, all of which are protected under the ESA (16 USC 1531 et seq.). These include the leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), Kemp's ridley sea turtle (*Lepidochelys kempii*), and green sea turtle (*Chelonia mydas*). A fifth species, the hawksbill sea turtle (*Eretmochelys imbricata*), occurs in the larger geographic analysis area but is very unlikely to occur in the Project area because it typically inhabits tropical waters. While it has been recorded in New England during the summer (Lazell 1980), there are no sightings of hawksbill sea turtle currently documented within Atlantic coastal waters off New Jersey (Conserve Wildlife Foundation of New Jersey 2021). Therefore, this species is not considered further. Table 3.19-1 lists the four sea turtle species and DPS that could occur in the North Atlantic coastal waters offshore New Jersey, and provides the listing status and likelihood of occurrence in the Project area.

Sea turtles inhabit tropical and subtropical seas throughout the world. In coastal U.S. Atlantic waters, sea turtles are seasonally distributed, migrating to and from habitats extending from Florida to New England, with overwintering concentrations in southern waters and nesting sites on southern beaches from Virginia south through Florida. There is potential for the four sea turtle species to seasonally inhabit offshore waters in the Project area in the spring (March–May), summer (June–August), and fall (September–November), including the area of direct effects during the winter months (December–February). Water temperature is a primary factor influencing sea turtle distribution; sea turtles typically occur in the coastal waters off New Jersey when water temperatures exceed 59°F (NJDEP 2010). Sea turtles in the North Atlantic migrate north from warmer South Atlantic waters in the spring (May and June) to take advantage of abundant prey in warming northeastern waters, including both the OCS and inshore embayments and estuaries. Sea turtles return to southern waters as water temperatures decline in the fall and are unlikely to be present in the Project area after November 30. However, not all sea turtles leave the area during winter and there are occasional strandings of sea turtles that become incapacitated or "cold-stunned" at water temperatures below 50°F (NJDEP 2010 citing Mrosovsky 1980).

Sea Turtles Geographic Analysis Area
Ocean Wind 1 Lease Area (OCS-A 0498)
Other BOEM Lease Areas



Source: BOEM 2021.

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Figure 3.19-1 Sea Turtles Geographic Analysis Area

Table 3.19-1 Sea Turtle Species that May Potentially Occur in the Project Area

Common Name	Scientific Name	DPS	ESA Status[1]	Frequency of Occurrence in New Jersey	Seasonal Occurrence in Project Area	Likelihood of Occurrence in Project Area
Leatherback sea turtle	*Dermochelys coriacea*	Not applicable[2]	E	Common	May to November[3]	Likely
Loggerhead sea turtle	*Caretta caretta*	Northwest Atlantic	T	Common	May to November[3]	Likely
Kemp's ridley sea turtle	*Lepidochelys kempii*	Not applicable	E	Uncommon	May to November[3]	Likely
Green sea turtle	*Chelonia mydas*	North Atlantic	T	Uncommon	May to November[3]	Likely

Sources: NMFS 2021a; NJDEP 2006, 2010
[1] ESA status: E = Endangered, T = Threatened
[2] NMFS and USFWS have not designated DPSs for leatherback sea turtles because the species is listed as endangered throughout its global range (85 *Federal Register* 48332).
[3] May to November is the primary season, but each species can occur beyond these months (see text).

Sea turtle nesting does not occur in New Jersey and there are no nesting beaches or designated critical habitat in the vicinity of the Project (GARFO 2021). Individuals occurring in the Project area are either migrating or foraging, and are likely to spend the majority of time below the surface. Sea turtles can remain underwater for extended periods, ranging from several minutes to several hours, depending on factors such as daily and seasonal environmental conditions and specific behavioral activities associated with dive types (Hochscheid 2014; NSF and USGS 2011). Such physiological traits and behavioral patterns allow them to spend as little as 3 to 6 percent of their time at the water's surface (Lutcavage and Lutz 1997). These adaptations are important because sea turtles often travel long distances between their feeding grounds and nesting beaches (Meylan 1995).

The combination of sightings, strandings, and bycatch data provides the best available information on sea turtle distribution in the Project area. This section summarizes data for each of the four sea turtle species from shipboard and aerial surveys of New Jersey's offshore wind study area (NJDEP 2010), NMFS AMAPPS (Palka et al. 2017, 2021), NMFS Sea Turtle Stranding and Salvage Network (STSSN) (NMFS 2021a), and recent and historic population or density estimates from NMFS, the Department of the Navy, and the New York State Energy Research and Development Authority, where available. A total of 34 sea turtles were recorded in the Project area vicinity during the summer 2017 HRG survey, including 9 loggerhead, 3 green, and 22 unidentified sea turtle species (Alpine 2017), and 4 sea turtles were recorded within the Wind Farm Area during the Geotechnical 1A Survey in winter 2017–2018, including 2 loggerhead and 2 unidentified sea turtles (Smultea Environmental Sciences 2018).

Population dynamics and habitat use of different sea turtle species along the New Jersey shore is still poorly understood. Sea turtles are wide-ranging and long-lived, making population estimates difficult, and survey methods vary depending on species (TEWG 2007; NMFS and USFWS 2013, 2015a, 2015b). Because sea turtles have large ranges and highly migratory behaviors, the current condition and trend of sea turtles are affected by many factors beyond the geographic analysis area.

Sea turtles in the geographic analysis area are subject to a variety of ongoing human-caused impacts, including collisions with vessels, entanglement with fishing gear, fisheries by-catch, dredging, anthropogenic noise, pollution, disturbance of marine and coastal environments, effects on benthic habitat, accidental fuel leaks or spills, waste discharge, and climate change. Sea turtle migrations can cover long distances, and these factors can have impacts on individuals over broad geographical scales. The *Atlantic OCS Proposed Geological and Geophysical Activities: Final Programmatic Environmental Impact Statement* (BOEM 2012), incorporated here by reference, provides further details about each species' range and distribution, population status, ecology and life history, and conservation and management.

Leatherback Sea Turtle: The leatherback sea turtle is the largest and the most widely distributed sea turtle species, ranging broadly from tropical and subtropical to temperate regions of the world's oceans (NMFS and USFWS 1992). Individuals in the Project area belong to the Northwest Atlantic population, which is one of seven leatherback populations globally. The species was listed as endangered under the ESA in 1970 (35 *Federal Register* 8491), inclusive of all populations.[1] Unlike the other three sea turtle species, the leatherback does not use shallow waters to prey on benthic invertebrates or sea grasses. Leatherbacks are highly pelagic in nature, but are also commonly observed in coastal waters along the U.S. OCS (NMFS and USFWS 1992). They feed almost exclusively on jellyfish, siphonophores, and salps (Eckert et al. 2012; NMFS and USFWS 2020). Leatherback sea turtles dive the deepest of all sea turtles to forage and are more tolerant of cooler oceanic temperatures than other sea turtles. In a study tracking 135 leatherbacks fitted with satellite tracking tags, leatherbacks were identified to inhabit waters

[1] NMFS and USFWS have not designated DPSs for leatherback sea turtles because the species is listed as endangered throughout its global range (85 *Federal Register* 48332).

with sea surface temperatures ranging from 52°F to 89°F (Bailey et al. 2012). The study also found that oceanographic features such as mesoscale eddies, convergence zones, and areas of upwelling attracted foraging leatherbacks because these features are often associated with aggregations of jellyfish. In 2007, the population of nesting females in the Northwest Atlantic was estimated at 4,800 to 11,000 (TEWG 2007). NMFS and USFWS (2020) concluded that the Northwest Atlantic population has a total index of nesting female abundance of 20,659 females with a decreasing nest trend at nesting beaches with the greatest known nesting female abundance. During visual aerial and shipboard abundance surveys conducted under AMAPPS I (2010 to 2014) and AMAPPS II (2014 to 2019), approximately 6 percent were positively identified as leatherback sea turtles. Leatherbacks were detected in the vicinity of the Project area during summer and fall (June through November), but not during winter and spring (December through May). The majority of leatherbacks tagged by AMAPPS research have remained in Atlantic OCS waters from North Carolina up the mid-Atlantic shelf and into southern New England and the Gulf of Maine (Palka et al. 2021). From 2010 through 2020, the STSSN reported 12 offshore and six inshore leatherback sea turtle strandings within Zone 39, which encompasses southern New Jersey (NMFS 2021a). During NJDEP (2010) aerial and shipboard surveys for marine mammals and sea turtles, sightings included a total of 12 leatherback sea turtles in waters ranging from 59 to 98 feet deep, with a mean depth of 79 feet. Sightings were recorded from 6.4 to 22.5 miles from shore, with a mean distance of 17.8 miles. The sea surface temperatures associated with leatherback sea turtle sightings ranged from 64.6°F to 68.5°F with a mean temperature of 66.2°F. Leatherback sea turtles undergo extensive migrations in the western North Atlantic and usually start arriving along the New Jersey coast in late spring/early summer (Shoop and Kenney 1992; James et al. 2006). A surrogate density estimate was calculated using the results from New York State Energy Research and Development Authority’s surveys across the New York offshore planning area by Normandeau Associates and APEM (2018a, 2018b, 2019a, 2019b, 2020). The estimated leatherback sea turtle density during the fall, the season with the highest density, was 0.789 turtle per 100 km^2, which translates to around three leatherback sea turtles within the Project area (Table 3.19-2). Another density estimate is available from the Navy OPAREA Density Estimates model for the Atlantic Ocean, which estimates sea turtle density each season based on habitat variables (e.g., sea surface temperature, seafloor depth) (Navy 2007) and indicates that the density of leatherback sea turtles in the Project area during fall ranges from 2.675 to 3.745 animals per 100 km^2. That equates to a higher density of approximately 7 to 11 leatherback sea turtles within the 68,450-acre Wind Farm Area. Based on this information, BOEM expects leatherback sea turtles to be common in New Jersey and likely in the Project area from May to November (Table 3.19-1).

Table 3.19-2 Sea Turtle Density Estimates Derived from New York State Energy Research and Development Authority Annual Reports

Common name	Density (animals/100 km^2)			
	Spring (March–May)	Summer (June–August)	Fall (September–November)	Winter (December–February)
Leatherback sea turtle	0	0.331	0.789	0
Loggerhead sea turtle	0.254	26.799	0.19	0.025
Kemp’s ridley sea turtle	0.05	0.991	0.19	0
Green sea turtle	0	0.038	0	0

Sources: Normandeau Associates and APEM 2018a, 2018b, 2019a, 2019b, 2020.

Loggerhead Sea Turtle: Loggerhead sea turtles range widely and have been observed along the entire Atlantic Coast as far north as Canada (Brazner and McMillan 2008; Ceriani et al. 2014; Shoop and Kenney 1992). Loggerheads in the Project area belong to the Northwest Atlantic DPS, which is listed as threatened under the ESA (76 *Federal Register* 58868). The regional abundance estimate in the

Northwest Atlantic OCS in 2010 was approximately 588,000 adults and juveniles of sufficient size to be identified during aerial surveys (interquartile range of 382,000 to 817,000 [NEFSC and SEFSC 2011]). The three largest nesting subpopulations responsible for most of the production in the western North Atlantic (peninsular Florida, northern United States, and Quintana Roo, Mexico) have all been declining since at least the late 1990s, thereby indicating a downward trend for this population (TEWG 2009). While some progress has been made since publication of the 2008 Loggerhead Sea Turtle Recovery Plan, the recovery units have not met most of the critical benchmark recovery criteria (Bolten et al. 2019).

The loggerhead sea turtle has a powerful beak and crushing jaws specially adapted to feed on hard-bodied benthic invertebrates, including crustaceans and mollusks. Mollusks and crabs are primary food items for juvenile loggerheads (Burke et al. 1993). Although loggerheads are dietary specialists, the species demonstrates the ability to adjust its diet in response to changes in prey availability in different geographies (Ruckdeschel and Shoop 1988; Plotkin et al. 1993). For example, loggerheads in the Gulf of Mexico feed primarily on crabs, but sea pens are also a major part of the diet. Loggerheads in Chesapeake Bay, Virginia, primarily targeted horseshoe crabs (*Limulus polyphemus*) in the early to mid-1980s but subsequently shifted their diet to blue crabs in the late 1980s, and then to finfish from discarded fishery bycatch in the mid-1990s (Seney and Musick 2007).

Winton et al. (2018) reported that loggerheads tagged within the Northwest Atlantic primarily restrict their summertime distribution to OCS waters and occasionally make excursions inshore to bays and estuaries. Core habitat includes sea surface temperatures from 59.0°F to 82.4°F and at depths between 26.3 and 301.8 feet, and the highest probability of occurrence occurs in regions with sea surface temperatures from 63.9°F to 77.5°F and at depths between 85.6 and 243.5 feet (Patel et al. 2021). Studies have indicated that the Mid-Atlantic Bight of the Atlantic OCS, where the Project area occurs, is an important a seasonal foraging ground for approximately 40,000 to 60,000 juvenile and adult loggerheads during summer months (NEFSC and SEFSC 2011). Satellite telemetry data indicate that potentially 30 to 50 percent of loggerheads that nest and reside along the U.S. eastern seaboard seasonally forage within the Mid-Atlantic Bight (Winton et al. 2018; Patel et al. 2021). Spatial models developed by Winton et al. (2018) based on satellite-tagged turtles demonstrate that the Project occurs within an area of medium to high relative density of loggerheads from May through October; higher densities are predicted to occur farther offshore to the east of the Project (NROC 2023). AMAPPS surveys reported that loggerhead sea turtles are by far the most commonly sighted sea turtles on the Atlantic OCS waters from New Jersey to Nova Scotia, Canada, with 47 percent of all sea turtle observations being positively identified as loggerheads (Palka et al. 2021). Loggerheads were detected in the Project vicinity during spring (March through May) and summer and fall (March through November) but not during winter months (December through February) (Palka et al. 2021).

The NJDEP (2010) aerial and shipboard surveys recorded a total of 615 loggerhead sea turtle sightings between January 2008 and December 2009. The loggerhead sea turtle was the second most frequently sighted species during the survey and the vast majority of sightings were during the summer (NJDEP 2010). From 2010 through 2020, STSSN reported 139 offshore and 74 inshore loggerhead sea turtle strandings within Zone 39, which encompasses southern New Jersey (NMFS 2021a). Loggerheads are stranded far more often than other sea turtles in New Jersey (NMFS 2021a), as they have a higher relative abundance. New York State Energy Research and Development Authority reported that, in the New York offshore planning area, most of the sea turtles recorded were loggerhead sea turtles, by an order of magnitude. The estimated density of loggerhead sea turtles was greatest during summer (26.779 turtles per 100 km^2), followed by fall with approximately 74 animals within the Project area (0.1 turtle per 100 km^2) (Table 3.19-2) (Normandeau Associates and APEM 2018a, 2018b, 2019a, 2019b, 2020). Additionally, the Navy (2007) OPAREA Density Estimates models predict that the density of loggerhead sea turtles in the Project area during summer ranges from 3.608 to 7.955 animals per 100 km^2, which equates to approximately 10 to 22 loggerhead sea turtles within the 68,450-acre Wind Farm Area.

Collectively, available information indicates that loggerhead sea turtles are expected to occur commonly as adults, subadults, and juveniles from the late spring through fall, with the highest probability of occurrence from July through September. Based on this information, BOEM expects loggerhead sea turtles to be common in New Jersey and likely within the Project area from May to November (Table 3.19-1).

Kemp's Ridley Sea Turtle: The Kemp's ridley sea turtle is one of the smallest sea turtle species and is most commonly found in the Gulf of Mexico and along the U.S. Atlantic Coast. Juvenile and subadult Kemp's ridley sea turtles are known to travel as far north as Cape Cod Bay during summer foraging (NMFS et al. 2011). All Kemp's ridley sea turtles belong to a single population that is endangered under the ESA (35 *Federal Register* 183290). The species is primarily associated with habitats on the Atlantic OCS, with preferred habitats consisting of sheltered areas along the coastline, including estuaries, lagoons, and bays (Burke et al. 1994; NMFS 2019) and nearshore waters less than 120 feet deep (Shaver et al. 2005; Shaver and Rubio 2008), although they can also be found in deeper offshore waters. The species is coastally oriented, rarely venturing into waters deeper than 160 feet (50 meters). It is primarily associated with mud sand-bottomed habitats, where primary prey species are found (NMFS and USFWS 2007a). Kemp's ridley sea turtles are generalist feeders that prey on a variety of species, including crustaceans, mollusks, fish, jellyfish, and tunicates, and forage on aquatic vegetation (Carr and Caldwell 1956; Byles 1988; Schmid 1998). However, their preferred diet is crabs (NMFS and USFWS 2007a). The species is also known to ingest natural and anthropogenic debris (Burke et al. 1993, 1994; Witzell and Schmid 2005).

The population was severely reduced prior to 1985 due to intensive egg collection and fishery bycatch, with a low in 1985 of 702 nests counted from an estimated 250 nesting females on three primary nesting beaches in Mexico (NMFS and USFWS 2015a). Recent estimates of the total population of age 2 years and older is 248,307; however, recent models indicate a persistent reduction in survival or recruitment, or both, in the nesting population, suggesting that the population is not recovering to historical levels (NMFS and USFWS 2015a). A total of 20,570 nests were documented in Mexico in 2011. Similar to Mexico, Texas also experienced an increase in the number of nests from 1985 through 2009, but saw a noticeable decline in 2010 when only 141 nests were recorded. The number of nests continues to be low with 199 in 2011, 209 in 2012, 153 in 2013, and 119 in 2014 (NMFS and USFWS 2015a). A record high number of Kemp's ridley sea turtle nests were recorded in 2017 (24,586 in Mexico and 353 in Texas). In 2019 there were 11,090 nests, a 37.61-percent decrease from 2018 and a 54.89-percent decrease from 2017. This decline is typical due to the reproduction biology of the species, as females nest approximately every 2 to 3 years (NPS 2021). Using the standard International Union for Conservation of Nature protocol for sea turtle assessments, the number of mature individuals was recently estimated at 22,341; the assessment concluded the current population trend is unknown (Wibbels and Bevan 2019).

Recent models indicate a persistent reduction in survival or recruitment, or both, in the nesting population, suggesting that the population is not recovering (NMFS and USFWS 2015a). Visual sighting data are limited because this small species is difficult to observe using typical aerial survey methods (Kraus et al. 2016) or because their density is truly low in Atlantic OCS waters. AMAPPS surveys rarely encountered Kemp's ridley sea turtles, with around 1 percent of all sea turtle observations being positively identified as Kemp's ridley. No Kemp's ridley sea turtles were detected in the vicinity of the Project area (Palka et al. 2021). The Marine Mammal Stranding Center in New Jersey rescued an average of 45 Kemp's ridley turtles each year between 1995 and 2005, of which 18 percent had become impinged on power plant grates, 4 percent had been struck by boat propellers, and 20 percent showed signs of other impacts (NJDEP 2006). From 2010 through 2020, STSSN reported 11 offshore and five inshore Kemp's ridley sea turtle strandings within Zone 39, which encompasses southern New Jersey (NMFS 2021a).

Based on surveys by Normandeau Associates and APEM (2018a, 2018b, 2019a, 2019b, 2020) across the New York offshore planning area, the estimated density of Kemp's ridley sea turtles was greatest during the summer (0.991 turtle per 100 km^2) and is approximately three animals within the Project area (see Appendix J, Table J-6). Additionally, the Navy (2007) OPAREA Density Estimates model indicates that the density of Kemp's ridley sea turtles in the Project area during summer ranges from 0 to 0.0186 animal per 100 km^2, which equates to approximately 0 to 1 Kemp's ridley sea turtle within the 68,450-acre Wind Farm Area. Kemp's ridley sea turtles commonly occur in inshore and nearshore New Jersey waters as they migrate to the North Atlantic during May and June and forage for crabs in SAV (Burke et al. 1994). These often are juveniles foraging for food and return to the Gulf of Mexico as coastal waters cool in fall (Ocean Wind 2023). Based on this information, Kemp's ridley sea turtles could occur infrequently as juveniles and subadults from July through September, potentially occurring as late as November. The highest likelihood of occurrence is in coastal nearshore areas adjacent to Ocean City and Barnegat Bay where the offshore export cable is anticipated to make landfall, as they seek protected shallow-water habitats. BOEM expects Kemp's ridley sea turtles to occur in the Project area from May to November.

Green Sea Turtle: Green sea turtles are found in tropical and subtropical waters around the globe. However, juveniles and subadults are occasionally observed in Atlantic coastal waters as far north as Massachusetts (NMFS and USFWS 1991). They are most commonly observed feeding in the shallow waters of reefs, bays, inlets, lagoons, and shoals that are abundant in algae or marine grass (NMFS and USFWS 2007b). They feed on aquatic vegetation and invertebrates, including jellyfish, sponges, sea pens, and pelagic prey (Heithaus et al. 2002; Seminoff et al. 2015). Green turtles do not nest on beaches in the Project area; their primary nesting beaches are in Costa Rica, Mexico, the United States (Florida), and Cuba. Green turtles are commonly associated with drift lines or surface current convergences, which commonly contain floating *Sargassum* capable of providing small turtles with shelter and sufficient buoyancy to raft upon (NMFS and USFWS 1991). They rest underwater in coral recesses, the underside of ledges, and sand-bottom areas that are relatively free of strong currents and disturbance from natural predators and humans.

Green sea turtles in the Project area belong to the North Atlantic DPS, which is listed as threatened under the ESA (81 *Federal Register* 20057). The most recent status review for the North Atlantic DPS estimates the number of female nesting turtles to be approximately 167,424 individuals (NMFS and USFWS 2015b). According to NMFS and USFWS (2015b), nesting trends are generally increasing for this DPS. Because of their association with warm waters, green turtles are uncommonly found in New Jersey waters during the summer, foraging on marine algae and marine grasses (Conserve Wildlife Foundation of New Jersey 2021).

AMAPPS visual aerial and shipboard positively detected low numbers of green sea turtles that displayed similar seasonal migrations as other sea turtles; it reported that green sea turtles composed approximately 4 percent of the 9,455 positively identified sea turtles. Green sea turtles were detected in the vicinity of the Project area during summer and fall (June through November), but not during winter and spring (December through May) (Palka et al. 2021). NMFS STSSN rescued eight green sea turtles between 1995 and 2005, of which six had evidence of human interactions with fishing activities, boat strikes, and impingement on a power plant grate (NJDEP 2006). From 2010 to 2020, STSSN reported seven offshore and two inshore green sea turtle strandings within Zone 39, which encompasses southern New Jersey (NMFS 2021a).

Based on surveys in the New York offshore planning area by Normandeau Associates and APEM (2018a, 2018b, 2019a, 2019b, 2020), the estimated density green sea turtles was greatest during the summer (0.38 turtle per 100 km^2). Fall density estimates were less than one animal within the Project area (see Appendix J, Table J-6). Additionally, the Navy OPAREA Density Estimates data modeled the density of green sea turtles in the Project area during summer with ranges from 0 to 2.338 animals per 100 km^2 (Navy 2007). This translates to approximately 0 to 6 green sea turtles within the 68,450-acre Wind Farm Area. Based on this information, the occurrence of green sea turtles in the Project area is expected to be uncommon and limited to small numbers.

3.19.2 Environmental Consequences

3.19.2.1. Impact Level Definitions for Sea Turtles

Definitions of impact levels are provided in Table 3.19-3.

Table 3.19-3 Impact Level Definitions for Sea Turtles

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on sea turtles would be undetectable or barely measurable, with no consequences to individuals or populations.
	Beneficial	Impacts on sea turtles would be undetectable or barely measurable, with no consequences to individuals or populations.
Minor	Adverse	Impacts on sea turtles would be detectable and measurable, but of low intensity, highly localized, and temporary or short term in duration. Impacts may include injury or loss of individuals, but these impacts would not result in population-level effects.
	Beneficial	Impacts on sea turtles would be detectable and measurable, but of low intensity, highly localized, and temporary or short term in duration. Impacts could increase survival and fitness, but would not result in population-level effects.
Moderate	Adverse	Impacts on sea turtles would be detectable and measurable and could result in population-level effects. Adverse effects would likely be recoverable and would not affect population or DPS viability.
	Beneficial	Impacts on sea turtles would be detectable and measurable and could result in population-level effects. Impacts would be measurable at the population level.
Major	Adverse	Impacts on sea turtles would be significant and extensive and long term in duration, and could have population-level effects that are not recoverable, even with mitigation.
	Beneficial	Impacts would be significant and extensive and contribute to population or DPS recovery.

3.19.3 Impacts of the No Action Alternative on Sea Turtles

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on sea turtles, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for sea turtles. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.19.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for sea turtles described in Section 3.19.1, *Description of the Affected Environment for Sea Turtles*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. The ongoing non-offshore wind activities that may affect sea turtles include marine transportation; onshore development activities; dredging and port improvements; marine minerals use and ocean dredged material disposal; commercial and recreational fishing; undersea transmission lines, gas pipelines, and other submarine cables; oil and gas activities; military use; and global climate change (see Section F.2 in Appendix F for a complete description of ongoing and planned activities). Under the No Action Alternative, BOEM expects ongoing activities would continue having temporary to permanent impacts (disturbance, displacement, injury, mortality, and reduced foraging success) on sea turtles, primarily due to lighting associated with coastal development, noise, marine pollution, vessel strikes, entanglement or ingestion of fishing gear, and ongoing climate change.

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on sea turtles include:

- Continued O&M of the Block Island project (five WTGs) installed in state waters;
- Continued O&M of the Coastal Virginia Offshore Wind project (two WTGs) installed in OCS-A 0497; and
- Ongoing construction of two offshore wind projects, the Vineyard Wind 1 project (62 WTGs and 1 OSS) in OCS-A 0501 and the South Fork project (12 WTGs and 1 OSS) in OCS-A 0517.

The effects of approved projects have been evaluated through previous NEPA review and are incorporated by reference. Ongoing O&M of the Block Island and Coastal Virginia Offshore Wind projects and ongoing construction of the Vineyard Wind 1 and South Fork projects would affect sea turtles through the primary IPFs of noise, presence of structures, and land disturbance. Ongoing offshore wind activities would have the same type of impacts from noise, presence of structures, and land disturbance that are described in detail in Section 3.19.3.2 for planned offshore wind activities but the impacts would be of lower intensity.

See Table F1-21 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for sea turtles.

Lighting: The impacts of coastal development affects sea turtles primarily through habitat loss from development and artificial lighting near sea turtle nesting areas, which can disorient nesting females and hatchlings. Artificial lighting on the OCS does not appear to have the same potential for effects. In spite of increasing human population growth and associated coastal development, and negative correlation between sea turtle nest numbers and the presence of artificial light (Mazor et al. 2013), Weishampel et al. (2016) found that nighttime light levels decreased for more than two-thirds of Florida’s surveyed sea turtle nesting beaches despite of coastal urbanization trends. It is anticipated that there will be increasing adoption of state and local lighting ordinances in places where sea turtles nest. However, the impacts of lighting on sea turtles resulting from ongoing non-offshore wind activities would be minor because coastal development trends are likely to continue and sea turtle nesting is also affected by light from more distant urban lighting.

Impacts of lighting on sea turtles from ongoing construction and operation of offshore wind projects have been previously analyzed and were found to be negligible because construction vessel activity was unlikely to measurably alter baseline vessel light levels and proposed lighting will be intermittent, and because of the lack of evidence that offshore platform illumination leads to impacts on sea turtles (BOEM 2021a, 2021b).

Noise: Very little data exist on the behavioral responses of sea turtles to noise. Of the available studies, sea turtles typically change their behavior in some way in response to noise. Further information on sea turtle hearing and thresholds for potential impacts (PTS, TTS, or behavioral disturbance) are provided in the analysis of other offshore wind activities (Section 3.19.3.2). In the geographic analysis area, ongoing activities that may produce noise would include site characterization surveys and scientific surveys (i.e., G&G surveys). These would be infrequent and produce high-intensity impulsive noise that has the potential to affect sea turtles, including potential auditory injuries and behavioral responses, which could include short-term displacement of feeding or migrating (NSF and USGS 2011). The potential for PTS and TTS in sea turtles is considered possible if these animals were to occur in close proximity to the G&G survey noise source. Also, noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water or through the seabed can result in high-intensity, low-exposure-level, and long-term but localized intermittent risk to sea turtles. Lastly, noise from infrequent trenching activities for pipeline and cable laying, as well as other cable burial, dredging, and marine minerals extraction, could cause behavioral disturbance to sea turtles, which is expected to be localized and temporary. The impacts of noise on sea turtles resulting from ongoing non-offshore wind activities are expected to be minor. Although there is some risk for permanent injury (PTS), no mortality is expected.

Impacts of noise on sea turtles from ongoing construction and operation of offshore wind projects have been previously analyzed and were found to range from negligible to moderate during construction and would be negligible during operation. Moderate impacts would result from impact pile driving during construction; however, low numbers of sea turtles are expected to be present. WTG operation noise could result in localized behavioral effects (BOEM 2021a, 2021b).

Traffic (vessel strikes): Vessel strike is an increasing concern for sea turtles. Injuries from propellers and collisions resulting from small boats and ships are expected to occur even more frequently as recreational boat activity increases in conjunction with ongoing coastal development. For example, the percentage of loggerhead strandings attributed to vessel strikes has increased from approximately 10 percent in the 1980s to a record high of 20.5 percent in 2004 (NMFS and USFWS 2007c). Sea turtles cannot reliably avoid being struck by vessels exceeding 2 knots (Hazel et al. 2007) and typical vessel speeds in the geographic analysis area may exceed 10 knots. Increased vessel traffic could result in sea turtle injury or mortality (Foley et al. 2019). The impacts of vessel traffic on individual sea turtles resulting from ongoing non-offshore wind activities would be minor. Although population-level impacts from vessel strikes alone have not been demonstrated, marine traffic is increasing and vessel strikes are understood to be a major threat to sea turtles.

Impacts of traffic (vessel strikes) from ongoing construction and operation of offshore wind projects have been previously analyzed and were found to be minor. Vessels would implement the use of protected species observers, vessel speed restrictions, and other measures to minimize vessel strikes (BOEM 2021a, 2021b).

Accidental releases: Marine pollution is an ongoing threat, as sea turtle ingestion of human trash and debris has been observed in all species of sea turtles (Bugoni et al. 2001; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). Ingestion often occurs when sea turtles mistake debris for potential prey items (Gregory 2009; Hoarau et al. 2014; Thomás et al. 2002). Although the threat varies among species and life stages due to differing feeding, plastic ingestion is an issue for marine turtles from the earliest stages of life (Eastman et al. 2020) and the volume of debris ingested is related to the size of the turtles (Thomás et al. 2002). Fuel spills have lesser potential impacts on sea turtles due to their low probability of occurrence and relatively limited spatial extent, although impacts of large spills can be significant. However, sea turtle exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality (Shigenaka et al. 2010) or sublethal effects on individual fitness. Sea turtles could also become entangled in lost or abandoned fishing gear, which is a significant source of mortality for both juveniles and adults (National Research Council 1990). The impacts of accidental releases on sea turtles resulting from ongoing non-offshore wind activities would be minor. Marine pollution is believed to be a significant factor limiting the recovery of sea turtles.

Impacts from accidental releases and discharges associated with ongoing construction and operation of offshore wind projects have been previously analyzed and were found to be negligible because of the low probability, short-term duration, and highly localized nature of accidental releases (BOEM 2021a, 2021b). Offshore wind projects will comply with their Oil Spill Response Plan and USCG requirements for the prevention and control of oil and fuel spills.

Gear utilization: A primary threat to sea turtles is their unintended capture in fishing gear, which can result in drowning or cause injuries that lead to injury and mortality (e.g., swallowing hooks). For example, trawl fishing is among the greatest continuing primary threats to the loggerhead turtle (Bolten et al. 2019) and sea turtles are also caught as bycatch in other fishing gear including longlines, gillnets, hook and line, pound nets, pot/traps, and dredge fisheries. A substantial impact of commercial fishing on sea turtles is the entrapment or entanglement that occurs with a variety of fishing gear. Although the requirement for the use of bycatch mitigation measures, such as requirements for "turtle excluder devices" in trawl fishing gear, has reduced sea turtle bycatch, Finkbeiner et al. (2011) compiled data on sea turtle bycatch in U.S. fisheries and found that in the Atlantic, a mean estimate of 137,700 interactions, 4,500 of which were lethal, occurred annually since implementation of bycatch mitigation measures. The impacts of gear utilization associated with fisheries use on sea turtles are expected to be minor. A reduction of sea turtle interactions with fisheries is a priority for sea turtle recovery.

Impacts of gear utilization from ongoing construction and operation of offshore wind are expected to occur at short-term, regular intervals over the lifetime of the projects and are expected to be negligible (BOEM 2021a, 2021b).

Climate change: Global climate change could result in population-level impacts on sea turtle species by displacement, impacts on prey species, altered population dynamics, and increased mortality. It is well established that climate change has the potential to affect the distribution and abundance of sea turtles and their prey due to changing water temperatures, ocean currents, and increased acidity. Furthermore, rising sea levels and increased storm intensity may negatively affect turtle nesting beaches. Increasing air temperatures can affect sea turtle population structure because temperature-dependent sex determination of embryos would result in a shift toward more female-biased sex ratios (Poloczanska et al. 2009). Patel et al. (2021) used global climate models to predict that the future distribution of suitable thermal habitat for loggerheads along the OCS will likely increase in northern regions. Sea turtle nesting could also shift northward on the U.S. Atlantic Coast. Because these changes may affect sea turtle reproduction, survival, and demography, the impacts of climate change on sea turtles are expected to be minor.

3.19.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities within the geographic analysis area that contribute to cumulative impacts on sea turtles include but are not limited to various coastal development projects permitted through regional planning commissions, counties, and towns; dredging for the New Jersey Wind Port on the Delaware River in Salem County; the Davisville/Brooklyn/Newark Container-on-Barge Service; the approved liquefied natural gas export terminals in Elba Island, Georgia, and Jacksonville, Florida; the Roosevelt Island Tidal Energy Project; dredging for beach replenishment used for the Long Beach Island Coastal Storm Risk Management Project, Barnegat Inlet to Little Egg Inlet; the Atlantic City marina upgrades; and the Port of Virginia channel deepening. These and other planned non-offshore wind activities may affect sea turtles via the same IPFs listed above and discussed in further detail below. Impacts on sea turtles may be temporary (displacement or behavioral responses) or permanent (e.g., habitat loss or mortality). All activities would be required to comply with federal, state, and local regulations, which would avoid or minimize most potential impacts.

Planned offshore wind activities have the potential to produce impacts resulting from site characterization studies, site assessment data collection activities that involve installation of meteorological towers or buoys, and installation and operation of turbine structures. Other planned offshore wind projects in the geographic analysis area are estimated to collectively:

- Install 3,109 WTG and OSS foundations
- Install 4,988 miles (8,027 kilometers) of offshore export cable and 5,309 miles (8,544 kilometers) of inter-array cable
- Disturb 27,126 acres (110 km^2) of seabed for WTG foundations and scour protection, cable emplacement, and anchoring
- Store 5,300 gallons (19,041 liters) of diesel fuel, oils, lubricants, and coolant per WTG

BOEM expects planned offshore wind activities (without the Proposed Action) to affect the primary IPFs of accidental releases, discharges, EMF, cable placement and maintenance, noise, vessel traffic, port utilization, presence of structures, and gear utilization. This section provides a general description of these activities, recognizing the extent and significance of potential effects on conditions cannot be fully quantified for projects that are in the conceptual or proposal stage and have not been fully designed. Where appropriate, certain potential effects resulting from these actions can be generally characterized by comparison to effects resulting from the Proposed Action that are likely to be similar in nature and significance. The intent of this section is to provide a general overview of how reasonably foreseeable future activities might influence environmental conditions. Should any or all of the activities described in Appendix F proceed, each would be subject to independent NEPA analyses and regulatory approvals, and their environmental effects would be fully considered therein.

Accidental releases: Accidental releases of fuel, fluids, hazardous materials, trash, and debris may increase as a result of planned offshore wind activities. The risk of any type of accidental release would be increased primarily during construction, but also during operations and decommissioning of offshore wind facilities.

Planned offshore wind development would require large quantities of coolant fluids, oils and lubricants, and diesel fuel (see Table F2-3 in Appendix F for specific quantities). In the planned activities scenario (see Table F2-3 in Appendix F), there would be a low risk of a leak of fluids from any single one of approximately 2,946 WTGs, each with approximately 5,300 gallons (19,041 liters) of diesel fuel, oils, lubricants, and coolant stored. According to BOEM’s modeling (Bejarano et al. 2013), a release of 128,000 gallons is likely to occur no more often than once per 1,000 years, and a release of 2,000 gallons or less is likely to occur every 5 to 20 years. The likelihood of a spill occurring from multiple WTGs and OSS at the same time is very low and, therefore, the potential impacts from a spill larger than 2,000 gallons are largely discountable. Based on the volumes potentially involved, the likely amount of additional releases associated with planned offshore wind development would fall within the range of accidental releases that already occur on an ongoing basis from non-offshore wind activities. Impacts resulting from accidental releases may pose a long-term risk to sea turtles and could potentially lead to mortality and sublethal impacts on individuals present in the vicinity of the spill, but the potential for exposure would be minor given the isolated nature of these accidental releases and the variable distribution of sea turtles in the geographic analysis area.

The accidental release of trash and debris may occur by vessels during construction, operations, and decommissioning of planned offshore wind facilities. Ingestion of trash or exposure to aquatic contaminants can be lethal to sea turtles. However, sea turtles may also be affected sublethally in a variety of ways, which could include experiencing depressed immune system function, poor body condition, and reduced growth rates, fecundity, and reproductive success (Hoarau et al. 2014). Sea turtles could also become entangled in debris accidentally released by offshore wind project vessels, causing lethal or injurious impacts. Additionally, refueling of primary construction vessels at sea would likely be proposed for planned offshore wind activities, which could affect sea turtles and their prey if spills were to occur. Impacts on individual sea turtles, including decreased fitness, health effects, and mortality, may occur if individuals are present in the vicinity of a spill, but accidental releases are expected to be rare and injury or mortality are not expected to occur. BOEM assumes all vessels will comply with laws and regulations to minimize releases. In the unlikely event of a trash or debris release, it would be an accidental, localized event in the vicinity of an offshore wind lease area.

Accidental releases from planned offshore wind activities would likely result in minor impacts for sea turtles and are unlikely to result in population-level effects, although consequences to individuals would be detectable and measurable. Impacts from accidental releases from planned non-offshore wind activities would likely be minor because fuel spills have lesser potential impacts on sea turtles due to their low probability of occurrence and relatively limited spatial extent and debris release would be accidental and localized.

EMF: The EMFs produced by cables have the potential to affect sea turtle migration because they are known to possess geomagnetic sensitivity and use cues from Earth's magnetic field for orientation, navigation, and migration. Sea turtles appear to have a detection threshold of magnetosensitivity and behavioral responses to field intensities ranging from 0.0047 to 4,000 microteslas for loggerhead turtles and 29.3 to 200 microteslas for green turtles, with other species likely similar due to anatomical, behavioral, and life history similarities (Normandeau et al. 2011). In the planned activities scenario, up to 4,988 miles (8,027 kilometers) of offshore export cable and 5,309 miles (8,544 kilometers) of inter-array cable would be added in the geographic analysis area for sea turtles, producing EMFs in the vicinity of each cable during operations (Appendix F, Table F2-1). Submarine power cables in the geographic analysis area for sea turtles are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF from cable operation to low levels. Juvenile and adult sea turtles may detect the EMF over relatively small areas near cables (e.g., when resting on the bottom or foraging on benthic organisms near cables or concrete mattresses). There are no data on impacts on sea turtles from EMFs generated by underwater cables, although anthropogenic magnetic fields can influence migratory deviations (Luschi et al. 2007; Snoek et al. 2016). Lohmann et al. (2008) speculated that navigation methods used by adult and juvenile sea turtles were dependent upon the stage of migration, initially relying on magnetic orientation. While the specific mechanisms of leatherback sea turtle navigation are unknown, it is believed that they possess a compass sense similar to hardshell turtle species, possibly related to geomagnetic cues (Eckert et al. 2012; Luschi et al. 2007; NMFS and USFWS 2013). Therefore, although EMF associated with planned offshore wind development cables could cause some deviations to sea turtle routes, these deviations would likely be minor (Normandeau et al. 2011) and biologically insignificant due to the minor energy expenditure they may cause. Furthermore, this IPF would be limited to extremely small portions of the areas used by resident or migrating sea turtles. As such, exposure to EMF planned offshore wind activities would be negligible.

Lighting: All WTGs and OSS associated with planned offshore wind activity would be lit with navigational and FAA hazard lighting. Although lighting on nesting beaches or in nearshore habitats has the potential to result in disorientation to nesting females and hatchling turtles, artificial lighting on the OCS does not appear to have the same effects. Orr et al. (2013) indicated that lights on WTGs that flash intermittently for navigational or safety purposes do not present a continuous light source, and therefore do not appear to have a disorienting influence for any sea turtle life history stages. Additionally, the continuous lighting of construction equipment and wind turbines at night during project construction would not be expected to attract or disorient sea turtles. Salmon and Wyneken (1990) conducted laboratory tests that indicated that hatchlings no longer oriented toward brighter horizons after they began swimming. Therefore, if hatchlings swim in the vicinity of offshore wind facilities with lighting, their behavior should not be affected by the lights. BOEM anticipates that impacts on sea turtles from structure lighting associated with planned offshore wind activity would be negligible. Impacts from lighting from planned non-offshore wind activities would likely be minor because coastal development trends are likely to continue and sea turtle nesting is also affected by light from more distant urban lighting.

Cable emplacement and maintenance: Planned offshore wind development would require the placement and maintenance of cabling to bring generated electricity onshore and would result in seafloor disturbance and elevated levels of suspended sediment. This could affect 32,346 acres (131 km^2) of seabed while associated undersea cables are installed, causing an increase in suspended sediment (see Appendix F, Table F2-2). Cable emplacement may occur from a variety of methods that include trenching devices, plows, and jetting and are dependent upon seabed sediments. The impacts from these cable emplacement methods are variable but typically include suspension of seabed sediments that vary in extent and intensity depending on the project and site-specific conditions. Impacts from cable burial would be spatially and temporally localized, with the main impacts occurring within a few feet vertically and a few hundred feet horizontally from the point of disturbance. Suspended sediment concentrations due to jet plow would be within the range of natural variability. Potential impacts from construction activities on sea turtles would be short term and involve increased turbidity for 1 to 6 hours in the immediate vicinity of the cable emplacement corridor. If elevated turbidity caused any behavioral responses such as avoiding the turbidity zone or changes in foraging behavior, such behaviors would be temporary. Sea turtles would be expected to swim away from the sediment plume and return to the area once turbidity has returned to background levels. Elevated turbidity could temporarily affect the foraging behavior of sea turtles by attracting prey to feed on detritus or interfering with visual prey detection, but no impacts due to swimming through the plume would be expected (NMFS 2020). It is expected that mitigation measures would be implemented to minimize and reduce the potential for adverse effects from water quality changes on sea turtles.

Dredging for sand wave clearance may be necessary in places to ensure cable burial below mobile seabed sediments, which could result in additional impacts on sea turtles related to impingement, entrainment, and capture associated with mechanical and hydraulic dredging techniques. Sea turtles have been known to become entrained in trailing suction hopper dredge or trapped beneath the draghead as it moves across the seabed. Direct impacts, especially for entrainment, typically results in severe injury or mortality (Dickerson et al. 2004; USACE 2020). About 69 projects have recorded sea turtle takes within channels in New Jersey, Delaware, and Virginia and there have likely been numerous other instances not officially recorded (Ramirez et al. 2017). However, the risk of interactions between hopper dredges and individual sea turtles is expected to be lower in the open ocean areas where dredging may occur compared to nearshore navigational channels where sea turtles are more concentrated in a constrained operating environment (Michel et al. 2013; USACE 2020). This may be due to the lower density of sea turtles in these areas as well as differences in behavior and other risk factors.

Dredging within nearshore areas could affect green sea turtle habitat by directly removing SAV or creating suspended sediments that may be deposited on top of seagrass (see Section 3.6, *Benthic Resources*). To mitigate that risk, it is anticipated that planned offshore wind projects would perform SAV surveys and avoid these areas during construction, to the extent practicable. Changes in turbidity and suspended sediments could temporarily disrupt normal sea turtle behaviors, especially if turtles rely on vision to forage. Sea turtles may experience behavioral effects upon exposure to turbidity or suspended sediments and become more susceptible to other threats like vessel strikes, but this has not been studied or measured. There are also no studies that evaluate the behavioral effects of suspended sediments on mobile prey species and Johnson (2018) suggested that any effects on sea turtle prey species from suspended sediments, sediment deposition, or turbidity may cause turtles to move to other areas and then return to the affected areas at some time in the future. It is not believed that dredging would permanently change the sea turtle prey base (Michel et al. 2013) and planned wind projects would implement turbidity reduction measures to contain the silt and sediment stirred up by dredging.

Lastly, while there would be a loss of existing benthic habitat, the presence of scour protection and hard protection on top of cables could create a more complex habitat and increase the abundance of associated organisms like mussels and crustaceans on and around the cables (Hutchison et al. 2020), providing a prey resource for loggerhead and Kemp's ridley sea turtles. The hard substrate may increase the abundance of jellyfish, an important prey species for leatherback sea turtles (Janßen et al. 2013). It is anticipated that offshore wind cables may cause long-term to permanent impacts on some areas with SAV, adversely affecting green sea turtles' forage availability, although cable routes for planned projects have not been fully determined at this time. Studies on the effects of dredging on green sea turtles in Florida found that they utilized adjacent unaffected habitats and returned to the dredged area within 2 years (Michel et al. 2013).

Given the available information, the risk of injury or mortality of individual sea turtles resulting from dredging necessary to support planned offshore wind projects would be minor and population-level effects are unlikely to occur.

Noise: In the geographic analysis area, planned offshore wind activities that could cause underwater noise are impact pile driving (installation of WTGs and OSS), vibratory pile driving (installation and removal of cofferdams), HRG surveys, detonations of UXO, vessel traffic, aircraft, cable laying or trenching, and turbine operation.

The installation of ongoing WTG foundations into the seabed involves pile driving and other construction activities that could cause underwater noise in the geographic analysis area and result in short-term behavioral disturbance and impacts on sea turtle hearing that may recover over time (i.e., TTS) as well as long-term impacts on sea turtle hearing (i.e., PTS). Noise from pile driving would occur during installation of foundations for offshore structures. The potential for underwater noise to result in adverse impacts on a sea turtle depends on the received sound level and the frequency content of the sound relative to the hearing ability of the animal. The limited data available on sea turtle hearing abilities are summarized in Table 3.19-4. Sea turtles appear to hear frequencies from 30 Hz to 2 kilohertz, with a range of best hearing sensitivity between 100 and 700 Hz; however, there is some sensitivity to frequencies as low as 60 Hz and possibly as low as 30 Hz (Ridgway et al. 1969). Therefore, there is substantial overlap in the frequencies that sea turtles can detect and the dominant frequencies produced by offshore wind activities, including pile driving, impulsive sources used for HRG surveys, and UXO.

Table 3.19-4 Hearing Capabilities of Sea Turtles

Sea Turtle Species	Hearing		Source
	Range (Hertz)	Highest Sensitivity (Hertz)	
Green Sea Turtle (*Chelonia mydas*)	60–1,000	300–500	Ridgway et al. 1969
	100–800	600–700 (juveniles) 200–400 (subadults)	Bartol and Ketten 2006; Ketten and Bartol 2006
	50–1,600	50–400	Piniak et al. 2012a, 2016
Loggerhead Sea Turtle (*Caretta caretta*)	250–1,000	250	Bartol et al. 1999
	50–1,100	100–400	Martin et al. 2012; Lavender et al. 2014
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	100–500	100–200	Bartol and Ketten 2006; Ketten and Bartol 2006

Sea Turtle Species	Hearing		Source
	Range (Hertz)	Highest Sensitivity (Hertz)	
Leatherback Sea Turtle (*Dermochelys coriacea*)	50–1,600	100–400	Piniak et al. 2012b

Given the high energy levels of offshore wind energy survey and installation noise sources, it can be concluded that sea turtles could be affected by associated noise. However, there are no available empirical data regarding threshold levels for impacts on sea turtle hearing from sound exposure. As a result, there have been no regulatory threshold criteria established for sea turtles. There are limited data pertaining to behavioral responses of sea turtles and none specifically to sounds generated by offshore wind activities. McCauley et al. (2000) observed that one green turtle and one loggerhead sea turtle in an open water pen increased swimming behaviors in response to a single seismic airgun at received levels of 166 dB re 1 µPa and exhibited erratic behavior at received levels greater than 175 dB re 1 µPa. Moein et al. (1994) documented similar avoidance reactions to similar levels of seismic signals, although both studies were done in a caged environment, so the extent of avoidance could not be monitored. DeRuiter and Larbi Doukara (2012) observed that 57 percent of loggerhead sea turtles exhibited a diving response after seismic airgun array firing at received levels between 175 and 191 dB re 1 µPa. Moein et al. (1994) did observe a habituation effect to the airguns; the animals stopped responding to the signal after three presentations. Sea turtles can become habituated to repeated noise exposure over time and not suffer long-term consequences (O'Hara and Wilcox 1990). This type of noise habituation has been demonstrated even when the repeated exposures were separated by several days (Bartol and Bartol 2011; Navy 2018).

In the absence of NMFS acoustic thresholds, the U.S. Navy has adopted PTS and TTS thresholds for sea turtles as presented in Finneran et al. (2017) (see Table 3.19-5). Table 3.19-5 outlines the acoustic thresholds for the onset of PTS, TTS, and behavioral disturbance for sea turtles for impulsive noise sources. NMFS has considered behavioral response beginning at 175 dB re 1 µPa SPL_{RMS} for impulsive and non-impulsive noise sources (Navy 2017). These thresholds apply to juvenile, subadult, and adult life stages.

Table 3.19-5 Acoustic Thresholds for Onset of Acoustic Impacts (PTS, TTS, or Behavioral Disturbance) for Sea Turtles

Injury (PTS)		TTS		Behavioral Disturbance
SPL_{peak} (dB re 1 µPa) Impulsive	SEL_{cum} (dB re 1 µPa^{2}s) Impulsive	SPL_{peak} (dB re 1 µPa) Impulsive	SEL_{cum} (dB re 1 µPa^{2}s) Impulsive	SPL_{RMS} (dB re 1 µPa) Impulsive/Non-Impulsive
232	204	226	189	175

dB re 1 µPa = decibels relative to 1 micropascal; dB re 1 µPa^{2}s = decibels relative to 1 micropascal squared second; SEL_{cum} = cumulative sound exposure level

In the planned activities scenario (see Appendix F), the construction of 3,109 WTG and OSS foundations would create underwater noise and may temporarily affect sea turtles if they are present in the ensonified area. While these potential effects are acknowledged, their potential significance is unclear.

Impact pile driving noise: Impulsive underwater noise from impact pile driving during planned offshore wind development, due to the anticipated frequency and spatial extent of effects, represents the IPF with the highest likelihood for effects on individual sea turtles. Sea turtles migrating through the area when pile driving occurs are expected to adjust their course to avoid the area where noise is elevated above 175 dB re 1 μPa SPL_{RMS}. Such behavioral alterations could cause turtles to cease foraging or expend additional effort and energy avoiding the area. Presumably, sea turtles could continue foraging activities outside the area of elevated noise levels as adjacent habitat provides similar foraging opportunities. Although information is lacking, some sea turtles could be temporarily displaced into areas that have a lower foraging quality or result in higher risk of interactions with ships or fishing gear. Sea turtles may experience physiological stress during this avoidance behavior, but this stressed state would be anticipated to dissipate over time once the sea turtle is outside the ensonified area. Furthermore, this displacement would result in a relatively small energetic consequence that would not be expected to have long-term impacts on sea turtles.

While there have been no documented sea turtle mortalities associated with pile driving and no direct evidence of PTS occurring in sea turtles, TTS has been demonstrated in many species from exposure to impulsive and non-impulsive noise (a full review is provided in Southall et al. 2007 and NOAA 2013). Prolonged or repeated exposure to sound levels sufficient to induce TTS without recovery time can lead to PTS (Southall et al. 2007). The accumulated stress and energetic costs of avoiding repeated exposure to pile-driving noise over a season or a life stage could have long-term impacts on survival and fitness (Navy 2018). Conversely, sea turtles could become habituated to repeated noise exposure over time, ignore a stimulus that was not accompanied by an overt threat, and not suffer long-term consequences (O’Hara and Wilcox 1990; Hazel et al. 2007). This type of noise habituation has been demonstrated even when the repeated exposures were separated by several days (Bartol and Bartol 2011; Navy 2018). The magnitude of potential impacts on sea turtles would be dependent upon the locations of concurrent construction operations, as well as the number of hours per day, the number of days that pile driving would occur, and the time of year in which pile driving occurs. Reduced hearing sensitivity because of pile driving could limit the ability to detect predators, prey, or potential mates and reduce the survival and fitness of affected individuals; however, the role and importance of sound in these biological functions for sea turtles remain poorly understood (Lavender et al. 2014).

HRG survey noise: Planned offshore wind energy projects perform HRG surveys that use a combination of sonar-based methods to map shallow geophysical features and can be classified as impulsive or non-pulsive noise sources. The equipment is towed behind a moving survey vessel and generates a short-duration pulse in the 1.1- to 200-kilohertz range, with the interval between pulses ranging from 0.2 to 1 second, depending on the specific type of equipment used. The equipment only operates when the vessel is moving along a survey transect, meaning that the ensonified area is intermittent and constantly moving. HRG surveys that use non-impulsive sources are not expected to affect sea turtles because they operate at frequencies above the sea turtle hearing range.

BOEM (2018) and NMFS (2021b) evaluated potential underwater noise effects on sea turtles from HRG surveys using impulsive sources (boomers/airguns/sparkers/sub-bottom profilers) and concluded that for an individual sea turtle to experience PTS (204 dB re 1 $\mu Pa^2 s$ SEL_{cum}; 232 dB re 1 $\mu Pa^2 \cdot s$ SPL [0–pk] impulsive sources), it would have to be within 1 meter of the loudest possible noise source. In fact, NMFS (2021b) states that none of the equipment being operated for HRG surveys with hearing overlap for sea turtles has source levels loud enough to result in PTS or TTS. However, noise from impulsive sources used during HRG surveys could exceed the behavioral effects threshold (175 dB) up to 90 meters from the source, depending on the type of equipment used. Given the limited extent of potential noise effects, injury-level exposures (PTS/TTS) are unlikely to occur. As stated above and based on the loudest impulsive noise source, it is highly unlikely that noise from HRG survey sound sources would cause PTS or TTS in sea turtles (NMFS 2021b). While low-level behavioral exposures could occur, these disruptions would be limited in extent and short term in duration given the movement of the survey vessel and the mobility of the animals. Therefore, underwater noise impacts from HRG surveys are expected to be minor.

UXO detonation noise: Planned offshore wind activities may encounter UXO on the seabed in their lease areas or along export cable routes. While non-explosive methods may be employed to lift and move these objects, some may need to be removed by explosive detonation. Underwater explosions of this type generate high pressure levels that could cause disturbance and injury to sea turtles, but the number of affected individuals would be small relative to the population sizes. The number and location of detonations that may be required for planned projects as well as the Proposed Action are relatively unknown. Impacts associated with UXO detonations for other projects would be similar to those described and modeled for the Proposed Action in Section 3.19.5.

Vessel noise: Due to the large number of vessels required for planned offshore wind development, vessel noise could potentially result in impacts on individual sea turtles. The use of ocean vessels could potentially result in long-term but infrequent impacts on sea turtles, including temporary startle responses, masking of biologically relevant sounds, physiological stress, and behavioral changes, especially their submergence patterns (NSF and USGS 2011; Samuel et al. 2005). However, Hazel et al. (2007) suggest that sea turtles' ability to detect approaching vessels is primarily vision-dependent, not acoustic. Sea turtles may respond to vessel approach, noise, or both, with a startle response (diving or swimming away) and a temporary stress response (NSF and USGS 2011). Samuel et al. (2005) indicated that vessel noise can have an effect on sea turtle behavior, especially their submergence patterns. BOEM anticipates that the potential effects of noise from construction and installation vessels would elicit brief responses to the passing vessel that would dissipate once the vessel or the turtle left the area.

Turbine operational noise: Sound is generated by operating WTGs due to pressure differentials across the airfoils of moving turbine blades and from mechanical noise of bearings and the generator converting kinetic energy to electricity. Sound generated by the airfoils, like aircraft, is produced in the air and enters the water through the air-water interface. Mechanical noise associated with the operating WTG is transmitted into the water as vibration through the foundation and subsea cable. Both airfoil sound and mechanical vibration may result in long-term, continuous noise in the offshore environment. Measured underwater sound levels in the literature are limited to geared smaller wind turbines (less than 6.15 MW), as summarized by Tougaard et al. (2020). Tougaard et al. 2009 measured SPLs ranging between 109 and 127 dB re 1 μPa underwater 45 and 65 feet (14 and 20 meters) from the foundations at frequencies below 315 Hz up to 500 Hz. Wind turbine acoustic signals above ambient background noise were detected up to 2,066 feet (630 meters) from the source (Tougaard et al. 2009). Noise levels were shown to increase with higher wind speeds (Tougaard et al. 2009). Operational noise from larger, current-generation WTGs on the order of 10 MW would generate higher source levels than the range noted above, at around 170 dB re 1 μPa SPL_{RMS} (Stöber and Thomsen 2021). However, the shift from using gear boxes to direct-drive technology is expected to reduce the sound level by around 10 dB and, based on available data, the sound levels produced during the operation of planned offshore wind projects would be less than the injurious thresholds defined by NMFS for sea turtles. While it may cause behavioral effects, these effects would be at relatively short distances from the foundations and would reach ambient underwater noise levels within 50 meters of the foundations (Miller and Potty 2017; Tougaard et al. 2009). Sea turtles may respond to underwater noise generated by WTG operation through avoidance or behavioral alteration for some sea turtles. Such localized behavioral effects would be negligible and sea turtles could be expected to become habituated to the sound. In contrast, the decommissioning of a project would reverse any sea turtle displacement effects caused by operational noise. Also, underwater noise from offshore wind project operation is unlikely to result in significant effects on the forage base for sea turtles. These species are primarily invertivores or, in the case of green sea turtles, omnivorous vegetarians. The sound sensitivity of invertebrates like crabs, jellyfish, and mollusks is restricted to particle motion and the affect dissipates rapidly such that any effects are highly localized to the immediate proximity (i.e., less than 3.3 feet [1 meter]) of the noise source (Edmonds et al. 2016). Although loggerhead and Kemp's ridley sea turtles may periodically prey on fish, fish represent a minor component of a flexible and adaptable diet. Underwater noise could temporarily reduce the availability of fish prey species, but these effects would be limited in extent and duration.

Based on the above discussion, BOEM anticipates that the impacts of noise on sea turtles from planned offshore wind activities would be minor. Impacts from noise from planned non-offshore wind activities would likely be minor because noise associated with these activities is anticipated to be localized, infrequent, and temporary.

Traffic (vessel strikes): Planned offshore wind projects on the OCS would be constructed between 2023 and 2030, contributing to increases in vessel traffic and associated noise impacts within the sea turtle geographic analysis area. Based on the current vessel traffic generated by ongoing activities, it is assumed that vessel traffic associated with planned offshore wind development poses a high-frequency, high-exposure collision risk for sea turtles in coastal waters when transiting through offshore wind lease areas during construction, operations, and decommissioning. Construction of each individual offshore wind project would generate approximately 20 to 65 simultaneous construction vessels (refer to Section 3.16 for additional information regarding vessel traffic). This vessel traffic increase would be expected to result in a small incremental increase in overall vessel traffic within the geographic analysis area for sea turtles. Sea turtles are likely to be most susceptible to vessel strikes in coastal waters, where they forage from May through November. Vessel speed may exceed 10 knots in such waters, and those vessels traveling at greater than 10 knots would pose the greatest threat to sea turtles (Hazel et al. 2007).

The relative risk of vessel strikes with sea turtles from wind industry vessels would depend upon the density of sea turtles within the area, stage of project development, time of year, number of vessels, and speed of vessels during each stage. Planned offshore wind projects may also cause shifts in vessel traffic, including temporary restrictions of fishing vessels during construction due to implementation of safety zones, potential increases in vessel traffic within the offshore wind lease areas after construction due to an influx of recreational fishing vessels targeting species associated with an artificial reef effect, and likely shifts in commercial fishing vessels from the offshore wind lease areas to areas not routinely fished due to recreation vessel congestion and gear-conflict concerns. Collision risk for sea turtles would be expected to occur primarily when vessels transit to and from the offshore wind lease areas from ports. Once within the offshore wind lease areas, vessels would typically be stationary and no collision risk would be expected, but some transits between locations may also occur. The increased collision risk from transiting vessels has the potential to result in injury to or mortality of individual sea turtles, but impacts would be minor given the broad distribution and low densities of most sea turtle species. Population-level impacts would also be expected to be unlikely due to the low densities of each species and their extensive distribution within the geographic analysis area. Therefore, BOEM anticipates that the impacts of vessel strikes on sea turtles from ongoing and planned offshore wind activities would be minor. Impacts from traffic (vessel strikes) from planned non-offshore wind activities would likely be minor because although marine traffic is increasing, population-level impacts from vessel strikes alone have not been demonstrated.

Port utilization: Offshore wind on the mid-Atlantic OCS may require the expansion or improvement of regional ports to support planned projects. The State of New Jersey is planning to build an offshore wind port on the eastern shore of the Delaware River in Lower Alloways Creek (Appendix F). Port improvements could lead to an increase in vessel traffic during construction, O&M, and decommissioning. The resulting change in vessel traffic in the geographic analysis area cannot be predicted, however, because only locations for port expansion are identified and no specific project plans have been proposed. Any future port expansion and associated increase in vessel traffic would be subject to independent NEPA analysis and regulatory approvals requiring full consideration of potential effects on sea turtles regionwide. For these reasons, the impacts of port utilization on sea turtles from planned offshore wind activities would likely be minor because the potentially affected habitats would be small relative to the habitat used by sea turtles in the geographic analysis area.

Presence of structures: Development of offshore wind projects in the planned activities scenario would install more buoys, meteorological towers, foundations, and hard protection. Up to 3,109 new WTG and OSS foundations would be installed, which could create a reef effect. Foundations and armoring create biological hotspots that support species range shifts and expansions, and changes in biological community structure (Raoux et al. 2017; Methratta and Dardick 2019; Degraer et al. 2020). Around the base of the monopiles, colonizing organisms on the surface of the pile would likely enhance food availability and food web complexity through an accumulation of organic matter (Degraer et al. 2020; Mavraki et al. 2020). The accumulation could lead to an increased importance of the detritus-based food web but is unlikely to result in significant broad-scale changes to the local trophic structure (Raoux et al. 2017). The available information suggests that the prey base for leatherback, loggerhead, and Kemp's ridley sea turtles may increase in the geographic analysis area due to the reef effect of the WTGs and associated scour protection and an increase in crustaceans and other forage species. These structures would affect ocean mixing and alter thermal stratification, which although small compared to other naturally occurring mixing mechanisms (Schultze et al. 2020) could influence sea turtle dive behavior and thermoregulation. This effect would also influence primary and secondary productivity, the distribution and abundance of fish and invertebrates, and overall community structure within and in proximity to project footprints. Depending on proximity and extent, hydrodynamic and reef effects from future actions could influence the availability of prey and forage resources for sea turtles.

As discussed above regarding scour protection for cable emplacement, the presence of new, hard surfaces, including WTG foundations, would provide habitat that could be colonized by an abundance of organisms that are sea turtle prey, like mussels, crustaceans, and jellyfish. In the Gulf of Mexico, loggerhead, leatherback, green, Kemp's ridley, and hawksbill sea turtles have been documented in the vicinity of offshore oil and gas platforms, with the probability of occupation increasing with the age of the structures (Gitschlag and Herczeg 1994; Hastings et al. 1976). Sea turtles would be expected to use habitat in between the WTGs as well as around structures for feeding, breeding, resting, and migrating for short periods, but residency times around structures may increase with the age of structures if communities develop on and around foundations.

Project-specific effects would vary, recognizing that larger and contiguous projects could have more significant effects on prey and forage resources, but the extent and significance of these effects cannot be predicted based on currently available information. The ultimate effects of planned offshore wind structures on ocean productivity, sea turtle prey species, and thereby sea turtles are difficult to predict with certainty and are expected to vary by location, season, and year, depending on broader atmospheric conditions and ecosystem processes. Impacts would also be highly localized and unlikely to have biologically meaningful effects on individual sea turtles. Project decommissioning, including the removal of the monopile foundations and scour and cable protection, would reverse the artificial reef effect provided by these structures and remove or disperse the associated biological community. Sea turtle species accustomed to the foraging opportunities provided in this community would have to adapt.

While the anticipated reef effect would result in long-term beneficial impacts on sea turtles, some potential exists for increased exposure to fishing gear that could lead to entanglement, ingestion, injury, and death. The presence of structures may concentrate recreational fishing around foundations and would also increase the risk of gear loss or damage. This could cause entanglement, especially with monofilament line, and increase the potential for entanglement in both lines and nets leading to injury and mortality due to abrasions, loss of limbs, and increased drag, resulting in reduced foraging efficiency and ability to avoid predators (Barnette 2017; Berreiros and Raykov 2014; Foley et al. 2008). The reef effect may attract recreational fishing effort from inshore areas and attract sea turtles for foraging opportunities, resulting in a small increased risk of sea turtle entanglement and hooking or ingestion of marine debris where fishermen and turtles are concentrated around the same foundations.

Given the available information, the risk of injury to or mortality of individual sea turtles due to the presence of structures planned offshore wind activities, and the interactions with fishing gear that they may cause, would be minor and population-level effects are unlikely to occur. Likewise, any beneficial impacts from the reef effect would be minor, as individuals may benefit but there would be no population-level effects.

Gear utilization (biological/fisheries monitoring surveys): Sea turtles could be affected by monitoring surveys of planned offshore wind activities due to vessel traffic and associated underwater vessel noise and potential for vessel strikes. These effects would be similar to those discussed above under *Noise* and *Traffic*. Additional impacts on sea turtles could result from trawl and trap surveys and the use of acoustic survey technologies. Offshore wind projects are expected to use trawl surveys, among other methods, for project monitoring. The capture and mortality of sea turtles in bottom-trawl fisheries are well documented (Henwood and Stuntz 1987; NMFS and USFWS 1991, 1992; National Research Council 1990). While sea turtles are capable of remaining submerged for long periods of time, they appear to rapidly consume oxygen stores when entangled and forcibly submerged in fishing gear (Lutcavage and Lutz 1997). The preponderance of available research (Epperly et al. 2002; Sasso and Epperly 2006) and anecdotal information from past trawl surveys indicates that limiting tow times to less than 30 minutes would likely eliminate the risk of death for incidentally captured sea turtles. It is anticipated that the proposed trawls for offshore wind project monitoring would be limited to 20 minutes, indicating that this activity poses a negligible risk of mortality and mitigation measures would be expected to eliminate the risk of serious injury and mortality from forced submergence for sea turtles caught in bottom-trawl survey gear.

Other fisheries resource surveys using stationary gear like Chevron traps or baited remote underwater video could pose a risk of entanglement for sea turtle species due to buoy and anchor lines. While there is a theoretical risk of sea turtle entanglement, particularly for leatherbacks, in trap and pot gear (NMFS 2016), the likelihood would be discountable given the limited, patchy distribution of sea turtles, the small number of vertical lines used in the surveys, and the limited duration of each survey event. Efforts would also be taken to reduce sea turtle interactions during fisheries surveys. Sea turtle prey items such as horseshoe crabs, other crabs, whelks, and fish may be removed from the marine environment as bycatch in trap gear. However, all bycatch is expected to be returned to the water alive, dead, or injured to the extent that the organisms would shortly die. Injured or deceased bycatch would still be available as prey for sea turtles, particularly loggerhead sea turtles, which are known to eat a variety of live prey as well as scavenge dead organisms. Given this information, any effects on sea turtles from the collection of potential sea turtle prey in trap gear would be so small that it cannot be meaningfully measured, detected, or evaluated and, therefore, effects would be insignificant.

The equipment used in the clam, oceanography, and pelagic fish surveys pose minimal risk to sea turtles. Tows for the clam survey have a very short duration of 120 seconds, and the vessels would be subject to mitigation measures similar to those for the trawl survey. Both the oceanography and pelagic fish surveys are non-extractive and would also be subject to mitigation measures that would avoid minimize potential impacts on sea turtles. Therefore, the effects of the equipment used in clam, oceanography, and pelagic fish surveys on sea turtles would insignificant or discountable. Lastly, the passive acoustic monitoring surveys would not have any direct impacts on sea turtles; as with all other monitoring surveys, impacts on sea turtles could arise from vessel noise and the potential for vessel strike as discussed above. Mooring lines for such surveys pose a theoretical entanglement risk to sea turtles but BOEM anticipates requiring that moored systems would use the best available technology to reduce any potential risks of entanglement and that they would pose a discountable risk of entanglement to sea turtles.

Monitoring surveys are expected to occur at short-term, regular intervals over the lifetime of a project and therefore impacts of this IPF on sea turtles from planned offshore wind projects would be negligible even though the potential extent and number of animals potentially exposed cannot be determined without project-specific information. Impacts from gear utilization from planned non-offshore wind activities would likely be minor because although the requirement for bycatch mitigation measures has reduced sea turtle bycatch, interactions with fisheries gear would continue.

3.19.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, baseline conditions for sea turtles would continue to follow current regional trends and respond to IPFs introduced by other ongoing activities, including other offshore wind activities. BOEM expects ongoing activities would have temporary to permanent impacts on sea turtles (disturbance, displacement, injury, mortality, and reduced foraging success), primarily due to lighting associated with coastal development, noise, marine pollution, vessel strikes, entanglement or ingestion of fishing gear, and ongoing climate change. The No Action Alternative, including ongoing non-offshore wind and offshore wind activities, would result in **minor** impacts on sea turtles because impacts on sea turtles would be detectable and measurable but of low intensity, localized, and temporary or short term in duration.

Cumulative Impacts of the No Action Alternative. Construction of planned offshore wind projects in the geographic analysis area could affect migration, feeding, breeding, and individual fitness of sea turtles through the primary IPFs. Most impacts on sea turtles would be localized and temporary or short term. Intermittent, temporary impacts from underwater noise may be of high intensity and result in a high exposure level but impacts on sea turtles are not expected to result in population-level effects. Although there would be a loss of existing benthic habitat, WTG and OSS foundations may provide foraging and sheltering opportunities for sea turtles. The significance of this reef effect is unknown, however, and is not expected to result in biologically significant impacts on sea turtles and the presence of structures would result in negligible beneficial impacts. BOEM anticipates that the No Action Alternative combined with all ongoing and planned activities (including other offshore wind activities) would result in **minor** impacts, because potential impacts may include injury or loss of individuals, but these impacts would not result in population-level effects.

3.19.4 Relevant Design Parameters and Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix E) would influence the magnitude of the impacts on sea turtles:

- Noise associated with the construction, operation, and decommissioning of Project structures (e.g., pile driving and construction vessels), which could have behavioral and physiological effects, or cause auditory injury to sea turtles;
- Vessel traffic, which could increase collision risk for sea turtles due to vessels transiting to and from the Wind Farm Area during construction, operations, and decommissioning, and increased recreational fishing vessels; and
- The presence of structures, which could cause both beneficial and adverse impacts on sea turtles through localized changes to hydrodynamic disturbance, prey aggregation and associated increase in foraging opportunities, incidental hooking from recreational fishing around foundations, entanglement in lost and discarded fishing gear, migration disturbances, and displacement.

Variability of the proposed Project design exists as outlined in Appendix E. The following is a summary of potential variances in impacts:

- Foundation Type. The potential acoustic impacts on sea turtles differ among the foundation types that Ocean Wind would use, which is up to three pin-piled jacket foundations or monopile foundations for OSS and up to 98 monopile foundations for WTGs. Construction of the jacket-type foundation would have a higher acoustic impact than construction of the monopile foundation due to the increased risk of exposure because of the longer time required to install more piles (up to four 9.8-foot [3-meter] pin piles per jacket).
- Monopile diameter. The potential acoustic impacts on sea turtles differ among the WTG monopile diameters that may be used. Ocean Wind would use monopiles with a maximum outer diameter at seabed of 34 feet (11 meters) that taper to a maximum top diameter of 25 feet (8 meters). The acoustic impacts of a monopile with a smaller diameter would differ.
- The WTG number. All potential impacts would be lessened with a decrease in number of WTGs built.
- Onshore export cable routes: The route chosen (including variants within the general route) would determine the amount of habitat affected.
- Season of construction: The active season for sea turtles in New Jersey is from May through November. Construction outside of this window would have a lesser impact on sea turtles than construction during the active season.

Although some variation is expected in the design parameters, the impact assessment on sea turtles in this section analyzes the maximum-case scenario.

Ocean Wind has committed to measures to minimize impacts on sea turtles. The APMs are considered part of the Proposed Action and applicable action alternatives and are assessed within each IPF. The measures outlined in the COP include maintaining reasonable distances from sea turtles (MMST-01), adhering to NMFS Regional Viewing Guidelines to minimize the risk of vessel collision (MMST-02), posting protected species observers as required by NMFS during construction activities (MMST-04), obtaining necessary permits and establishing appropriate and practicable mitigation and monitoring measures (MMST-05), and developing and implementing a Protected Species Mitigation and Monitoring Plan (MMST-06) (COP Volume II, Table 1.1-2; Ocean Wind 2023).

As part of its COP, Ocean Wind has also developed a Protected Species Mitigation and Monitoring Plan for marine mammals, sea turtles, and ESA-listed fish species (COP Volume III, Appendix AA; Ocean Wind 2023). Measures proposed in the Protected Species Mitigation and Monitoring Plan include but are not limited to protected species observers, vessel avoidance measures such as separation distances and speed restrictions, pile driving time-of-year restrictions, visual monitoring for HRG surveys, UXO detonation monitoring, marine debris awareness training, and monitoring and reporting of sea turtle observations during activities with potential impacts. Appendix H, Table H-1 provides a full list of the committed measures in greater detail.

3.19.5 Impacts of the Proposed Action on Sea Turtles

3.19.5.1. Impacts of the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.19.8, *Impacts of Alternative E on Sea Turtles*.

This section summarizes the potential impacts of the Proposed Action on sea turtles during the various phases of the proposed Project. Routine activities would include construction, O&M, and decommissioning of the proposed Project, as described in Chapter 2, *Alternatives*. BOEM prepared a BA for the potential effects on ESA-listed species under NMFS' jurisdiction, which found that the Proposed Action *may affect and is likely to adversely affect* ESA-listed sea turtles (BOEM 2022). The BA concluded that auditory effects due to the Proposed Action may affect, but are not likely to adversely affect, ESA-listed sea turtles. Non-auditory effects from UXO detonations due to the Proposed Action could include mortality and therefore may adversely affect ESA-listed sea turtles. Also, trawl surveys could lead to the capture and minor injury of small numbers of individual sea turtles, which may adversely affect small numbers of sea turtles as detailed in the BA (BOEM 2022).

The analysis of impacts under the No Action Alternative (see Section 3.19.3.2), and references therein, applies to the following discussion of impacts under the Proposed Action. The most impactful IPFs associated with the Proposed Action, discussed below, include underwater noise during pile driving, which could cause temporary impacts; increased vessel traffic, which could lead to injury or mortality from vessel strikes; the presence of structures, which would lead to permanent impacts that may be either adverse or beneficial; and cable emplacement and maintenance, which could affect sea turtles from mechanical and hydraulic dredging techniques and via water quality effects.

Accidental releases: Accidental release of trash and debris may occur from Project vessels during construction, operations, and decommissioning. BOEM assumes operator compliance with federal and international requirements for managing shipboard trash; such events also have a relatively limited spatial impact. While precautions to prevent accidental releases would be employed by vessels and port operations associated with the Project, it is likely that some debris could be lost overboard during construction, maintenance, and routine vessel activities. However, the amount would likely be miniscule compared to other inputs. In the event of a release, it would be an accidental, localized event in the vicinity of the Project area, likely resulting in non-measurable impacts, if any. However, because sea turtle ingestion of trash can be fatal, the overall impact would be minor. Proposed mitigation and monitoring for waste management, including marine debris awareness and elimination training for Project personnel, would be required, reducing the likelihood of an accidental release.

EMF: The Project would install up to 190 miles of 8-inch 170-kV array cable among the WTGs. Up to 175 miles of up to three 13-inch 275-kV export cables would be added in the Project area, buried to a depth of 4 to 6 feet (1.2 to 1.8 meters) depending on site conditions (Ocean Wind 2023). Normandeau et al. (2011) concluded that sea turtles are unlikely to detect magnetic field intensities below 50 milligauss, suggesting that these species would be insensitive to EMF effects from the Project's electrical cables. Furthermore, the proposed shielding and burial depths would minimize EMF intensity and extent. Given the extremely small area where exposure to this IPF would occur and the proposed burial depth of the submarine cable, no measurable impacts such as changes in swimming direction and altered migration routes would be expected. These effects on sea turtles are more likely to occur with direct current cables than with alternating current cables (Normandeau et al. 2011). Because alternating current cables have been proposed for the Project and the Project area represents an extremely small area within the coastal waters used by sea turtles, BOEM expects non-measurable, minor impacts, if any, on sea turtle behavior.

Cable emplacement and maintenance: The Proposed Action would include up to 390 acres (1.6 km^2) of seafloor disturbance by cable installation, which would mostly be done by jet or mechanical plow. The predicted concentrations of suspended sediment for various cable emplacement activities are described in Section 3.15.5, *Impacts of the Proposed Action on Marine Mammals*. Sediment within the Wind Farm Area is generally fine and medium-grained sand with areas of gravelly sand and gravel deposits near the Wind Farm Area. Based on the grain sizes evaluated by the studies in Massachusetts, Rhode Island, and Virginia, the gravelly sand and gravel deposits near the Wind Farm Area are likely to settle to the bottom of the water column quickly and sand re-deposition would be minimal and close to the trench centerline.

For grain sizes that are fine and medium-grained sand within the Wind Farm Area, sediments would settle on the seafloor within minutes and potentially extend laterally up to 160 meters. Although turbidity is likely to be high in the affected areas, the sediment would no longer affect water quality once it has settled. Elevated turbidity levels would be localized, short term, and temporary in duration. Physical or lethal effects are unlikely to occur because sea turtles are air-breathing and lay eggs on land, and therefore do not share the physiological sensitivities of susceptible organisms like fish and invertebrates. If elevated turbidity caused any behavioral responses in sea turtles such as avoidance of the turbidity zone or changes in foraging behavior, such behaviors would be temporary (Michel et al. 2013). Furthermore, sea turtles are migratory species that forage over wide areas and would likely be able to avoid short-term suspended sediment impacts that are limited in severity and extent without consequence. Because the effect of sediment suspension would be short term and localized and the use of dredging would be restricted, negligible impacts, if any, would be expected.

Dredging could contribute additional impacts on sea turtles related to impingement, entrainment, and capture associated with mechanical and hydraulic dredging techniques. Dredging may be used for cable installation in areas for sand wave clearance and for HDD in-water exit pits. The area of potential dredging is currently unknown due to the dynamic nature of sand waves. Dredging would also likely be required in shallow areas in Barnegat Bay to allow vessel access for the export cable installation, which may include the prior access channel on the western side of Island Beach State Park and the western side of Barnegat Bay at the export cable landfall. The duration of inshore dredging is proposed for less than 1 month. Locations include the prior channel (west side of Island Beach State Park/east side of Barnegat Bay), the west side of Barnegat Bay at the export cable landfall, and the Oyster Creek section of the federal channel in Barnegat Bay. Ocean Wind proposes to conduct maintenance dredging of the Oyster Creek channel if USACE is unable to conduct dredging in this area as part of the federal channel dredging that is currently under contract. Dredging for the Project is anticipated to be less than 1 acre/7,000 cubic yards (5,352 m^2). Approximately 18,000 cubic yards (13,762 cubic meters) of sediment would be removed from a 3.7-acre (0.015-km^2) area to maintain the Oyster Creek federal navigation channel to its authorized 200-foot width and 8-foot depth (61-meter width and 2.4-meter depth). Ocean Wind proposes to use a hydraulic cutterhead or closed-clamshell dredge and will evaluate use of previously permitted and available confined disposal locations or other upland facilities using either a pipeline system or a barge to transport the dredged material.

As noted in Section 3.19.3.2 under cable emplacement and maintenance, considerations should be taken for the dredge type used in evaluating the potential impacts on sea turtles. Mechanical dredging would consist of lowering an open clamshell bucket through the water column and, once the bucket contacts the seafloor, closing the bucket jaws to trap and scoop the sediment that is then brought to the surface. Based on all available evidence, sea turtles being captured in a mechanical dredge is extremely unlikely to occur. Hydraulic dredging uses dragheads that trail along the seafloor removing sediment. Sea turtles are most often able to escape from the oncoming draghead of a hydraulic dredge due to the slow speed that the draghead advances (up to 3 miles per hour or 4.4 feet per second [1.4 m/s]) (NMFS 2020). During swimming and surfacing, sea turtles are highly unlikely to interact with the draghead and are most vulnerable when foraging or resting on the seafloor. The Project would employ protected species observers on landfall dredges, inshore where sea turtles are known to be more vulnerable to dredging, like in the Barnegat Bay, which would decrease the risk of impingement or entrainment of sea turtles during dredging activities. Also, there are no known large aggregation areas or areas where sea turtles would be expected to spend large amounts of time stationary on the bottom where they would be likely affected by dredging, and the potential capture of sea turtles is most likely in areas like channels, SAV beds, and areas that otherwise have relatively high densities of sea turtles. Because there is a low risk of interactions with dredges and Ocean Wind would implement mitigation and monitoring measures, the likelihood of a sea turtle becoming entrained in a dredge associated with the Proposed Action, if it were to occur, would be considered minor.

Dredging would increase turbidity and temporarily affect an overall very small area that may be used as foraging habitat by sea turtles. During ultrashallow dredging in proximity to SAV beds, Ocean Wind would consider installing silt curtains parallel to the SAV beds to reduce sediment deposition in these sensitive areas. Also, to avoid impacts on adjacent SAV beds, Ocean Wind is performing geotechnical investigations and will use that data to determine whether HDD is the installation technique with the least environmental impact or whether the risk of inadvertent return is such that open cut would result in the least impact. This method would limit the impacts on SAV to approximately 2.92 acres (0.012 km^2) and make the likelihood of impacts on green sea turtle foraging from Project dredging activities so small it cannot be meaningfully measured, detected, or evaluated. Impacts would be reduced because Ocean Wind would implement a SAV monitoring and mitigation plan to ensure that any impacts on SAV during construction and installation of the export cable are monitored and reasonable actions are taken to avoid and minimize seabed disturbance and sediment dispersion, consistent with permit conditions. Because SAV restoration is likely to have poor success, Ocean Wind is proposing a 3:1 mitigation ratio, consisting of mapping efforts, monitoring activities, restoration of documented impacts at an in-situ 1:1 ratio, and additional research to improve SAV mitigation in the future. Pelagic prey items are extremely unlikely to be affected due to the operation of both dredges on the seafloor; therefore, leatherback sea turtle prey items are extremely unlikely to be affected. The benthic organisms preyed upon by Kemp's ridley and loggerhead sea turtles may survive entrainment and motile organisms, such as crabs, may avoid the dredge. However, entrainment of crabs does occur (Reine and Clarke 1998) and BOEM expects that most small benthic invertebrates in the path of the dredge would be entrained. Given the size of the area where dredging will occur and the short duration of dredging, the loss of benthic invertebrates would be small, temporary, and localized. Based on this analysis, BOEM expects any impact on foraging for sea turtles from the loss of prey items due to dredging to be negligible.

Given the available information, the risk of injury or mortality of individual sea turtles resulting from dredging necessary to support offshore wind Project construction would be low and population-level effects are unlikely to occur.

Noise: Project noise transmitted through water, through the seabed, or both can result in high-intensity, low-exposure-level, and long-term but localized intermittent risk to sea turtles. Data regarding sea turtle hearing abilities were summarized in Table 3.19-4. The acoustic thresholds for the onset of PTS, TTS, and behavioral disruptions for sea turtles for impulsive and non-impulsive noise sources were detailed in Table 3.19-5. Underwater noise generated by impact installation of monopiles and pin piles, vibratory installation and removal of sheet piles for cofferdams, detonations of UXO, vessel activity, and WTG operation would increase sound levels in the marine receiving environment and may result in potential adverse effects on sea turtles in the Project area including PTS, TTS, or behavioral disturbance.

Impact pile-driving noise: Noise from pile driving, which would occur during the installation of Project structures, would result in a potential risk of behavioral disturbance or TTS in sea turtles. Pile driving would involve two pile types: monopiles and pin piles. For the WTGs, a single (8-meter-diameter at top, 11-meter-diameter at bottom) vertical hollow steel monopile would be installed for each location using an impact hammer (IHC-4000 or IHC-S-2500 kilojoule impact hammer or similar) to an expected penetration depth of 50 meters. Installation of a single monopile is expected to take 9 hours (1 hour pre-clearance period, 4 hours piling, 4 hours moving to next location). Up to two piles are expected to be installed per 24-hour period. Concurrent monopile installation at more than one location is not planned. For the OSS, a piled jacket foundation is being considered. This would involve installing 16- by 2.44-meter-diameter pin piles as a foundation for each OSS foundation using an impact hammer (IHC-S-2500 kilojoule impact hammer or similar) to an expected penetration depth of 70 meters. Alternatively, a single monopile like the ones used for WTGs may be used for each OSS. Each pin pile takes approximately 4 hours to install, and a single OSS foundation is expected to take 6 days to install.

For installation of both the WTG and OSS monopile foundations, 24-hour-per-day pile driving is expected to occur. A total of 98 monopiles would be installed for WTGs and 48 pin piles (or three monopiles) would be installed for OSS, constituting about 584 hours of active pile driving (404 if monopiles are used, assuming OSS monopile installation is identical to WTG). Sea turtle hearing sensitivity is within the frequency range of sound produced by impact pile driving, although their rigid external anatomy may make sea turtles highly protected from such impulsive sound effects (for a summary, see Popper et al. 2014). Any sea turtle present in the area could be exposed to the noise from one pile-driving event per day, repeated over a period of days.

As described in Section 3.15, Ocean Wind has committed to using a noise mitigation system during installation of both monopiles and pin piles that achieves a performance of 10 dB broadband attenuation during pile-driving activities. Accordingly, the modeled isopleths for potential behavioral disturbance to sea turtles for one monopile per day ranged from 0.76 to 1.18 kilometers during summer. The number of sea turtles predicted to receive sound levels above exposure criteria during pile driving for WTGs and OSS is summarized in Tables J-12 through J-14 in Appendix J. The number of individual sea turtles predicted to receive sound levels above PTS (e.g., injury) with 10-dB attenuation during impact pile driving for WTG and OSS installation is discountable for Kemp’s ridley, leatherback, and green sea turtles, as fewer than one individual sea turtle is predicted to be affected.

Potential PTS effects on loggerhead sea turtles are considered possible, and up to eight individuals may be exposed to underwater noise in excess of PTS thresholds during WTG monopile installation. Up to 16 Kemp’s ridley, seven leatherback, and 175 loggerhead sea turtles could be exposed to underwater noise exceeding behavioral thresholds from impact pile-driving of WTG and OSS monopiles. Acoustic modeling of pile driving for pin piles supporting OSS jacket foundations predicted that an additional 15 loggerheads could be exposed to underwater noise exceeding behavioral thresholds. With the use of APMs such as soft-start procedures, noise-attenuating systems, and implementation of monitoring zones and clearance zones (Table H-1), mortality or injury (PTS) would not be expected and pile-driving noise would therefore not be expected to affect the population level of any of the sea turtle species.

Vibratory pile driving noise: Temporary sheet pile cofferdams may be installed at the following four locations and would likely involve vibratory pile driving:

- Oyster Creek HDD, two cofferdams (Atlantic Ocean to Island Beach State Park; sea-to-shore)
- Island Beach State Park Barnegat Bay HDD, two cofferdams (Barnegat Bay onshore; bay-to-shore)
- Oyster Creek HDD, two cofferdams (bayside of Oyster Creek; shore-to-bay)
- BL England HDD, one cofferdam (sea-to-shore)

Selection of a preferred design for cofferdams and landfall works is pending additional design and coordination. Ocean Wind anticipates that impacts relating to cofferdam installation and removal would eclipse any potential impacts of alternative methods, and therefore cofferdam estimates represent the most conservative values and are carried forward in this EIS. It is possible that some injury (TTS or PTS) and behavioral disturbance effects could occur on green and Kemp’s ridley sea turtles, but the installation and removal is only expected to occur over a 4-day period. Given the low density of sea turtles within inshore areas of New Jersey, impacts from vibratory pile driving on sea turtles would be negligible to minor.

In summary, pile-driving noise (impact and vibratory) associated with the Proposed Action may result in temporary impacts, including behavioral effects and minor auditory injury to individual turtles activities. Given that pile-driving activities would be conducted with mitigation measures such as the use of noise-attenuating systems, soft-start procedures, and protected species observers, impacts on individual sea turtles through this sub-IPF would be expected to be reduced. Once pile driving stops, this sub-IPF would be removed from the environment and sea turtle behavior would be expected to return to normal. If exposed to noise that leads to PTS, individuals would experience permanent effects. Impacts at the population level are not anticipated given the low density of turtles in the Project area and the spacing between individual work areas.

HRG survey noise: Ocean Wind expects that there would be an estimated 19,496 miles (31,375 kilometers) of HRG surveys required in the Offshore Project area (including the export cable routes), with a single vessel being able to cover 43.5 miles (70 kilometers) per day. Specific details of these surveys can be found in Section 2.1.2.2.1, *Site Preparation Activities.*

As discussed above under the No Action Alternative, HRG surveys used in the Project area can use a combination of sonar-based methods to map shallow geophysical features and can be classified as impulsive or non-pulsive noise sources. HRG surveys that use non-impulsive sources are not expected to affect sea turtles because they operate at frequencies above the sea turtle hearing range.

Previously, BOEM (2018) and NMFS (2021b) evaluated potential underwater noise effects on sea turtles from HRG surveys using impulsive sources (boomers, airguns, sparkers, sub-bottom profilers) and concluded that for an individual sea turtle to experience PTS, it would have to be within 3.3 feet (1 meter) of the loudest possible noise source. Furthermore, it was determined that none of the equipment being operated for HRG surveys with hearing overlap for sea turtles has source levels loud enough to result in PTS or TTS.

The only potential effects on sea turtles may be the noise from impulsive sources used during HRG surveys that exceed the behavioral effects threshold (175 dB). For sea turtles to experience behavioral disturbance they would have to be within 295 feet (90 meters) of the sound source (maximum sound levels). Ocean Wind estimates that the number of sea turtles exposed to sound levels eliciting behavioral changes would be low given the large monitoring and shutdown zone monitored. Activities would be stopped if an animal entered the 295-foot (90-meter) shutdown zone. While low-level behavioral exposures could occur, these disruptions would be limited in extent and short term in duration given the movement of the survey vessel and the mobility of the animals and would have limited effects on both the individual and population. Therefore, underwater noise impacts from HRG surveys are expected to be minor.

UXO detonation noise: UXO detonations could generate high pressure levels that could cause disturbance and injury to sea turtles. Ocean Wind conducted modeling of acoustic ranges for UXO, which included three sound pressure metrics (peak pressure level, SEL, and acoustic impulse), four different depths at four different sites, and five charge weight bins (ranging from 2.3 kilograms [bin E4] up to 454 kilograms [bin E12]). The modeling of acoustic fields was performed using a combination of semi-empirical and physics-based computational models. The modeling assumed that the full weights of UXO explosive charges are detonated together with their donor charges and that no shielding by sediments occurs. It also assumed that only one UXO would be detonated within a 24-hour period. Both unmitigated and mitigated (10-dB reduction) detonations were included in the model. For UXO detonations, auditory PTS thresholds for all sea turtles would be exceeded up to 1,549 feet (472 meters) from the source, and for behavioral thresholds this distance increases to 7,382 feet (2,250 meters). Potential non-auditory effects on sea turtles from UXO could be expected up to 1,273 feet (388 meters) from the source. UXO detonations could thus result in mortality of sea turtles in spite of pre-clearance efforts because surveys for small species in clearance zones can be difficult. However, impacts would be minor given the relatively low number of potential UXO anticipated to be encountered within the Project area and Ocean Wind’s commitment to using a dual noise mitigation system. Additional details about impacts of UXO detonations and other underwater noise on sea turtles are also presented in the BA (BOEM 2022).

Vessel noise: The frequency range for vessel noise (10 to 1,000 Hz; MMS 2007) overlaps with sea turtles’ known hearing range (less than 1,000 Hz with maximum sensitivity between 200 to 700 Hz;

Bartol and Ketten 2006) and, therefore, the vessel noise would be audible. The broadband source level of a modern commercial container ship traveling at 21.7 knots is up to 188 dB re 1 µPa (McKenna et al. 2012). This source level is below the non-impulsive acoustic injury threshold of 204 dB re 1 µPa for sea turtles (Finneran et al. 2017), meaning that only behavioral responses could be expected for sea turtles exposed to Project vessel noise. The increase in vessel traffic associated with the Project would be greatest during construction, with an estimated 20 to 65 vessels operating at any given time. In total, the Proposed Action would generate approximately 3,847 vessel trips during the construction and installation phase (COP Volume I, Section 6.1, Tables 6.1.2-1 through 6.1.2-5; Ocean Wind 2023). The construction vessels used for Project construction are described in the COP Volume 1, Section 6.1.2.4.2 and Tables 6.1.2-1 to 6.1.2-4 (Ocean Wind 2023). Typical large construction vessels used in this type of project range from 325 to 350 feet in length, from 60 to 100 feet in beam, and draft from 16 to 20 feet (Denes et al. 2021). The noise from these smaller, slower vessels may be below the behavioral response thresholds of sea turtles or limited to the area immediately adjacent to the vessel. Sea turtles are regularly subjected to commercial shipping traffic and other vessel noise and may be habituated to vessel noise as a result of this exposure. Given the lower sound levels associated with vessel transit and operation and the limited ensonified area produced by this source, the risk of impacts on sea turtles is expected to be negligible to minor.

Turbine operational noise: Sound generated by WTGs aerodynamics and mechanical vibration may result in long-term, continuous underwater noise in the offshore environment. Noise generated by offshore WTGs less than 6.15 MW range from around 80 to 135 dB re 1 µPa SPL_{RMS} underwater, with frequencies between 10 Hz and 8 kilohertz (Tougaard et al. 2020). Recent studies conducted by Stöber and Thomsen (2021) have suggested that operational noise from larger, current-generation WTGs on the order of 10 MW would generate higher source levels than the range noted above, at around 170 dB re 1 µPa SPL_{RMS}. However, the shift from using gear boxes to direct-drive technology is expected to reduce the sound level by 10 dB. Based on the current available data, as discussed above under the No Action Alternative, underwater noise from turbine operations is unlikely to cause PTS or TTS in sea turtles but could cause behavioral effects. It is expected that these effects would be at relatively short distances from the foundations and would reach ambient underwater noise levels within 50 meters of the foundations (Miller and Potty 2017; Tougaard et al. 2009) and sea turtles would be expected to habituate to the noise.

Summary of Noise Impacts: Noise generated from Project activities would include impulsive (e.g., impact pile driving, UXO detonations, some HRG surveys) and non-impulsive sources (e.g., vibratory pile diving, some HRG surveys, vessels, aircraft, cable laying or trenching, dredging, turbine operations). Of those activities, only impact pile driving, UXO detonations, and, to a lesser extent, vibratory pile driving could cause injury-level effects (i.e., PTS) in sea turtles. UXO detonation may also cause non-auditory mortality at close range. All noise sources have the potential to cause behavior-level effects and some may also cause TTS. The APMs proposed to reduce the effects of underwater noise on sea turtles are expected to be effective in limiting the potential for PTS and non-auditory injury and mortality; however, the potential for some PTS, TTS, and behavioral effects remains. The intensity of this IPF is considered medium for impact and vibratory pile driving, as PTS thresholds would be exceeded; severe for UXO detonations, as mortality thresholds would be exceeded; and low for all other activities, as TTS and behavioral thresholds would be exceeded. The predicted effects would be permanent in the case of some PTS effects and non-auditory injury/mortality resulting from UXO detonations and short term with respect to TTS, behavioral effects, and masking. The geographic extent is considered localized for PTS effects and extensive for behavioral disturbance effects. The frequency of the activity causing the effect is considered infrequent for impact pile driving, vibratory pile driving, UXO detonations, aircraft, cable-laying, and trenching and dredging noise; frequent for HRG survey noise; and continuous for WTG operational noise. With the APMs in place for UXO detonations such as pre-clearance surveys and the relatively small areas where mortality is possible, the likelihood of mortality of a sea turtle from UXO detonations is considered low. With implementation of effective APMs such as a noise mitigation system (for impact pile driving), as well as a pile driving monitoring plan and operational sound field verification plan, impacts on individual sea turtles are anticipated but not at the population level.

Traffic (vessel strikes): Vessels would occur during the pre-construction, construction, O&M, and decommissioning phases. Based on information provided by Ocean Wind, construction activities would require several types of vessels transiting between the various ports and the Project area, totaling an estimated 2,859 vessel trips over the 20-month construction period, or approximately 143 trips per month (COP Table 1-6; Ocean Wind 2023). Increased vessel traffic associated with the Project may increase the potential for high-intensity impacts from vessel strikes traveling between the Wind Farm Area and the following ports that are expected to be used during construction: Atlantic City, New Jersey, as a construction management base; Paulsboro, New Jersey, or from Europe directly for foundation fabrication and load out; Norfolk, Virginia, or Hope Creek, New Jersey, for WTG pre-assembly and load out; and Port Elizabeth, New Jersey, or Charleston, South Carolina, or directly from Europe for cable staging. All O&M transits would occur from Atlantic City, New Jersey, to the Offshore Project area. Construction would generate between 20 and 65 vessels operating in the Wind Farm Area or over the offshore export cable route at any given time. The regions of greatest risk for sea turtles from vessel strike are beyond the Project area where high densities of sea turtles and high concentrations of recreational-boat traffic occur, such as the eastern Florida coast, Florida Keys, and the shallow coastal bays in the Gulf of Mexico (National Research Council 1990). The lack of nesting beaches in the Project area where vessels may be close to shore makes this factor irrelevant for this analysis, with the exception of boats transiting from Charleston, South Carolina. However, these would be large, slow-moving cargo vessels that will be operating offshore where sea turtles are more dispersed. Also, due to the small number of proposed vessel transits in otherwise heavily traveled waters, Project vessels transiting south of the Project area would not result in a measurable increased risk to sea turtles. It is possible that some vessels would transit from Europe, although the number and port locations are unknown. These vessels would be specialized construction vessels and cargo vessels that may travel up to around 12 knots (6.1 m/s). They would represent an extremely small portion of the vessel traffic to and from ports in western Europe and the Atlantic coast. It is extremely unlikely that any sea turtles would occur along the vessel transit route at the same time one of these Project vessels is moving through the area due to the dispersed nature of sea turtles in the open ocean and the intermittent presence of such vessels. Together, these factors make it extremely unlikely that any sea turtle would be struck by a Project vessel transiting from Europe.

Sea turtle exposure to vessel traffic would be expected to be concentrated in nearshore habitats during Project construction, which is estimated to occur between 2023 to 2025. This is because nearshore areas would be most regularly traversed by high volumes of Project vessels and shallow foraging habitat may be particularly dangerous for turtles because of their tendency to flee toward deeper water and use deeper water to rest between foraging bouts during the day as well as overnight (Hazel et al. 2007). The collision risk for turtles in all areas is likely to be further exacerbated if water clarity is low and if vessel traffic continues at night, because both turbid water and darkness would impede turtles' visual detection of danger areas. Several other factors contribute to the probability of vessel strikes, including sea turtle density, time of year, sea turtle submergence rates, vessel type and speed, vessel trip numbers, and vessel trip distances. While not available for this analysis, a risk model was developed by BOEM (Barkaszi et al. 2021) for assessing vessel strike risk associated with offshore wind development, which incorporates information from databases and reports to obtain sea turtle density, distribution, and swim depth data. Information about sea turtle density considerations is discussed in Section 3.19.1 and summarized in Table 3.19-2. Sea turtles, with the exception of hatchlings and pre-recruitment juveniles, spend a majority of their time submerged, during which time they may not be susceptible to vessel strikes. Sea turtles spend less than 6 percent of their time at the water's surface (Lutcavage and Lutz 1997), during which they would be most vulnerable to being struck by vessels or propellers. Information on swim depth is provided in the U.S. Navy Undersea Warfare Center's dive distribution and group size parameter reports (Watwood and Buonantony 2012; Borcuk et al. 2017); these data suggest that loggerhead and green sea turtles spend 60 to 75 percent of the time within 32 feet (10 meters) of the surface, leatherback sea turtles spend about 20 percent of the time within 32 feet (10 meters) of the water surface, and there are insufficient data to quantify Kemp's ridley sea turtle activity. Any sea turtle found in the geographic analysis area could thus occur at or near the surface, whether resting, feeding, or periodically surfacing to breathe.

Based on information provided by Ocean Wind, construction activities (including offshore installation of WTGs, substations, array cables, interconnection cable, and export cable) would require up to 20 to 65 simultaneous construction vessels (COP Volume I Tables 6.1.2-1 to 6.1.2-4; Ocean Wind 2023). Over 80 percent of the vessels and vessel trips would transit between the Wind Farm Area and Atlantic City, New Jersey. For this transit, vessels would traverse waters with sea turtle densities similar to those described above. At this relatively low density, vessel strikes would be statistically unlikely. Vessels transiting from Norfolk and Charleston could potentially traverse waters where sea turtle abundance may be almost three times higher, with the highest densities of sea turtles predicted to occur for loggerheads near the mouth of the Chesapeake Bay, approximately 20 to 30 miles (32 to 48 kilometers) offshore (Navy 2007). When considered relative to existing vessel traffic, these vessel transits would have a low risk of vessel strikes with sea turtles.

Project construction would also cause shifts in commercial fishing vessel traffic, which includes over 1,000 annual vessel trips in the Lease Area (see Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*). These vessels would be displaced during Project construction and might decide to avoid the Lease Area during Project operation. This reduction in commercial fishing within the Wind Farm Area could lead to a reduced risk of vessel strikes with sea turtles, but collision risk could increase in those areas where fishing vessels relocate. Conversely, recreational fishing vessel traffic in and around the Wind Farm Area could increase as a result of the reef effect generated by the monopile foundations. This assumes similar densities of sea turtles occur in both areas; however, the future distribution of commercial and recreational fishing vessels in response to the Project cannot be predicted. The increased collision risk in some areas is anticipated to be commensurate with the decreased risk within the Wind Farm Area, so changes in collision risk from relocated commercial and for-hire fishing vessels during Project construction would not be measurable from baseline. At most, impacts of relocation of fishing vessel traffic would be considered minor on sea turtles.

Given the mobility of sea turtles and the use of trained, dedicated protected species observers, vessel speed restrictions, and protected species identification training and implementation of monitoring/ clearance zones and shutdown zones, interactions between Project vessels and sea turtles would be reduced. However, sea turtles are not fast swimmers and have difficulty detecting vessels traveling more than 4 kilometers per hour (Hazel et al. 2007). Also, sea turtles are hard to detect in the open ocean and collision risk for turtles in all areas is likely to be further exacerbated if water clarity is low and if vessel traffic continues at night, because both turbid water and darkness would impede sea turtles ability to detect approaching boats. When monitoring at night or in low-visibility conditions, protected species observers would use night-vision goggles with thermal clip-ons, a hand-held spotlight, or a mounted thermal camera system. Although sea turtles are ectothermic, because they do have some capacity to retain heat and are able to maintain body temperatures that are slightly higher than the surrounding environment, the use of thermal imaging is fact capable of detecting sea turtles (Snyder 2017). This was demonstrated by the summer 2017 HRG surveys for the Project, which documented three sea turtle sightings using night vision binoculars, all within 50 meters of a vessel; however, the narrow field of view and low-resolution monochrome image reduces the ability of the observer to discern animals with small surface presence, particularly at greater distances, and also to determine fine-scale features for species identification (Alpine 2017). While these mitigation measures would reduce the probability of a Project-related vessel strike, they would not result in complete avoidance. The Project would have a period of peak vessel activity lasting approximately 1 year (during construction and installation of offshore export cables, WTGs, OSS, and inter-array cables). However, avoidance measures would be designed to avoid vessel strikes on sea turtles by reducing vessel speed and avoiding sighted turtles. The additional measure of training personnel to watch for and report sea turtles would further increase vigilance to avoid striking sea turtles.

Presence of structures: Impacts on sea turtles could result from the reef effect created by the presence of up to 101 foundations and 131 acres (0.53 km^2) of scour/cable protection. Studies have found increased biomass for benthic fish and invertebrates (Pezy et al. 2018; Raoux et al. 2017; Wang et al. 2019), indicating that offshore wind facilities can generate beneficial permanent impacts on local ecosystems, translating to increased foraging opportunities for sea turtles. The WTG and OSS foundations would provide some level of reef effect and may result in long-term, minor beneficial impacts on sea turtle foraging and sheltering; however, long-term, minor adverse impacts could occur as a result of increased interaction with fishing gear. The reef effect and associated increase in fish biomass could increase recreational fishing effort in and around turbine foundations, which may increase marine debris from fouled fishing gear in the area. Sea turtle entanglement in fishing gear is not considered a new IPF, however, but a change in the distribution of fishing effort from other locations.

Gear utilization (biological/fisheries monitoring surveys): The presence of gear used for fisheries and benthic monitoring surveys under the Proposed Action could affect sea turtles by entrapment or entanglement as described for other offshore wind projects in Section 3.19.3. Surveys are expected to occur at short-term, regular intervals over the lifetime of the Project. Trawl surveys for fisheries monitoring could result in small numbers of sea turtle captures, but serious injuries or mortalities would mostly be avoided because the bottom time for proposed trawls would be limited to 20 minutes and available research indicates that limiting tow times to less than 30 minutes likely eliminates the risk of death for incidentally captured sea turtles (Epperly et al. 2002; Sasso and Epperly 2006). As noted previously, further details about this impact are provided in the BA. Because trawl surveys for Project monitoring could lead to potential capture or minor injury or mortality of small numbers of loggerhead and Kemp’s ridley sea turtles, impacts on sea turtles would likely be minor.

3.19.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with past, ongoing, and planned activities. Ongoing and planned non-offshore wind activities within the geographic analysis area that contribute to cumulative impacts on sea turtles include but are not limited to various coastal development projects permitted through regional planning commissions, counties, and towns; dredging for the New Jersey Wind Port on the Delaware River in Salem County; the Davisville/Brooklyn/Newark Container-on-Barge Service; the approved liquefied natural gas export terminals in Elba Island, Georgia, and Jacksonville, Florida; the Roosevelt Island Tidal Energy Project; dredging for beach replenishment used for the Long Beach Island Coastal Storm Risk Management Project, Barnegat Inlet to Little Egg Inlet; the Atlantic City marina upgrades; and the Port of Virginia channel deepening. Ongoing and planned offshore wind activities in combination with the Proposed Action would result in an estimated 3,044 WTGs, to which the Proposed Action would contribute 98 WTGs, or 3 percent.

Accidental releases: The Proposed Action would contribute an undetectable increment to the cumulative accidental release impacts on sea turtles, which are expected to be minor.

EMF: The Proposed Action would contribute an undetectable increment to the cumulative EMF impacts on sea turtles, which are expected to be negligible.

Cable emplacement and maintenance: The Proposed Action would contribute an undetectable increment to the cumulative cable emplacement and maintenance impacts on sea turtles, which are expected to be minor.

Noise Impacts: The Proposed Action would contribute a noticeable increment to the cumulative noise impacts on sea turtles, which are expected to be minor.

Traffic (vessel strikes): The Proposed Action would contribute a noticeable increment to the cumulative vessel traffic impacts on sea turtles, which are expected to be minor.

Presence of structures: The Proposed Action would contribute a noticeable increment to the cumulative impacts of structures on sea turtles, which are expected to be minor.

Gear utilization (biological/fisheries monitoring surveys): The Proposed Action would contribute a noticeable increment to the cumulative impacts of gear utilization, which are expected to be negligible.

3.19.5.3. Conclusions

Impacts of the Proposed Action. Project construction and installation, O&M, and conceptual decommissioning would result in habitat disturbance, entrainment and impingement, underwater and airborne noise, water quality degradation, vessel traffic (strikes and noise), artificial lighting, and potential discharges/spills and trash. BOEM anticipates the impacts resulting from the Proposed Action would range from **negligible** to **minor** adverse impacts and could include potentially **minor beneficial** impacts. Adverse impacts are expected to result mainly from pile-driving noise and increased vessel traffic. Beneficial impacts are expected to result from the presence of structures. Beneficial impacts; however, may be offset given the increased risk of entanglement due to derelict fishing gear on the structures.

Cumulative Impacts of the Proposed Action. The incremental impacts contributed by the Proposed Action to the cumulative impacts on sea turtles would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts on sea turtles associated with the Proposed Action would be **minor**. The main drivers for these impact ratings are pile-driving noise and associated potential for auditory injury, the presence of structures, ongoing climate change, and ongoing vessel traffic posing a risk of collision. The Proposed Action would contribute to the cumulative impacts primarily through pile-driving noise and the presence of structures. BOEM made this decision because the overall effect would be detectable and measurable, but these impacts would not result in population-level effects.

3.19.6 Impacts of Alternatives B-1, B-2, C-1, and D on Sea Turtles

Impacts of Alternatives B-1, B-2, C-1, and D. Alternatives B-1, B-2, C-1, and D would include exclusion of proposed WTGs and would lead to the same types of impacts on sea turtles from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. Alternatives B-1, B-2, C-1, and D would exclude up to 9, 19, 8, and 15 turbines, respectively; this is equivalent to an approximately 10- to 20-percent reduction in the size of the Project. Table 3.19-6 summarizes the differences in the number of monopiles as they related to each alternative. The corresponding reduction in the number or duration of construction vessels in the Offshore Project area is unknown; therefore, the discussion regarding a reduction in vessels during construction is qualitative.

Table 3.19-6 Summary of Changes to Impact Pile-Driving Requirements Among Alternatives

Alternative	WTGs	Reduction in Monopiles	Total Number of Monopiles	Total Hours of Impact Pile Driving (4 to 6 hrs/pile)	Number of days
Proposed Action	98	98	98	392 to 588 hours	98
Alternative B-1	exclusion of up to 9 WTG positions	Up to 9 fewer	89	356 to 534 hours	89
Alternative B-2	exclusion of up to 19 WTG positions	Up to 19 fewer	79	316 to 474 hours	79
Alternative C-1	exclusion of 8 WTG positions	Up to 8 fewer	90	360 to 540 hours	90
Alternative D	exclusion of up to 15 WTG positions	Up to 15 fewer	83	332 to 498 hours	83

Notes: Assumes each pile would require 4 to 6 hours of impact pile driving per pile, with a maximum-case scenario of one pile per day.
hrs/pile = hours per pile

These alternatives may change the duration for the IPFs in comparison to that described for the Proposed Action in Section 3.19.5, as described in following paragraphs.

Noise: The 10- to 20-percent reduction in the number of monopiles for Alternatives B-1, B-2, C-1, and D would reduce the overall number of impact pile-driving hours required for installation. This would limit the duration of the effect by the days outlined in Table 3.19-6. However, the overall effects would remain the same (e.g., PTS, TTS, disturbance, and masking) as described in Section 3.19.5. Limiting the duration of the effect could reduce the number of sea turtles exposed to underwater sound. However, the overall sound levels resulting from construction and decommissioning activities would still have temporary, minor impacts on sea turtles due to potential auditory injuries and behavioral effects as described previously; no mortality or injury (PTS) would be expected. Likewise, a reduction in the number of WTGs would result in a reduction in the number or duration of construction vessels used and may reduce the probability of UXO detonations during Project construction. The magnitude of the effects of underwater noise from Project vessels during construction would remain the same (e.g., disturbance, masking) as described in Section 3.19.5; however, the duration of the effects would be reduced.

Presence of structures: The 10- to 20-percent reduction in the number of monopiles would reduce the overall footprint of the alternatives on the seafloor as compared to the Proposed Action. The beneficial impact of the reef effect on sea turtle resting and foraging and the potential adverse effects of sea turtle entanglement with fisheries gear on WTG foundations would both be proportionally reduced by 10 to 20 percent.

Cable emplacement and maintenance: Alternatives B-1, B-2, C-1, and D would have short-term and localized water quality impacts from inter-array and export cable installation via jet or mechanical plow, and dredging if necessary for sand wave clearance and installation of HDD in-water exit pits, which would produce undetectable, negligible impacts on sea turtles due to increased turbidity. Compared to the Proposed Action, there would be a smaller area of seabed disturbance and water column disturbance and a shorter duration of associated water quality degradation. The area of seabed disturbed by scour protection would be reduced by 0.82 acre per WTG foundation; thus, the 80 acres of total seabed scour protection under the Proposed Action would be reduced by 7 to 12 acres under Alternatives B-1, B-2, C-1, and D. Alternatives that reduce the number of WTGs would also reduce the risk of interactions between hopper dredges and individual sea turtles due to the reduced length of dredging for installation of inter-array cables.

Traffic (vessel strikes): A reduction in the number of monopiles would result in a reduction in the number of construction vessels or the duration of vessels in the Offshore Project area during construction activities that would be required for installation. While unquantifiable, the 10- to 20-percent reduction in the number of monopiles could reduce the probability of a vessel strike on a sea turtle proportionally by 10 to 20 percent during Project construction, operation, and decommissioning. A decrease in Project vessels would also slightly reduce the risk of accidental releases (e.g., fuel spills, trash, debris) that could potentially affect sea turtles.

Cumulative Impacts of Alternatives B-1, B-2, C-1, and D. The incremental impacts contributed by Alternatives B-1, B-2, C-1, and D to the cumulative impacts on sea turtles would be similar to those described under the Proposed Action.

3.19.6.1. Conclusions

Impacts of Alternatives B-1, B-2, C-1, and D. Alternatives B-1, B-2, C-1, and D would reduce the number of WTGs and their associated inter-array cables, which would result in an incremental reduction in effects on sea turtles from certain construction and installation, O&M, and conceptual decommissioning impacts. BOEM expects that the impacts resulting from the alternatives individually would be similar to those of the Proposed Action and would range from **negligible** to **minor** adverse and could include potentially **minor beneficial** impacts.

Cumulative Impacts of Alternatives B-1, B-2, C-1, and D. The incremental impacts contributed by Alternatives B-1, B-2, C-1, and D to the cumulative impacts on sea turtles would range from undetectable to noticeable. BOEM anticipates that the cumulative impacts of Alternatives B-1, B-2, C-1, and D would be the same level as under the Proposed Action: **minor**.

3.19.7 Impacts of Alternative C-2 on Sea Turtles

Impacts of Alternative C-2. Under Alternative C-2, the compressed layout would have the same types of impacts on sea turtles from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action within a smaller construction and operational footprint. Although the area affected by noise, turbidity, and use of construction and operational vessels would be decreased, the number of vessels and monopiles would stay the same. BOEM expects that the impacts resulting from Alternative C-2 would be similar to those of the Proposed Action and would range from negligible to minor adverse and could include potentially minor beneficial impacts.

Cumulative Impacts of Alternative C-2. The incremental impacts contributed by Alternative C-2 to the cumulative impacts on sea turtles would range from undetectable to noticeable. The cumulative impacts of Alternative C-2 would be the same level as under the Proposed Action: minor.

3.19.7.1. Conclusions

Impacts of Alternative C-2. Although Alternative C-2 would result in a decreased construction and operational footprint, BOEM expects that the impacts resulting from the alternative would be similar to those of the Proposed Action and range from **negligible** to **minor** and could include potentially **minor beneficial** impacts.

Cumulative Impacts of Alternative C-2. The incremental impacts contributed by Alternative C-2 would be similar to those of the Proposed Action and range from undetectable to noticeable. BOEM anticipates that the cumulative impacts of Alternative C-2 would be the same level as under the Proposed Action: **minor**.

3.19.8 Impacts of Alternative E on Sea Turtles

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternative E. Alternative E would lead to the same types of impacts on sea turtles from construction and installation, O&M, and conceptual decommissioning activities in the Offshore Project Area as described for the Proposed Action. The reduced acreage of SAV affected by the Oyster Creek export cable emplacement within Barnegat Bay under Alternative E (0.89 acre) compared to the northernmost export cable route under the Proposed Action (15.25 acres) would reduce potential impacts on adult green sea turtles, as they are the only sea turtles that forage exclusively on aquatic vegetation such as eelgrass. While the number of green sea turtles that would potentially benefit is not quantifiable, the species regularly occurs in Barnegat Bay (Excelon Generation 2012); therefore, minimizing impacts on SAV in Barnegat Bay would avoid the destruction of important green sea turtle foraging habitat. Additionally, SAV provides important nursery habitat for sea turtle prey and is a rich foraging ground. Loggerheads prey on the abundant shellfish found in SAV, especially horseshoe crabs and blue crabs. However, Alternative E would still require trenching activities and would not significantly change potential impacts. It would therefore produce the same types of direct impacts on sea turtles from construction and installation, O&M, and conceptual decommissioning activities as described for the Proposed Action. Impacts within the Offshore Project area would stay the same as under the Proposed Action. Therefore, Alternative E would result in negligible to minor adverse and potentially minor beneficial impacts.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E to the cumulative impacts on sea turtles would be similar to those described under the Proposed Action: minor.

3.19.8.1. Conclusions

Impacts of Alternative E. Although Alternative E would result in reduced acreage of SAV affected by cable emplacement, BOEM expects that the impacts resulting from the alternative alone would be similar to those of the Proposed Action and range from **negligible** to **minor** and could include potentially **minor beneficial** impacts.

Cumulative Impacts of Alternative E. The incremental impacts contributed by Alternative E would be similar to those of the Proposed Action and range from undetectable to noticeable. BOEM anticipates that the cumulative impacts of Alternative E would be the same level as under the Proposed Action: **minor**.

3.19.9 Proposed Mitigation Measures

Several measures are proposed to minimize impacts on sea turtles (Appendix H, Table H-2 and H-3, as well as Table 1-11 in the BA). If one or more of the measures analyzed below are adopted by BOEM or cooperating agencies, some adverse impacts could be further reduced.

Table 3.19-7 Measures Resulting from Consultations (Also Identified in Appendix H, Table H-2): Sea Turtles

Measure	Description	Effect
Passive Acoustic Monitoring (PAM) Plan	BOEM, BSEE, and USACE would ensure that Ocean Wind prepares a PAM Plan that describes all proposed equipment, deployment locations, detection review methodology and other procedures, and protocols related to the required use of PAM for monitoring. This plan would be submitted to NMFS, BOEM and BSEE (at OSWsubmittals@bsee.gov) for review and concurrence at least 120 days prior to the planned start of pile driving.	Ocean Wind has committed to implementing passive acoustic monitoring, pile-driving monitoring, protected species observer coverage, sound field verification, and shutdown zones as part of the Proposed Action. Compliance with these APMs would be enforced by BOEM, BSEE, and NMFS as indicated in Table H-1. Implementation and enforcement of these APMs would minimize the potential for underwater noise exposure to sea turtles during the conduct of impact pile driving, vibratory pile driving, HRG surveys, and UXO detonation, as disclosed in the analysis of the Proposed Action. Agency-proposed mitigation measures would further define how the effectiveness and enforcement of APMs would be ensured by requiring that Ocean Wind submit passive acoustic monitoring and pile-driving monitoring plans for approval by BOEM, BSEE, and NMFS and a sound field verification plan for approval by BOEM and BSEE; by ensuring that protected species observer coverage is sufficient and requiring deployment of additional protected species observers or platforms if found insufficient or in the event that clearance or shutdown zones are expanded beyond the distances modeled prior to verification. While adoption of these measures would increase accountability and ensure the effectiveness of APMs, it would not alter the impact determination of minor for the underwater noise IPF for sea turtles, because analysis of the
Pile driving monitoring plan	BOEM would ensure that Ocean Wind prepare and submit a *Pile Driving Monitoring Plan* to NMFS and BSEE (at OSWsubmittals@bsee.gov) for review and concurrence at least 90 days before the start of pile driving. The plan would detail all plans and procedures for sound attenuation as well as for monitoring ESA-listed whales and sea turtles during all impact and vibratory pile driving. The plan would also describe how BOEM, BSEE, and Ocean Wind would determine the number of whales exposed to noise above the Level B harassment threshold during pile driving with the vibratory hammer to install the cofferdam at the sea to shore transition. Ocean Wind would obtain NMFS' concurrence with this plan prior to starting any pile driving.	
PSO Coverage	BOEM, BSEE, and USACE would ensure that PSO coverage is sufficient to reliably detect whales and sea turtles at the surface in clearance and shutdown zones to execute any pile driving delays or shutdown requirements. If, at any point prior to or during construction, the PSO coverage that is included as part of the proposed action is determined not to be sufficient to reliably detect ESA-listed whales and sea turtles within the clearance and shutdown zones, additional PSOs and/or platforms would be deployed. Determinations prior to construction would be based on review of the *Pile Driving Monitoring Plan*. Determinations during construction would be based on review of the weekly pile driving reports and other information, as appropriate.	
Sound field verification	BOEM, BSEE, and USACE would ensure that if the clearance and/or shutdown zones are expanded, PSO coverage is sufficient to reliably monitor the expanded clearance and/or shutdown zones. Additional observers would be deployed on additional platforms for every 1,500 m that a clearance or shutdown zone is	

Measure	Description	Effect
	expanded beyond the distances modeled prior to verification.	Proposed Action already includes analysis of the APMs outlined in Table H-1.
Shutdown zones	BOEM, BSEE, and USACE may consider reductions in the pre-start clearance and/or shutdown zones based on the sound field verification measurements. BOEM and BSEE would ensure that Ocean Wind submits a Sound Field Verification Plan for review and approval at least 90 days prior to the planned start of pile driving.	
Look out for sea turtles and reporting	Between June 1 and November 30, Ocean Wind would have trained lookouts posted on all vessel transits during all phases of the project to observe for sea turtles within a 500-meter vessel strike avoidance zone and communicate any sightings in real time to the boat captain. If a sea turtle is sighted within 100 m or less of the operating vessel's forward path, the vessel operator would slow down to 4 knots (unless unsafe to do so) and then proceed away from the turtle at a speed of 4 knots or less until there is a separation distance of at least 100 m at which time the vessel may resume normal operations. If a sea turtle is sighted within 50 m of the forward path of the operating vessel, the vessel operator would shift to neutral when safe to do so and then proceed away from the turtle at a speed of 4 knots. The vessel may resume normal operations once it has passed the turtle.	Measures to minimize vessel interactions would reduce risk of vessel strike. While adoption of this measure would reduce risk to sea turtles under the Proposed Action, it would not alter the impact determination of minor for vessel traffic.
Sampling gear	All sampling gear would be hauled at least once every 30 days, and all gear would be removed from the water and stored on land between survey seasons to minimize risk of entanglement.	The regular hauling of sampling gear, recovery of lost survey gear, sea turtle disentanglement, and handling and resuscitation guidelines would reduce risk of entanglement or effects of entanglement in fisheries survey gear. Gear identification, sea turtle identification, and data collection would improve accountability in the case of gear loss or gear entanglement. While adoption of these measures would reduce risk to sea turtles and improve accountability under the Proposed Action, it would not alter the impact determination of minor for gear utilization.
Gear identification	To facilitate identification of gear on any entangled animals, all trap/pot gear used in the surveys would be uniquely marked to distinguish it from other commercial or recreational gear. Using yellow and black striped duct tape, place a 3-foot-long mark within 2 fathoms of a buoy. In addition, using black and white paint or duct tape, place 3 additional marks on the top, middle and bottom of the line. These gear marking colors are proposed as they are not gear markings used in other fisheries and are therefore distinct. Any changes in marking would not be made without notification and approval from NMFS.	
Lost survey gear	If any survey gear is lost, all reasonable efforts that do not compromise human safety would be undertaken to recover the gear. All lost gear would be reported to NMFS	

Measure	Description	Effect
	(nmfs.gar.incidental-take@noaa.gov) and BSEE (OSWIncidentReporting@bsee.gov) within 24 hours of the documented time of missing or lost gear. This report would include information on any markings on the gear and any efforts undertaken or planned to recover the gear.	
Sea turtle disentanglement	Vessels deploying fixed gear (e.g., pots/traps) would have adequate disentanglement equipment (i.e., knife and boathook) onboard. Any disentanglement would occur consistent with the Northeast Atlantic Coast STDN Disentanglement Guidelines at https://www.reginfo.gov/public/do/DownloadDocument?objectID=102486501 and the procedures described in “Careful Release Protocols for Sea Turtle Release with Minimal Injury” (NOAA Technical Memorandum 580; https://repository.library.noaa.gov/view/noaa/3773).	
Sea turtle/Atlantic sturgeon identification and data collection	Any sea turtles or Atlantic sturgeon caught and/or retrieved in any fisheries survey gear would first be identified to species or species group. Each ESA-listed species caught and/or retrieved would then be properly documented using appropriate equipment and data collection forms. Biological data, samples, and tagging would occur as outlined below. Live, uninjured animals should be returned to the water as quickly as possible after completing the required handling and documentation.	
Sea turtle/Atlantic sturgeon handling and resuscitation guidelines	Any sea turtles or Atlantic sturgeon caught and retrieved in gear used in fisheries surveys would be handled and resuscitated (if unresponsive) according to established protocols and whenever at-sea conditions are safe for those handling and resuscitating the animal(s) to do so.	
Marine debris awareness training	The Lessee would ensure that vessel operators, employees, and contractors engaged in offshore activities pursuant to the approved COP complete marine trash and debris awareness training annually. By January 31 of each year, the Lessee would submit to DOI an annual report that describes its marine trash and debris awareness training process and certifies that the training process has been followed for the previous calendar year.	Marine debris and trash awareness training would minimize the risk of sea turtle ingestion of or entanglement in marine debris. While adoption of this measure would reduce risk to sea turtles under the Proposed Action, it would not alter the impact determination of minor for accidental releases.
Take notification, monthly/annual reporting requirements, BOEM/NMFS	GARFO PRD would be notified as soon as possible of all observed takes of sea turtles, occurring as a result of any fisheries survey. At the end of each survey season, a report would be sent to NMFS that compiles all information	Reporting requirements to document take would improve accountability for documenting sea turtle take associated with the Proposed Action. While

Measure	Description	Effect
meeting requirements for sea turtle take documentation	on any observations and interactions with ESA-listed species. BOEM and BSEE would ensure that Ocean Wind submits regular reports (in consultation with NMFS) necessary to document the amount or extent of take that occurs during all phases of the proposed action. To facilitate monitoring of the incidental take exemption for sea turtles, through the first year of operations, BOEM and NMFS would meet twice annually to review sea turtle observation records.	adoption of these measures would improve accountability, it would not alter the overall impact determination for the Proposed Action.
Data Collection BA BMPs	BOEM would ensure that all Project Design Criteria and Best Management Practices incorporated in the Atlantic Data Collection consultation for Offshore Wind Activities (June 2021) shall be applied to activities associated with the construction, maintenance and operations of the Ocean Wind project as applicable.	Compliance with Project Design Criteria and best management practices for protected species would minimize risk to sea turtles during HRG surveys. While adoption of this measure would decrease risk to sea turtles under the Proposed Action, it would not alter the impact determination of negligible for HRG activities.
Alternative Monitoring Plan (AMP) for pile driving	BOEM would require Ocean Wind to submit an alternative monitoring plan for nighttime pile driving at least 6 months prior to initiating nighttime impact pile-driving activities. The purpose of the plan is to demonstrate that Ocean Wind can meet the visual monitoring criteria with the technologies Ocean Wind is proposing to use for monitoring during nighttime impact pile driving. This plan may include deploying additional observers; alternative monitoring technologies such as night vision, thermal, and infrared technologies; or use of passive acoustic monitoring and must demonstrate the ability and effectiveness to maintain all clearance and shutdown zones during daytime and nighttime to BOEM's and NMFS's satisfaction.	Adoption of this measure could increase the ability of Ocean Wind to detect sea turtles during pile driving but, given the small amount of time that sea turtles spend at the surface, these measures would not eliminate the minor impacts of pile-driving noise on sea turtles.
Periodic underwater surveys, reporting of monofilament and other fishing gear around WTGs	The Lessee must monitor indirect impacts associated with charter and recreational fishing gear lost from expected increases in fishing around WTG foundations by surveying at least 10 of the WTGs located closest to shore in the Ocean Wind 1 Lease Area (OCS-A 0498) annually and report the results of the surveys to BOEM and BSEE in an annual report.	Periodic underwater surveys and reporting of monofilament and other fishing gear around WTG foundations would reduce the risk of entanglement associated with the presence of structures. While adoption of this measure would reduce risk to sea turtles under the Proposed Action, it would not alter the impact determination associated with the presence of structures.

Measure	Description	Effect
PDC minimize vessel interactions with listed species	All vessels associated with survey activities must comply with vessel strike avoidance measures to reduce interaction with listed species.	Ocean Wind has committed to implementing a vessel strike avoidance policy, vessel separation distances, and vessel speed restrictions as part of the Proposed Action and as described in Table H-1. These measures include maintaining a separation distance of greater than 50 meters for sea turtles (see Table H-1). Compliance with Project Design Criteria to minimize vessel interactions with listed species would reduce risk of vessel strike. While adoption of these measures would reduce risk of vessel strike under the Proposed Action, it would not result in complete avoidance and negligible to minor impacts on sea turtles would still be expected.
Operational sound field verification plan	BOEM would require Ocean Wind to develop an operational sound field verification plan to determine the operational noises emitted from the offshore wind area. The plan would be reviewed and approved by BOEM and NMFS.	The development of an operational sound field verification plan would allow BOEM to confirm that impacts of operating WTG noise do not exceed predicted impacts based on existing monitoring data and modeling efforts. While adoption of this measure would improve accountability of WTG operational noise under the Proposed Action, it would not alter the impact determination for WTG noise.
Biological Opinion Reasonable and Prudent Measures and Terms and Conditions	Reasonable and Prudent Measures and Terms and Conditions to minimize the impact of incidental take of ESA-listed species were documented in the NMFS Biological Opinion dated April 3, 2023. These measures include adherence to mitigation measures specified in the final MMPA ITA to minimize impacts during pile driving and UXO detonation; compliance with requirements for vessel operations within the Delaware River and Delaware Bay included in the Incidental Take Statements provided with the Paulsboro Marine Terminal Biological Opinion (dated July 19, 2022) and the New Jersey Wind Port Biological Opinion (dated February 25, 2022); reporting requirements	These Reasonable and Prudent Measures and Terms would minimize the exposure of ESA-listed species to pile-driving noise and the effects of UXO detonation. These Reasonable and Prudent Measures and Terms would also ensure that all incidental take that occurs is documented and reported to NMFS in a timely manner and that any incidentally taken individual specimens are properly handled, resuscitated if necessary, transported for

Measure	Description	Effect
	related to effects to, or interactions with, ESA-listed species; submittal of required plans (e.g., PSO Training Plan for Trawl Surveys, Passive Acoustic Monitoring Plan, Marine Mammal and Sea Turtle Monitoring Plan, Cofferdam Installation and Removal Monitoring Plan, Alternative Monitoring Plan/Night Time Pile Driving Monitoring Plan, Sound Field Verification Plan, North Atlantic Right Whale Vessel Strike Avoidance Plan) to NMFS GARFO with sufficient time for review, comment and approval; and conducting on-site observation and inspection to gather information on the effectiveness and implementation of measures to minimize and monitor incidental take.	additional care or reporting, or returned to the sea. Reporting requirements to document take would improve accountability for documenting take associated with the Proposed Action. In some cases, these Reasonable and Prudent Measures and Terms provide additional detail or clarification of measures that are included as part of the proposed action. Implementation of these Reasonable and Prudent Measures and Terms would provide incremental reductions in impacts on sea turtles and would improve accountability but would not alter the overall impact determination of the Proposed Action.

GARFO = Greater Atlantic Regional Fisheries Office; ITA = incidental take authorization; m = meter; PAM = passive acoustic monitoring; PRD = Protected Resources Division; PSO = protected species observer

Table 3.19-8 Additional Proposed Measures (Also Identified in Appendix H, Table H-3): Sea Turtles

Measure	Description	Effect
Vessel speed restriction	All vessels, regardless of size, would comply with a 10-knot speed restriction in any SMA, DMA, or Slow Zone.	Sea turtles are not fast swimmers and have difficulty detecting vessels traveling more than 4 kilometers per hour (2.16 knots) (Hazel et al. 2007). Therefore vessel speed restrictions would not substantially reduce the risk of vessel strike for sea turtles under the Proposed Action and would not reduce the negligible to minor impact determination for sea turtles.

DMA = Dynamic Management Area; SMA = Seasonal Management Area

3.19.9.1. Measures Incorporated in the Preferred Alternative

Mitigation measures required through completed consultations, authorizations, and permits listed in Table 3.19-7 and Table H-2 in Appendix H, *Mitigation and Monitoring*, are incorporated in the Preferred Alternative. BOEM has identified the following additional measures in Table 3.19-8 as incorporated in the Preferred Alternative: vessel speed restriction. These measures, if adopted, would further define how the effectiveness and enforcement of APMs would be ensured and improve accountability for compliance with APMs by requiring the submittal of plans for approval by the enforcing agency(ies) and by defining reporting requirements. Because these measures ensure the effectiveness of and compliance with APMs that are already analyzed as part of the Proposed Action, implementation of these measures would not further reduce the impact level of the Proposed Action from what is described in Section 3.19.2, *Environmental Consequences*. Agency-proposed measures to minimize vessel interactions with sea turtles would reduce risk of vessel strike. While adoption of these measures would reduce risk to sea turtles under the Proposed Action, it would not alter the impact determination of minor for vessel traffic. The regular hauling of sampling gear, recovery of lost survey gear, sea turtle disentanglement, and handling and resuscitation guidelines would reduce risk of entanglement or effects of entanglement in fisheries survey gear. While adoption of these measures would reduce risk to sea turtles under the Proposed Action, it would not alter the impact determination of minor for gear utilization.

3.21. Water Quality

This section discusses potential impacts on water quality from the proposed Project, alternatives, and ongoing and planned activities in the water quality geographic analysis area. The water quality geographic analysis area, as shown on Figure 3.21-1, includes coastal waters within a 10-mile (16-kilometer) buffer around the Offshore Project area and a 15.5-mile (25-kilometer) buffer around the ports that may be used by the Project. In addition, the geographic analysis area includes an onshore component that includes any sub-watershed that is intersected by the Onshore Project area. The offshore geographic analysis area accounts for some transport of water masses due to ocean currents. The onshore geographic analysis area was chosen to capture the extent of the natural network of waterbodies that could be affected by construction and operational activities of the proposed Project.

3.21.1 Description of the Affected Environment for Water Quality

Surface waters in the geographic analysis area include: (1) coastal onshore waterbodies that generally include freshwater ponds, streams, and rivers; and (2) coastal marine waters that generally include saline and tidal/estuarine waters, such as Barnegat Bay, Manahawkin Bay, Delaware Bay, Delaware River, Charleston Harbor, Chesapeake Bay, James River, and the Atlantic Ocean. Surface waters within most of the geographic analysis area and all of the Onshore Project area are coastal marine waters.

The following key parameters characterize water quality. Some of these parameters are accepted proxies for ecosystem health (e.g., dissolved oxygen [DO], nutrient levels), while others delineate coastal onshore waters from coastal marine waters (e.g., temperature, salinity):

- *Nutrients*: Key ocean nutrients include nitrogen and phosphorous. Photosynthetic marine organisms need nutrients to thrive (with nitrogen being the primary limiting nutrient), but excess nutrients can cause problematic algal blooms. Algal blooms can significantly lower DO concentration, and toxic algal blooms can contaminate human food sources. Both natural and human-derived sources of pollutants contribute to nutrient excess.
- *Dissolved oxygen*: The amount of DO in water determines the amount of oxygen that is available for marine life to use. Temperature strongly influences DO content, which is further influenced by local biological processes. For a marine system to maintain a healthy environment, DO concentrations should be above 5 mg/L; lower levels may affect sensitive organisms (USEPA 2000).
- *Chlorophyll a*: Chlorophyll *a* is a measure of how much photosynthetic life is present. Chlorophyll *a* levels are sensitive to changes in other water parameters, making it a good indicator of ecosystem health. USEPA considers estuarine and marine levels of chlorophyll *a* under 5 micrograms per liter (µg/L) to be good, 5 to 20 µg/L to be fair, and over 20 µg/L to be poor (USEPA 2015).
- *Salinity*: Salinity, or salt concentration, also affects species distribution. In general, seasonal variation in the region is smaller than year-to-year variation and less predictable than temperature changes (Kaplan 2011).
- *Water temperature*: Water temperature heavily affects species distribution in the ocean. Large-scale changes to water temperature may affect seasonal phytoplankton blooms.

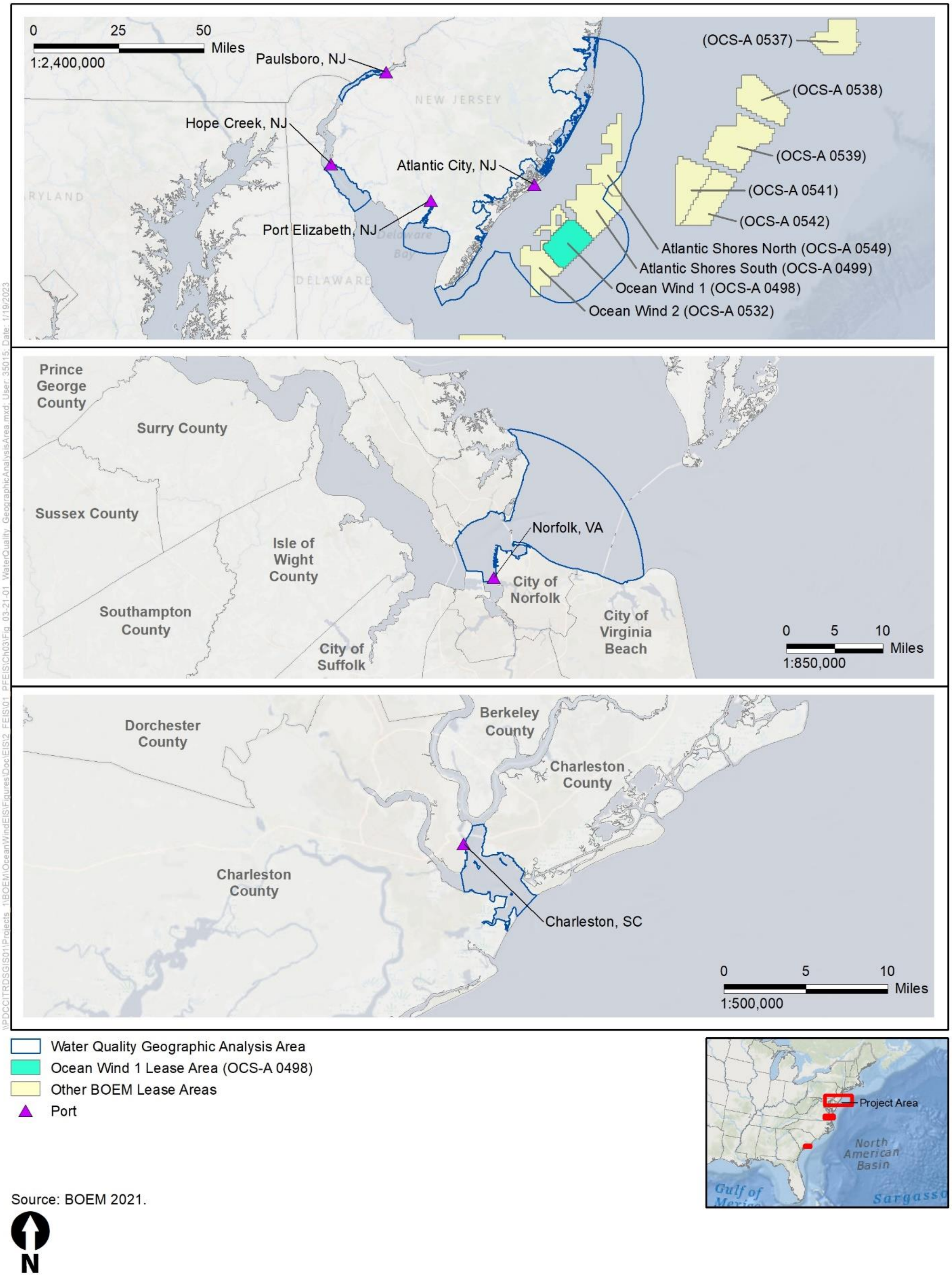

Figure 3.21-1 Water Quality Geographic Analysis Area

- *Turbidity*: Turbidity is a measure of water clarity, which is typically expressed as a concentration of total suspended solids in the water column, but can also be expressed as nephelometric turbidity units. Turbid water lets less light reach the seafloor, which may be detrimental to photosynthetic marine life (CCS 2017). In estuaries, a turbidity level of 0 to 10 nephelometric turbidity units is healthy while a turbidity level over 15 nephelometric turbidity units is detrimental (NOAA 2018). Marine waters generally have less turbidity than estuaries.

States also assess a variety of other water quality parameters as part of state requirements to evaluate and list state waters as impaired under CWA Section 303(d) requirements. Other water quality parameters assessed typically include, but are not limited to, concentrations of metals, pathogens, bacteria, pesticides, biotoxins, PCBs, and other chemicals. If a surface water is considered non-attaining under the assessment, this means a designated beneficial use (e.g., recreation, fish consumption) is impaired by an exceedance of one or more water quality parameters.

Water Quality Geographic Analysis Area: Coastal Marine Waters

Nutrients, DO, Chlorophyll *a*: Table 3.21-1 summarizes water quality parameters for coastal waters at specific point locations in the water quality geographic analysis area, including nutrients, chlorophyll *a*, and DO, for the Atlantic Ocean and various locations in the coastal marine waters between the barrier islands and the mainland around the Proposed project. Nutrient concentrations, as approximated by phytoplankton concentration as chlorophyll *a*, have also been measured via remote sensing techniques. In water closer to the shore, chlorophyll *a* and nutrient values are higher compared to the offshore areas due to input of nutrients from anthropogenic sources. The most recent phytoplankton blooms occur during the fall and winter seasons when stratification decreases due to frequent storms and seasonal overturn. Phytoplankton blooms are also common during the summer months when winds blow surface waters away from the coast and the deeper, cooler, nutrient-rich waters well up from the depths, a phenomenon known as upwelling. When upwelling occurs, these nutrients combined with sunlight lead to phytoplankton blooms along the shorelines in New Jersey (Ocean Wind 2023).

NJDEP conducts annual assessments of the state’s waterways for water quality parameters. Two sites within Barnegat Bay were non-attaining for DO. For Manahawkin Bay and Upper Little Egg Harbor, 50 percent of the 18 sampling stations were below the higher-than-5-mg/L DO target. For samples taken from 15 stations in Lower Little Egg Harbor, 44 percent were below the higher-than-5-mg/L DO target (Ocean Wind 2023).

Table 3.21-1 Water Quality of Coastal Waters in the Geographic Analysis Area

Water Quality Parameter	Unit	Mean	Maximum	Number of Samples
Great Egg Harbor Bay				
Ammonia	µg/L	61	385	188
Nitrate	µg/L	48	2288	194
Total Nitrogen	µg/L	344	2471	192
Total Phosphorus	µg/L	41	96	95
Chlorophyll a	µg/L	2	19	124
DO	mg/L	7	9	190
Little Egg Harbor				
Ammonia	µg/L	--	--	--
Nitrate	µg/L	21	369	409
Total Nitrogen	µg/L	413	1981	434

Water Quality Parameter	Unit	Mean	Maximum	Number of Samples
Total Phosphorus	µg/L	44	140	271
Chlorophyll a	µg/L	4	27	311
DO	mg/L	8	10.9	448
Great Bay				
Ammonia	µg/L	50	535	407
Nitrate	µg/L	37	396	409
Total Nitrogen	µg/L	375	1815	402
Total Phosphorus	µg/L	46	304	217
Chlorophyll a	µg/L	3	27	255
DO	mg/L	7.5	11.3	404
Manahawkin Bay				
Ammonia	µg/L	26	131	146
Nitrate	µg/L	20	214	148
Total Nitrogen	µg/L	544	1896	148
Total Phosphorus	µg/L	50	144	94
Chlorophyll a	µg/L	6	260	108
DO	mg/L	7.8	9	152
Atlantic Ocean				
Ammonia	µg/L	27	504	1188
Nitrate	µg/L	38	259	1218
Total Nitrogen	µg/L	314	8457	1201
Total Phosphorus	µg/L	39	286	803
Chlorophyll a	µg/L	3	50	1021
DO	mg/L	7.7	15.1	1188

Source: Connell 2010.

Salinity: BOEM and NOAA funded an assessment of benthic communities within offshore lease areas, including the Ocean Wind 1 Lease Area. Salinity measured in the Lease Area for the period of 2003–2016 was 32.2 practical salinity units, with a full range spanning 29.4 to 34.4 practical salinity units (n=4,205). This range is within the euhaline range (30–40 practical salinity units), which is the typical salinity range for seawater (Venice salinity classification system). In general, the average salinity increases in the offshore direction off New Jersey, with lower-salinity waters near the shoreline due to the seasonal river discharge and wind variations (Ocean Wind 2023).

Water temperature: Boat-based surveys were conducted to collect various water quality parameters, including temperature, within the Lease Area and surrounding Atlantic Ocean. The minimum sea surface temperature value collected was 36°F (2°C) during winter and the maximum sea surface temperature value collected was 79°F (26°C) during summer. Within the water column, data collected in the New Jersey OCS WEAs over the period of 2003 to 2016 showed seasonal fluctuations spanned as much as 68°F (20°C) at the surface and 59°F (15°C) at the bottom, with thermal stratification beginning in April and increasing into August. Actual surface and bottom temperatures varied substantially from year to year, particularly during the fall. Surface to bottom temperature gradients were warmer at the surface and cooler at the bottom, with a stratified condition in spring and summer and isothermal condition following the fall turnover during winter (Ocean Wind 2023).

Turbidity: Waters along the Northeast Coast, which includes the geographic analysis area around the Project, average 5.6 mg/L of total suspended solids, which is considered low. There are notable exceptions, including estuaries, which averaged 27.4 mg/L, although total suspended solids sampling throughout nine assessment units in and around Barnegat Bay did not record total suspended solids levels above 16 mg/L (USEPA 2012; Ocean Wind 2023). While most ocean waters had total suspended solids concentrations under 10 mg/L, which is the 90th percentile of all measured values, most estuarine waters (65.7 percent of the Northeast Coast area) had total suspended solids concentrations above this level. Near-bottom total suspended solids concentrations were similar to those near the water surface, averaging 6.9 mg/L. With the exception of the entrance to Delaware Bay, all other coastal ocean stations had near-bottom levels of total suspended solids less than or equal to 16.3 mg/L (USEPA 2012).

NJDEP conducts annual assessments of the state's waterways for water quality parameters. Five sampling sites within Barnegat Bay were non-attaining for turbidity. Manahawkin Bay, Upper Little Egg Harbor, and Lower Little Egg Harbor Bay water quality was designated as fully supporting recreation and shellfish, but not supporting wildlife due, in part, to increased turbidity (Ocean Wind 2023).

303(d) listed impaired waters: Nearly all water quality assessment units of Barnegat Bay and associated tidal tributaries in the geographic analysis area are listed as 303(d) impaired (see Appendix I, Figure I-4) (USEPA 2020). These waters are non-attaining for fish consumption, ecological function, or recreation, with causes including pathogens, turbidity, oxygen depletion, pesticides, and PCBs. Waters along all the ocean-side barrier island shorelines in the geographic analysis area are non-attaining for ecological function due to oxygen depletions (USEPA 2020).

Water Quality Specific to Proposed Ports

Four areas in the water quality analysis area are not in the immediate vicinity of the Project and generally include the Delaware River/Bay up to Philadelphia; the Maurice River up to Port Elizabeth; the confluence of the James River with Chesapeake Bay around Norfolk, Virginia; and Charleston Harbor, South Carolina.

USEPA (2012) assessed water quality conditions along the coasts of the United States and developed a water quality index (good, fair, or poor) that evaluated five water quality parameters: nitrogen, phosphorus, chlorophyl *a*, water clarity (total suspended solids or turbidity), and DO. The overall water quality condition of the Northeast Coast, which includes the Delaware River/Bay and Chesapeake Bay/James River, is considered fair. Phosphorus, chlorophyll *a*, DO, and water clarity ratings are all considered fair, while nitrogen rating is considered good (USEPA 2012). Delaware Bay has a water quality index of fair to poor, with poor water quality indices on the northern side of the bay and fair on the southern side of the bay. The Delaware River has a mostly poor water quality index all the way upstream to Philadelphia. Delaware Bay also has naturally high turbidity compared to most other waters in the Northeast Coast area. The water quality index around Norfolk, Virginia where the James River empties into Chesapeake Bay is generally considered fair for all five water quality parameters, with just a few sample locations considered poor, where two or more of the parameters did not meet standards. The overall water quality condition of the Southeast Coast, which includes Charleston Harbor, is generally considered fair; phosphorus, chlorophyll *a*, and DO water quality ratings are all considered fair, while nitrogen is considered good and water clarity is considered poor. Charleston Harbor has a water quality index of generally fair for all five parameters.

The Delaware River/Bay up to Philadelphia, Maurice River (to Port Elizabeth), James River, Chesapeake Bay, and associated waters around Norfolk, Virginia, and Charleston Harbor, South Carolina are all listed as impaired 303(d) waters that are non-attaining for at least one use with causes that vary including, but not limited to, mercury, PCBs, dioxins, oxygen depletion, noxious aquatic plants, pathogens, and copper (see Appendix I, Figure I-4) (USEPA 2020; South Carolina Department of Health and Environmental Control 2018).

Water Quality Geographic Analysis Area: Coastal Onshore Waters

As previously stated, surface waters within most of the geographic analysis area and all of the Onshore Project area are coastal marine waters. Coastal onshore waters in the geographic analysis area generally occur west of the Oyster Creek Onshore Project area and include Oyster Creek, Waretown Creek, Lochiel Creek, Long Branch, Cave Cabin Branch, Forked River (south, middle and north branch), and associated tributaries to these waters. The assessment units listed as impaired and 303(d) listed by NJDEP cover Waretown/Lochiel Creek, North Forked River (above old railroad grade), and associated tributaries (see Appendix I, Figure I-4). The Waretown/Lochiel Creek assessment unit is non-attaining for drinking water use caused by mercury and other metals. The North Forked River assessment unit is non-attaining for ecological use and recreation use caused by oxygen depletion, pathogens, and unknown causes. There are no coastal onshore waters around the BL England Onshore Project area, as all waters in and around the Project area include saline or tidal/estuarine waters.

Groundwater Quality

The Onshore Project area is within a sole-source aquifer known as the New Jersey Coastal Plain Aquifer. A sole-source aquifer is an aquifer that supplies at least 50 percent of the drinking water for its service area and is the only reasonable drinking water source for that area. Several aquifers compose this larger aquifer system and include the Kirkwood-Cohansey aquifer system, the Atlantic City 800-foot sand, the Wenonah-Mount Laurel aquifer, the Englishtown aquifer, and the Potomac-Raritan-Magothy aquifer system. Depth to groundwater in the aquifer system at several groundwater wells in the vicinity of the Onshore Project area range from 39.9 feet to 102.8 feet below the ground surface (COP Volume II, Table 2.1.2-12; Ocean Wind 2023). The New Jersey Ambient Ground Water Quality Monitoring Network program utilizes 150 wells throughout northern and southern New Jersey to evaluate shallow groundwater quality. The chemical and physical characteristics measured in each well-water sample include pH, specific conductivity, DO, temperature, alkalinity, major ions, trace elements, nutrients, gross-alpha particle activity, VOCs, total dissolved solids, and pesticides. In southern New Jersey, shallow groundwater has a more acidic pH and lower total dissolved solids levels, reflecting the coastal plain origin. In the urbanized areas of southern New Jersey, lower DO levels are detected due to large proportions of impervious surface area. Specific conductivity increases in southern New Jersey have been attributed to application of road salt during the winter. Urban areas in New Jersey have high concentrations of nutrients, such as nitrate and nitrite, in groundwater due to possible leakage from septic and sewer systems. Pesticides, VOCs, trace elements, and major ion concentrations are all higher in the urban areas of Southern New Jersey compared to undeveloped areas (Ocean Wind 2023).

The Onshore Project area does not overlap with any NJDEP-designated wellhead protection areas (NJDEP 2018).

3.21.2 Environmental Consequences

3.21.2.1. Impact Level Definitions for Water Quality

Definitions of impact levels are provided in Table 3.21-2. There are no beneficial impacts on water quality.

Table 3.21-2 Impact Level Definitions for Water Quality

Impact Level	Impact Level	Definition
Negligible	Adverse	Changes would be undetectable.
Minor	Adverse	Changes would be detectable but would not result in degradation of water quality in exceedance of water quality standards.
Moderate	Adverse	Changes would be detectable and would result in localized, short-term degradation of water quality in exceedance of water quality standards.
Major	Adverse	Changes would be detectable and would result in extensive, long-term degradation of water quality in exceedance of water quality standards.

3.21.3 Impacts of the No Action Alternative on Water Quality

Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. When analyzing the impacts of the No Action Alternative on water quality, BOEM considered the impacts of past and ongoing trends and activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for water quality. BOEM separately analyzes how resource conditions will be affected over time as reasonably foreseeable activities are implemented. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*. Separate impact conclusions are presented for both scenarios.

3.21.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for water quality described in Section 3.21.1, *Description of the Affected Environment for Water Quality*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on water quality generally relate to or include terrestrial runoff, ground disturbance (e.g., construction) and erosion, terrestrial point- and nonpoint-source discharges, atmospheric deposition, dredging and port operations and improvements, municipal waste discharges, marine transportation-related discharges, commercial fishing, submarine cable and pipeline maintenance, and climate change. The deposition of contaminated runoff into surface waters and groundwater can result in exceedances of water quality standards that can affect the beneficial uses of the water (e.g., drinking water, aquatic life, recreation). While water quality impacts may be temporary and localized (e.g., construction, dredging) and state and federal statutes, regulations, and permitting requirements (e.g., CWA Section 402) avoid or minimize these impacts, issues with water quality can still persist. There are no ongoing offshore wind activities within the geographic analysis area for water quality.

3.21.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned activities (without the Proposed Action). Other planned non-offshore wind activities that affect water quality include onshore development activities (including urbanization, forestry practices, municipal waste discharges, and agriculture); marine transportation-related discharges; dredging and port improvement projects; commercial fishing; military use; new submarine cables and pipelines; and climate change (see Section F.2 in Appendix F for a description of ongoing and planned activities). Water quality impacts from these activities, especially from dredging and harbor, port, and terminal operations, are expected to be localized and temporary to permanent, depending on the nature of the activities and associated IPFs. Similar to under ongoing activities, the deposition of contaminated runoff into surface waters and groundwater can result in exceedances of water quality standards that can affect the beneficial uses of the water (e.g., drinking water, aquatic life, recreation). State and federal water quality protection requirements and permitting would result in avoiding and minimizing these impacts. See Table F1-23 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for water quality.

The water quality geographic analysis area overlaps with most, but not all, of the Atlantic Shores South (OCS-A 0499) and Atlantic Shores North (OCS-A 0549) lease area and the Ocean Wind 2 (OCS-A 0532) lease areas. BOEM conservatively assumed in its analysis of water quality impacts that all 468 WTGs estimated for the Atlantic Shores South, Atlantic Shores North, and Ocean Wind 2 lease areas would be sited within the water quality geographic analysis area. BOEM anticipates that the Atlantic Shores South, Atlantic Shores North, and Ocean Wind 2 offshore project components would be constructed during years that would have some overlap with each other (Table F2-1).

BOEM expects planned offshore wind activities to affect water quality through the following primary IPFs.

Accidental releases: Other offshore wind activities could expose surface waters to contaminants (such as fuel, solid waste, or chemicals, solvents, oils, or grease from equipment) in the event of a spill or release during routine vessel use. Offshore wind projects would result in a small incremental increase in vessel traffic, with a short-term peak during construction. Vessel activity associated with construction is expected to occur regularly in the New York and New Jersey lease areas beginning in 2023 and continuing through 2030 and then lessen to near-baseline levels during operational activities. Increased vessel traffic would be localized near affected ports and offshore construction areas. Increased vessel traffic in the region associated with offshore wind construction could increase the probability of collisions and allisions, which could result in oil or chemical spills.

Based on the estimated construction schedules (see Table F2-1), offshore wind projects could occur with some overlapping construction schedules between 2023 and 2030. This EIS estimates that up to approximately 1,527,193 gallons of coolants, 2,121,777 gallons of oils, and 471,492 gallons of diesel fuel could be stored within WTG foundations and the OSS within the water quality geographic analysis area. Other chemicals, including grease, paints, and sulfur hexafluoride, would also be used at the offshore wind projects, and black and gray water may be stored in sump tanks on facilities. BOEM has assessed the toxicity of chemicals used at offshore wind facilities and conducted extensive modeling to determine the likelihood and effects of a chemical spill at offshore wind facilities at three locations along the Atlantic Coast, including an area near the proposed Project area (Maryland WEA) (Bejarano et al. 2013). Results of the model indicated a catastrophic, or maximum-case scenario, release of 129,000 gallons (488,318 liters) of oil mixture has a “Very Low” probability of occurring, meaning it could occur one time in 1,000 or more years. In other words, the likelihood of a given spill resulting in a release of the total container volume (such as from a WTG, OSS, or vessel) is low. The modeling effort also revealed the most likely type of spill (i.e., non-routine event) to occur is from the WTGs at a volume of 90 to 440 gallons (341 to 1,666 liters), at a rate of one time in 1 to 5 years, or a diesel fuel spill of up to 2,000 gallons (7,571 liters) at a rate of one time in 91 years. The likelihood of a spill occurring from multiple WTGs and OSS at the same time is very low and, therefore, the potential impacts from a spill larger than 2,000 gallons (7,571 liters) are largely discountable. The modeling effort was conducted based on information collected from multiple companies and projects and would therefore apply to the other projects in the water quality geographic analysis area. For the purposes of this discussion, small-volume spills equate to the most likely spill volume between 90 and 440 gallons (341 to 1,666 liters) of oil mixture or up to 2,000 gallons (7,571 liters) of diesel fuel, while large-volume spills are defined as a catastrophic release of 129,000 gallons (488,318 liters) of material, based on modeling conducted by

Bejarano et al. (2013). Small-volume spills could occur during maintenance or transfer of fluids, while low-probability small- or large-volume spills could occur due to vessel collisions, allisions with the WTGs/OSS, or incidents such as toppling during a storm or earthquake.

All offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of accidental spills administered by USCG and BSEE. Oil Spill Response Plans are required for each project and would provide for rapid spill response, cleanup, and other measures that would help to minimize potential impacts on affected resources from spills. Vessels would also have their own onboard containment measures that would further reduce the impact of an allision. A release during construction or operation would generally be localized and short term and result in little change to water quality. In the unlikely event an allision or collision involving project vessels or components resulted in a large spill, impacts on water quality would be adverse and short term to long term, depending on the type and volume of material released and the specific conditions (e.g., depth, currents, weather conditions) at the location of the spill.

Accidental releases of trash and debris would be infrequent and negligible because operators would comply with federal and international requirements for management of shipboard trash. All vessels would also need to comply with the USCG ballast water management requirements outlined in 33 CFR 151 and 46 CFR 162; allowed vessel discharges such as bilge and ballast water would be restricted to uncontaminated or properly treated liquids.

In summary, there is potential for moderate water quality impacts due to a maximum-case scenario accidental release; however, due to the very low likelihood of a maximum-case scenario release occurring, the expected size of the most likely spill to be small, and the expected occurrence to be of low frequency, the cumulative impact of accidental releases is anticipated to be short term, localized, and minor, resulting in little change to water quality. As such, accidental releases from offshore wind development in the water quality geographic analysis area would not be expected to contribute appreciably to cumulative impacts on water quality.

Anchoring: Offshore wind activities would contribute to changes in offshore water quality from resuspension and deposition of sediments from anchoring during construction, installation, maintenance, and decommissioning of offshore components. BOEM estimates that approximately 284 acres (1.15 km^2) of seabed could be affected by anchoring within the water quality geographic analysis area. Disturbances to the seabed during anchoring would temporarily increase suspended sediment and turbidity levels in and immediately adjacent to the anchorage area. The intensity and extent of the additional sediment suspension effects would be less than that of new cable emplacement (see new cable emplacement and maintenance IPF discussion below) and would therefore be unlikely to have an incremental impact beyond the immediate vicinity. If more than one project is being constructed during the same period, the impacts would be greater than for one project, and multiple areas would experience water quality impacts from anchoring but, due to the localized area for sediment plumes, the impacts would likely not overlap each other geographically. The cumulative impact of increased sediment and turbidity from vessel anchoring is anticipated to be adverse, localized, and short term, resulting in a minor impact on ambient water quality. Anchoring would not be expected to appreciably contribute to cumulative impacts on water quality.

Cable emplacement and maintenance: Emplacement of submarine cables would result in increased suspended sediments and turbidity. Using the assumptions in Table F2-2, offshore wind development in the water quality geographic analysis area would result in approximately 1,858 acres (7.5 km^2) of seabed impact. As described under anchoring above, these activities would contribute to changes in offshore water quality from the resuspension and deposition of sediment. Sediment dispersion modeling conducted for three other offshore wind projects (the Vineyard Wind 1 Project in Massachusetts, the Block Island Wind Farm in Rhode Island, and the Virginia Offshore Wind Technology Advancement Project of

Virginia) were reviewed and evaluated, and general sediment conditions and hydrodynamics are similar to those in the Project area (see COP Volume II, Section 2.1.2.2.1 for detailed descriptions; Ocean Wind 2023). The sediments within each project area were predominantly sands and current velocities were within similar ranges, indicating that the results of each modeling effort would be expected to be representative of the Project site. Turbidity concentrations greater than 10 mg/L would be short in duration up to 6 hours and limited to within approximately 50 to 200 meters of the trench in the offshore area. BOEM anticipates that offshore wind projects would use dredging only when necessary and rely on other cable laying methods for reduced impacts (such as jet plow or mechanical plow) where feasible. Due to the localized areas of disturbances and range of variability within the water column, the cumulative impacts of increased sediments and turbidity from cable emplacement and maintenance are anticipated to be localized, short term, and adverse, resulting in a minor impact on ambient water quality. If multiple projects are being constructed at the same time, the impacts would be greater than those identified for one project and would likely not overlap each other geographically due to the localized natures of the plumes. New cable emplacement and maintenance activities would not be expected to appreciably contribute to cumulative impacts on water quality.

Port utilization: Offshore wind development would use nearby ports and could also require port expansion or modification, resulting in increased vessel traffic or increased suspension and turbidity from any in-water work. These activities could also increase the risk of accidental spills or discharge. However, these actions would be localized and port improvements would comply with all applicable permit requirements to minimize, reduce, or avoid impacts on water quality. As a result, port utilization impacts on water quality would be minor and not expected to appreciably contribute to cumulative impacts on water quality.

Presence of structures: Using the assumptions in Table F2-2, reasonably foreseeable offshore wind projects are estimated to result in no more than 482 structures by 2030 within the water quality geographic analysis area. These structures could disturb up to 366 acres (1.5 km^2) of seabed within the water quality geographic analysis area from foundation and scour protection installation and disrupt bottom current patterns, leading to increased movement, suspension, and deposition of sediments. Scouring, which could lead to impacts on water quality through the formation of sediment plumes (Harris et al. 2011), would generally occur in shallow areas with tidally dominated currents. Structures may reduce wind-forced mixing of surface waters, whereas water flowing around the foundations may increase vertical mixing (Carpenter et al. 2016; Cazenave et al. 2016). Results from a recent BOEM (2021c) hydrodynamic model of four different WTG build-out scenarios of the offshore Rhode Island and Massachusetts lease areas found that offshore wind projects have the potential to alter local and regional physical oceanic processes (e.g., currents, temperature stratification),via their influence on currents from WTG foundations and by extracting energy from the wind. The results of the hydrodynamic model study show that introduction of the offshore wind structures into the offshore WEA modifies the oceanic responses of current magnitude, temperature, and wave heights by (1) reducing the current magnitude through added flow resistance, (2) influencing the temperature stratification by introducing additional mixing, and (3) reducing current magnitude and wave height by extracting of energy from the wind by the offshore wind turbines. BOEM conducted a similar model offshore Rhode Island and Massachusetts that evaluated ocean processes during two extreme weather events: the February 1978 Nor'easter storm (a 100-year storm) and the August 1991 Hurricane Bob (BOEM 2016). The results indicate that the wind turbine facility on the eastern shelf of Block Island, Rhode Island can cause more significant local and regional impacts than offshore wind facilities over the outer shelves off Massachusetts and Rhode Island. Inside the wind turbine area, the maximum change during the nor'easter storm and hurricane cases can be 0.2 to 0.4 meter for surface elevation, 3.5 to 7.3 meters for significant wave height, 0.7 to 1.7 m/s for vertically averaged, near-surface and near-bottom velocities, and 16.8 to 28.2 newtons per m^2 for bottom stress (BOEM 2016). Alterations in currents and mixing would affect water quality parameters such as temperature, DO, and salinity, but would vary seasonally and regionally. WTGs and the OSS associated with reasonably foreseeable offshore wind projects would be placed in average water depths of 100 to 200 feet where current speeds are relatively low, and offshore cables would be buried where possible. Cable armoring would be used where burial is not possible, such as in hard-bottomed areas. BOEM anticipates that developers would implement BMPs to minimize seabed disturbance from foundations, scour, and cable installation. As a result, adverse impacts on offshore water quality would be localized, short term, and minor. Presence of structures would not be expected to appreciably contribute to cumulative impacts on water quality.

The exposure of offshore wind structures, which are mainly made of steel, to the marine environment can result in corrosion without protective measures. Corrosion is a general problem for offshore infrastructures and corrosion protection systems are necessary to maintain the structural integrity. Protective measures for corrosion (e.g., coatings, cathodic protection systems) are often in direct contact with seawater and have different potentials for emissions, e.g., galvanic anodes emitting metals, such as aluminum, zinc, and indium, and organic coatings releasing organic compounds due to weathering and leaching. The current understanding of chemical emissions for offshore wind structures is that emissions appear to be low, suggesting a low environmental impact, especially if compared to other offshore activities, but these emissions may become more relevant for the marine environment with increased numbers of offshore wind projects and a better understanding of the potential long-term effects of corrosion protection systems (Kirchgeorg et al. 2018). Based on the current understanding of offshore wind structure corrosion effects on water quality, BOEM anticipates the potential impact to be minor.

Discharges: Other offshore wind projects would result in a small incremental increase in vessel traffic, with a short-term peak during construction. Vessel activity associated with offshore wind project construction is expected to occur regularly in the New York and New Jersey lease areas beginning in 2023 and continuing through 2030, and then lessen to near-baseline levels during operation. Increased vessel traffic would be localized near affected ports and offshore construction areas. Offshore wind development would result in an increase in regulated discharges from vessels, particularly during construction and decommissioning, but the events would be staggered over time and localized. Offshore permitted discharges would include uncontaminated bilge water and treated liquid wastes. BOEM assumes that all vessels operating in the same area will comply with federal and state regulations on effluent discharge. All offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of discharges and of nonindigenous species. All vessels would need to comply with the USCG ballast water management requirements outlined in 33 CFR Part 151 and 46 CFR Part 162. Furthermore, each project’s vessels would need to meet USCG bilge water regulations outlined in 33 CFR Part 151, and allowable vessel discharges such as bilge and ballast water would be restricted to uncontaminated or properly treated liquids. Therefore, due to the minimal amount of allowable discharges from vessels associated with offshore wind projects, BOEM expects impacts on water quality resulting from vessel discharges to be minimal and to not exceed background levels over time.

The WTGs and OSS are self-contained and do not generate discharges under normal operating conditions. In the event of a spill related to an allision or other unexpected or low-probability event, impacts on water quality from discharges from the WTGs or OSS during operation would be temporary. During decommissioning, all offshore wind structures would be drained of fluid chemicals via vessel, dismantled, and removed. BOEM anticipates decommissioning to have temporary impacts on water quality, with a return to baseline conditions.

Due to the staggered increase in vessels from various projects; the current regulatory requirements administered by USEPA, USACE, USCG, and BSEE; and the restricted allowable discharges, the cumulative impact of discharges from vessels is anticipated to be localized and short term. Based on the above, BOEM anticipates discharges to have a minor impact on water quality, as the level of impact in the water quality geographic analysis area from offshore wind development would be similar to that under existing conditions and would not be expected to appreciably contribute to cumulative impacts on water quality.

Land disturbance: Other offshore wind development could include onshore components that would lead to increased potential for water quality impacts resulting from accidental fuel spills or sedimentation during the construction and installation of onshore components (e.g., equipment, substation). Construction and installation of onshore components near waterbodies may involve ground disturbance, which could lead to unvegetated or otherwise unstable soils. Precipitation events could potentially erode the soils, resulting in sedimentation of nearby surface waters and subsequent increased turbidity. It is assumed that a SWPPP and erosion and sedimentation controls would likely be implemented during the construction period to minimize impacts, resulting in infrequent and temporary erosion and sedimentation events.

In addition, onshore construction and installation activities would involve the use of fuel and lubricating and hydraulic oils. Use of heavy equipment onshore could result in potential spills during active use or refueling activities. It is assumed that a Spill Prevention, Control, and Countermeasure Plan would be prepared for each project in accordance with applicable regulatory requirements, and would outline spill prevention plans and measures to contain and clean up spills if they were to occur. Additional mitigation and minimization measures (such as refueling away from wetlands, waterbodies, or known private or community potable wells) would be in place to decrease impacts on water quality. Impacts on water quality would be limited to periods of onshore construction and periodic maintenance over the life of each project.

Overall, the impacts from onshore activities that occur near waterbodies could result in temporary introduction of sediments or pollutants into coastal waters in small amounts where erosion and sediment controls fail. Land disturbance for offshore wind developments that are at a distance from waterbodies and that implement erosion and sediment control measures would be less likely to affect water quality. In addition, the impacts would be localized to areas where onshore components were being built near waterbodies. While it is possible that multiple projects could be under construction at the same time, the likelihood that construction of the onshore components overlaps in time or space is minimal, and the total amount of erosion that occurs and impacts on water quality at any one given time could be minimal. Land disturbance from offshore wind development is anticipated to be localized, short term, and minor, and would not be expected to appreciably contribute to cumulative impacts on water quality.

3.21.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and water quality would continue to be affected by natural and human-caused IPFs. BOEM expects ongoing activities to have continuing localized temporary to permanent impacts on water quality, ranging from negligible to moderate depending on the nature of the activities and associated IPFs. These impacts would result primarily through accidental releases and sediment suspension related to vessel traffic, port utilization, presence of structures, discharges, and runoff from land disturbance. Therefore, the No Action Alternative would result in a **moderate** impact on water quality.

Cumulative Impacts of the No Action Alternative: Planned activities would contribute to water quality impacts primarily through accidental releases, sediment resuspension, and runoff from land disturbance. BOEM anticipates that the impacts associated with Atlantic Shores South, Atlantic Shores North, and Ocean Wind 2 would generally be negligible to minor and include sediment resuspension during construction and decommissioning (both from regular cable laying and from prelaying); vessel discharges; sediment contamination; discharges from the WTGs and OSS during operation; sediment plumes due to scour; and erosion and sedimentation from onshore construction. Construction and decommissioning activities associated with Atlantic Shores South, Atlantic Shores North, and Ocean Wind 2 would lead to increases in sediment suspension and turbidity in the offshore lease areas during the first 6 to 10 years of construction of projects and in the latter part of the 30-year life spans of offshore wind projects due to decommissioning activities. However, sediment suspension and turbidity increases would be temporary and localized and BOEM anticipates the impact to be minor. BOEM has considered the possibility of impacts resulting from accidental releases; a moderate impact could occur if there was a large-volume, catastrophic release. However, the probability of catastrophic release occurring is very low, the expected size of the most likely spill would be very small, and such a spill would occur infrequently. BOEM anticipates the cumulative impacts of the No Action Alternative on water quality would be **moderate**, primarily driven by the unlikely event of a large-volume, catastrophic release.

3.21.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; BOEM expects any potential variances in the proposed Project build-out within the range of the PDE to result in impacts similar to or less than those described in the sections below. The following proposed-Project design parameters (Appendix E) would influence the magnitude of the impacts on water quality:

- The amount of vessel use during installation, operations, and decommissioning
- The number of WTGs and OSS and the amount of cable laid determines the area of seafloor and volume of sediment disturbed by installation. Representing the maximum-case scenario, a maximum of 98 WTGs installed, three OSS, 190 miles (300 kilometers) of inter-array cable, 19 miles (30 kilometers) of OSS interconnector cable, and 174 miles (281 kilometers) of offshore export cable (Appendix E).
- Installation methods chosen and the duration of installation
- Proximity to sensitive water sources and mitigation measures used for onshore proposed-Project activities
- In the event of a non-routine event such as a spill, the quantity and type of oil, lubricants, or other chemicals contained in the WTGs, vessels, and other proposed-Project equipment

Variability of the proposed-Project design as a result of the PDE includes the exact number of WTGs and OSS (determining the total area of foundation footprints); the number of monopile foundations and jacket foundations (OSS only); the total length of inter-array cable; the total area of scour protection needed; and the number, type, and frequency of vessels used in each phase of the proposed Project. Changes in the design may affect the magnitude (number of structures and vessels), location (WTG and other Project element layouts), and mechanism (installation method, non-routine event) of water quality impacts.

Ocean Wind has committed to measures to minimize impacts on water quality. Turbidity reduction measures would be implemented to the extent practicable to minimize impacts on hard-bottom habitats, including seagrass communities, from construction activities (WQ-01). All vessels will be certified to conform to vessel operations and maintenance protocols designed to minimize the risk of fuel spills and leaks (WQ-02) (COP Volume II, Table 1.1-2; Ocean Wind 2023).

3.21.5 Impacts of the Proposed Action on Water Quality

3.21.5.1. Impacts on the Proposed Action

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park, which is described in Section 3.21.6, *Impacts of Alternatives B, C, D, and E on Water Quality*.

The Proposed Action would contribute to impacts through all of the IPFs named in Section 3.21.3.2. The most impactful IPFs would likely include new cable emplacement and maintenance that could cause noticeable temporary impacts during construction through increased suspended sediments and turbidity, the presence of structures that could result in alteration of local water currents and lead to the formation of sediment plumes, and discharges that could result in localized turbidity increases during discharges or bottom disturbance during dredged material disposal.

Accidental releases: Similar to under other offshore wind projects, chemicals (e.g., coolants, oils, diesel fuel, other chemicals) would be used and stored in facilities and black and gray water may be stored in sump tanks on facilities. The Proposed Action would have a maximum of 39,690 gallons of coolants, 426,671 gallons of oils and lubricants, and 236,216 gallons of diesel stored within WTG foundations and OSS within the water quality geographic analysis area. As discussed previously, the risk of a spill from any single offshore structure would be low, and any effects would likely be localized. A reduction in the number of WTGs required due to increased capacity would result in a smaller total amount of materials being stored offshore. Modeling conducted for an area near the proposed Project area (Maryland WEA) indicates that the most likely type of spill (i.e., non-routine event) to occur during the life of a project is 90 to 440 gallons (341 to 1,666 liters), which would have brief, localized impacts on water quality (Bejarano et al. 2013). One difference between the Proposed Action and the Maryland WEA is that there would be fewer WTGs under the Proposed Action (98 instead of 125), which would lead to a decreased likelihood of spill events compared to the Bejarano et al. (Bejarano et al. 2013) model. There is potential for moderate water quality impacts due to a maximum-case scenario accidental release; however, due to the very low likelihood of a maximum-case scenario release occurring, the expected size of the most likely spill to be small, and the expected occurrence to be of low frequency, the overall impact is anticipated to be short term, localized, and minor, resulting in little change to water quality.

Increased vessel traffic in the region associated with the Proposed Action could increase the probability of collisions and allisions, which could possibly result in oil or chemical spills. However, collisions and allisions are anticipated to be unlikely based on the following factors that would be considered for the proposed Project: USCG requirement for lighting on vessels, NOAA vessel speed restrictions, the proposed spacing of WTGs and OSS, the lighting and marking plan that would be implemented, and the inclusion of proposed Project components on navigation charts. Ocean Wind would implement its Oil Spill Response Plan (COP Volume III, Appendix A; Ocean Wind 2023), which would provide for rapid spill response, cleanup, and other measures to minimize any potential impact on affected resources from spills and accidental releases, including spills resulting from catastrophic events. In the unlikely event an allision or collision involving vessels or components associated with the Proposed Action resulted in a large spill, impacts from the Proposed Action alone on water quality would be short term to long term depending on the type and volume of material released and the specific conditions (e.g., depth, currents, weather conditions) at the location of the spill. In addition, Ocean Wind has committed to a mitigation measure requiring that vessels conform to O&M protocols designed to minimize risk of fuel spills and leaks (WQ-02; COP Volume II, Table 1.1-2; Ocean Wind 2023). With implementation of this mitigation measure, risk of fuel spills and leaks from vessels would be minimized and the impact considered minor.

Onshore construction activities would require heavy equipment use or HDD activities, and potential spills could occur as a result of an inadvertent release from the machinery or during refueling activities. Ocean Wind would develop and implement a Spill Prevention, Control, and Countermeasure Plan to minimize impacts on water quality (prepared in accordance with applicable regulations such as NJDEP Site Remediation Reform Act, Linear Construction Technical Guidance, and Spill Compensation and Control Act). In addition, all wastes generated onshore would comply with applicable federal regulations, including the Resource Conservation and Recovery Act and the Department of Transportation Hazardous

Material regulations. Therefore, BOEM anticipates the Proposed Action would result in minor, temporary, and long-term impacts on water quality as a result of releases from heavy equipment during construction and other cable installation activities.

Ocean Wind proposes to use an onshore O&M facility in Atlantic City, New Jersey. Construction of the O&M facility would be separately reviewed and authorized by USACE and local authorities, as needed. BOEM anticipates that use of the facility would result in minor impacts on water quality because a potential release at the facility would likely be relatively small and would be cleaned up in accordance with federal and state regulations.

Anchoring: There would be increased vessel anchoring during the construction, installation, O&M, and decommissioning of offshore components of the Proposed Action. Anchoring would cause increased turbidity levels. Impacts on water quality from the Proposed Action alone due to anchoring would be localized, short term, and minor during construction and decommissioning. Anchoring during operation would decrease due to fewer vessels required during operation, resulting in reduced impacts. Ocean Wind anticipates between 20 and 65 vessels operating simultaneously during construction, depending upon the activity. The number of vessels is anticipated to result in 14 acres (0.05 km^2) of impact from anchoring, which would be additive with the impact(s) of any and all other anchoring activities, including offshore wind activities that occur within the water quality geographic analysis area during the same timeframe, resulting in a total of 298 acres (1.2 km^2) of seabed impact from anchoring.

Cable emplacement and maintenance: The installation of array cables and offshore export cables would include site preparation activities (e.g., sandwave clearance, boulder removal) and cable installation via jet plow, mechanical plow, or mechanical trenching, which can cause temporary increases in turbidity and sediment resuspension. Other projects using similar installation methods (e.g., jet plowing, pile driving) have been characterized as having minor impacts on water quality due to the short-term and localized nature of the disturbance (Latham et al. 2017). As described in Section 3.21.3.2, sediment dispersion modeling was conducted for three other offshore wind projects with conditions representative of the Wind Farm Area (see COP Volume II, Section 2.1.2.2.1 for detailed descriptions; Ocean Wind 2023). The modeling indicated sediments resuspended during trenching would settle quickly to the seabed within the trench, potential plumes would be limited to right above the seabed and not within the water column, and concentrations greater than 10 mg/L would be short in duration (up to 6 hours) and limited to within approximately 50 to 200 meters of the center of the trench. Jet plow activities in near-shore areas such as Barnegat Bay for the Project would be similar to the modeling results for other shallow water areas where the mostly fine sediment (silts and clays) were projected to persist for 2 days at very low levels of 10 mg/L above background (Ocean Wind 2023 citing Normandeau 2015). These impacts on water quality for finer sediments are anticipated to be localized adjacent to the trench and temporary in nature. Therefore, given the known hydrodynamic conditions within the area of the Project and the expected BMPs associated with jet plowing technologies, no long-term impacts on water quality are anticipated following cable installation activities. BOEM anticipates the Proposed Action alone would have negligible, long-term impacts on water quality via this mechanism. Overall, impacts on water quality from the Proposed Action due to cable emplacement and resulting suspension of sediment and turbidity would be short term and minor.

Port utilization: The current bearing capacity of existing ports was considered suitable for WTGs, requiring no port modifications for supporting offshore wind energy development (DOE 2014). During construction, several ports may be used, including Atlantic City, New Jersey; Paulsboro, New Jersey; Norfolk, Virginia; Hope Creek, New Jersey; or Charleston, South Carolina. During proposed Project operations, a retired marine terminal in Atlantic City would be used as the O&M facility. The impacts on water quality could include accidental fuel spills or sedimentation during port use. The incremental increases in ship traffic at the ports would be small; multiple authorities regulate water quality impacts from these operations (BOEM 2019). Therefore, the impacts of the Proposed Action alone on water quality from port utilization would be negligible.

Presence of structures: Existing stationary facilities that present allision risks are limited in the open waters of the geographic analysis area. Dock facilities and other structures are concentrated along the coastline. The Proposed Action would add up to 98 WTGs, three OSS, and related Project elements, which would increase seabed disturbance and potential water quality impacts. In the water quality geographic analysis area, offshore wind activities including the Proposed Action would result in 446 acres (1.8 km^2) of impact from installation of foundations and scour protection and 141 acres (0.57 km^2) of impact from hard protection for offshore cables and inter-array cables. As described in Section 3.21.3.2, results from a recent BOEM (2021c) hydrodynamic model of four different WTG build-out scenarios of the offshore Rhode Island and Massachusetts lease areas found that offshore wind projects have the potential to alter local and regional physical oceanic processes (e.g., currents, temperature stratification) via their influence on currents from WTG foundations and by extracting energy from the wind. Similarly, as described in Section 3.21.3.2, the presence of WTGs during an extreme weather event can affect oceanic processes (BOEM 2016).

Discharges: During construction of the Proposed Action, vessel traffic would increase in and around the Wind Farm Area, leading to potential discharges of uncontaminated water and treated liquid wastes. COP Table 8.2-1 lists types of waste potentially produced by the Proposed Action (COP Volume I, Section 8.2; Ocean Wind 2023). Ocean Wind would only be allowed to discharge uncontaminated water (e.g., uncontaminated ballast water and uncontaminated water used for vessel air conditioning) or treated liquid wastes overboard (e.g., treated deck drainage and sumps). Other waste such as sewage; and solid waste or chemicals, solvents, oils, and greases from equipment, vessels, or facilities would be stored and properly disposed of on land or incinerated offshore.

Ocean Wind expects substantially less vessel use during routine O&M than during construction. Vessel use would consist of scheduled inspection and maintenance activities, with corrective maintenance as needed. In a year, the Proposed Action would generate a maximum of 908 crew vessel trips, 102 jack-up vessel trips, 104 supply vessel trips, and 2,278 crew transfer vessel trips or service operations vessel trips (COP Volume I, Section 6.1.3.5, Table 6.1.2-11; Ocean Wind 2023). The proposed Project would require all vessels to comply with regulatory requirements related to the prevention and control of discharges, accidental spills, and nonindigenous species. All vessels would need to comply with waste and water management regulations described in Section 3.21.3.2, including USCG ballast water management requirements and USCG bilge water regulation. The bilge water from the proposed Project would either be retained onboard vessels in a holding tank and discharged to an onshore reception facility or treated onboard with an oily water separator, after which the treated water could be discharged overboard. In addition, bilge water would not be allowed to be discharged into the sea unless the oil content of the bilge water without dilution is less than 15 parts per million (33 CFR 151.10). For vessels operating within 3 nm from shore, bilge water regulations under USEPA's National Pollutant Discharge Elimination System program apply to any of the proposed Project's vessels that are covered by a Vessel General Permit (those that are 79 feet [24 meters] or greater in length). Bilge discharges within 3 nm from shore are subject to the rules in Section 2.2.2 of the Vessel General Permit and must occur in compliance with 40 CFR Parts 110, 116, and 117, and 33 CFR Part 151.10. Ocean Wind has also committed to developing and implementing a waste management plan for the Project (COP Volume II, Table 1.1-2, GEN-10; Ocean Wind 2023). With implementation of these APMs and the regulatory requirements described above, the temporary impact of routine vessel discharge is expected to be minor.

The WTGs and OSS are self-contained and do not generate discharges under normal operating conditions. In the event of a spill related to an allision or other unexpected or low-probability event, impacts on water quality from discharges from the WTGs or OSS during operation would be temporary. During decommissioning, Ocean Wind would drain all fluid chemicals from the WTGs and OSS and dismantle and remove them. BOEM anticipates decommissioning to have temporary impacts on water quality, with a return to baseline conditions.

Overall, the impacts on water quality from the Proposed Action would be short term and minor during construction and, to a lesser degree, during decommissioning. During operations, the number of vessels in use would decrease even more, resulting in fewer impacts.

Land disturbance: Construction of the Oyster Creek cable corridor would require up to 32 acres of total ground disturbance, with a total permanent corridor disturbance of 19 acres. Construction of the BL England cable corridor would require up to 48 acres of total ground disturbance, with a total permanent corridor disturbance of 29 acres. The BL England and Oyster Creek substation sites would require approximately 13 and 31.5 acres, respectively, to accommodate the area for the substation equipment and buildings, energy storage, stormwater management, and landscaping. During construction, up to 3 acres would be required for temporary workspace. Construction and installation of onshore components (e.g., substations, cable installation) would expose bare soils until permanent stabilization is achieved. Precipitation events could potentially erode the soils and discharge sediment-laden runoff into nearby surface waters, leading to increased turbidity. Ocean Wind would implement erosion and sedimentation controls during the construction period. Construction would lead to an increased potential for surface water quality impacts resulting from accidental fuel spills or sedimentation in waterbodies. The incremental increases in land disturbance from the Proposed Action would be small and mitigation measures, such as the use of a Spill Prevention, Control, and Countermeasure Plan and SWPPP, would be implemented. As such, impacts from the Proposed Action on surface water quality from land disturbance would be negligible to minor.

Onshore construction would disturb the ground with depths of up to 8 feet (e.g., trenching for onshore cable installation), which has the potential to interact with groundwater if groundwater were shallow enough to interact with the disturbance. However, as mentioned in Section 3.21.1, groundwater depths in the aquifer beneath the Onshore Project area (including those associated with the sole-source aquifer) are approximately 40 feet or more below the surface, which is too deep to have any direct interaction with or be affected by construction activities. Any contaminants spilled during construction would be localized, contained, and cleaned up per permitting requirements and Ocean Wind's Spill Prevention, Control, and Countermeasure Plan and, therefore, would not be anticipated to reach groundwater or have any effect on groundwater quality. Due to the depths of groundwater, BOEM does not anticipate any impact from construction, O&M, or decommissioning.

3.21.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities. Ongoing and planned non-offshore wind activities related to onshore development, terrestrial runoff and discharges, marine transportation-related discharges, dredging and port improvement projects, commercial fishing, military use, submarine cables and pipelines, atmospheric deposition, and climate change would contribute to impacts on water quality through the primary IPFs of accidental releases, anchoring, cable emplacement and maintenance, port utilization, discharges, and land disturbance. The construction, O&M, and decommissioning of both onshore and offshore infrastructure for offshore wind activities in the geographic analysis area would also contribute to the primary IPFs of accidental releases, anchoring, cable emplacement and maintenance, port utilization, discharges, presence of structures, and land disturbance. However, given the low probability of accidental releases, the temporary impacts of suspended sediment, and the regulatory and permitting requirements to avoid and minimize impacts on water quality (e.g., National Pollutant Discharge Elimination System permits, Vessel General Permit, Oil Spill Response Plan, Spill Prevention, Control, and Countermeasure Plan), adverse impacts on water quality would be minimized.

Accidental releases: The cumulative impact on water quality would likely be moderate, mostly as a result of the unlikely event of a large-volume, catastrophic release. The contribution of the Proposed Action to the cumulative accidental release impacts on water quality would likely be short term but noticeable due to the low risk and localized nature of the most likely spills and the use of an Oil Spill Response Plan for the Project. In the unlikely event that an allision or collision involving Project vessels or components resulted in an oil or chemical spill, it would be expected that a small spill would have minor, short-term impacts, while a larger spill would have potentially increased impacts for a longer duration.

Anchoring: The contribution of the Proposed Action to the cumulative anchoring impacts on water quality are anticipated to be localized, short term, and noticeable, primarily during construction and decommissioning.

Cable emplacement and maintenance: The contribution from the Proposed Action to increased sediment concentration and turbidity would be additive with the impact(s) of any and all other cable-installation activities, including offshore wind activities, that occur within the water quality geographic analysis area and that would have overlapping timeframes during which sediment is suspended.

Port utilization: Cumulative port utilization impacts of the Proposed Action would likely be short term and minor. There could be limited overlap in construction schedules for cable installation for the Ocean Wind 1 Project and the Atlantic Shores South project in the water quality geographic analysis area. The contribution of the Proposed Action to the cumulative port utilization impacts on water quality would likely be localized, short term, and noticeable.

Presence of structures: The contributions of the Proposed Action to the cumulative structure-placement impacts on water quality would likely be constant over the life of the Project. These disturbances would be localized but, depending on the hydrologic conditions, have the potential to affect water quality through altering mixing patterns and the formation of sediment plumes. Significant scour is not expected even without scour protection due to the low current speeds and minimal seabed mobility in the Wind Farm Area (COP Volume II, Table 2.1.2-13; Ocean Wind 2023). The addition of scour protection would further minimize effects on local sediment transport. The impacts from the Proposed Action on water quality due to the presence of structures would be negligible to minor during construction, O&M, and conceptual decommissioning. In addition, as described in Section 3.21.3.2, the exposure of offshore wind structures to the marine environment can result in emissions of metals and organic compounds from corrosion protection systems. However, the current understanding of chemical emissions for offshore wind structures is that emissions appear to be low, suggesting a low environmental impact (Kirchgeorg et al. 2018).

Discharges: Impacts on water quality from the Proposed Action due to discharges would be additive with the impact(s) of any and all discharges, including those of offshore wind activities, that occur within the water quality geographic analysis area during the same timeframe. Vessel traffic (e.g., fisheries use, recreational use, shipping activities, military uses) in the region would overlap with vessel routes and port cities expected to be used for the Proposed Action and vessel traffic would increase under the Proposed Action. Discharge events would mostly be staggered over time and localized, and all vessels would be required to comply with regulatory requirements related to prevention and control of discharges, accidental spills, and nonindigenous species administered by USEPA, USACE, USCG, and BSEE. Therefore, BOEM expects that the contribution of the Proposed Action to the cumulative discharge impacts on water quality would likely be short term, localized, and noticeable, primarily during construction and to a lesser extent during O&M and decommissioning.

Land disturbance: The contribution of the Proposed Action to the cumulative land disturbance impacts on water quality would likely be localized, short term, and negligible due to the low likelihood that construction of onshore components would overlap in time or space, and the minimal amount of expected erosion into nearby waterbodies.

Overall, in context of reasonably foreseeable environmental trends, the Proposed Action could contribute a detectable increment to the cumulative accidental release (in the event of a large-volume catastrophic release) and cable emplacement impacts (turbidity) on water quality.

3.21.5.3. Conclusions

Impacts of the Proposed Action. BOEM anticipates the impacts on water quality resulting from the Proposed Action would be **moderate**. Impacts from routine activities including sediment resuspension during construction and decommissioning, both from regular cable laying and from prelaying; dredging; vessel discharges; sediment contamination; discharges from the WTGs or OSS during operation; sediment plumes due to scour; and, erosion and sedimentation from onshore construction, would be negligible to minor. Impacts from non-routine activities, such as accidental releases, would be minor from small spills. While a larger spill could have moderate impacts on water quality, the likelihood of a spill this size is very low. The impacts associated with the Proposed Action are likely to be temporary or small in proportion to the geographic analysis area and the resource would recover completely after decommissioning.

Cumulative Impacts of the Proposed Action. BOEM anticipates that the cumulative impacts on water quality in the geographic analysis area would be **moderate**. The incremental impacts contributed by the Proposed Action to the cumulative impacts on water quality would be detectable should a large-volume, catastrophic release occur. BOEM anticipates that the contribution of the Proposed Action to these impacts would be noticeable. The main drivers for this impact rating are the short-term, localized effects from increased turbidity and sedimentation due to anchoring and cable emplacement during construction, and alteration of water currents and increased sedimentation during operations due to the presence of structures. BOEM has considered the possibility of a moderate impact resulting from accidental releases; this level of impact could occur if there was a large-volume, catastrophic release. While it is an impact that should be considered, it is unlikely to occur. The Proposed Action would contribute to the cumulative impact rating primarily through the increased turbidity and sedimentation due to anchoring and cable emplacement during construction, and alteration of water currents and increased sedimentation during operation due to the presence of structures.

3.21.6 Impacts of Alternatives B, C, D, and E on Water Quality

BOEM identified a combination of Alternative A (the Proposed Action) and Alternative E as the Preferred Alternative. The analysis of the impacts of the Preferred Alternative would be the same as that for the Proposed Action except for the export cable route across Island Beach State Park.

Impacts of Alternatives B, C, D, and E. The impacts resulting from individual IPFs under all action alternatives would be either the same or less than those described under the Proposed Action due to the same (Alternatives C-1, C-2, and E) or reduced (Alternatives B-1, B-2, and D) number of WTGs in the Wind Farm Area. While the reduced number of structures may slightly reduce localized water quality impacts during construction and operations, the difference in impacts compared to the Proposed Action would not be materially different. BOEM expects that the modifications to the Oyster Creek export cable route to avoid impacts on SAV in Barnegat Bay under Alternative E would not significantly change the potential impacts on water quality because cable emplacement would still result in short-term and localized sediment suspension, land disturbance would be small, and mitigation measures, such as the use of a Spill Prevention, Control, and Countermeasure Plan and SWPPP, would be implemented. Therefore, BOEM does not anticipate the impacts from the action alternatives to be materially different than those described under the Proposed Action.

Cumulative Impacts of Alternatives B, C, D, and E. The cumulative impacts on water quality would be moderate for the same reasons described for the Proposed Action. The incremental impacts contributed by the action alternatives to the cumulative water quality impacts would be similar to those described under the Proposed Action.

3.21.6.1. Conclusions

Impacts of Alternatives B, C, D, and E. As discussed above, the expected **moderate** impacts associated with the Proposed Action would not change substantially under the action alternatives. The same construction and installation, O&M, and conceptual decommissioning activities would still occur, albeit at differing scales in some cases. Alternatives B-1, B-2, and D may result in slightly less, but not materially different, minor impacts on water quality due to a reduced number of WTGs that would need to be constructed and maintained. Alternatives C-1 and C-2 would have the same WTG number as the Proposed Action and, therefore, would have similar minor impacts on water quality. Alternative E would result in similar, but not materially different, minor impacts on water quality in relation to sediment disturbance and turbidity and onshore ground disturbance. While a larger spill could have moderate impacts on water quality, the likelihood of a spill this size is very low.

Cumulative Impacts of Alternatives B, C, D, and E. Incremental impacts contributed by the action alternatives to the cumulative impacts on water quality would range from undetectable to noticeable. Because the impacts of the Proposed Action would not change under the action alternatives, BOEM anticipates that the cumulative impacts of the action alternatives on water quality would be the same as described for the Proposed Action. Therefore, the cumulative impacts of the action alternatives would be **moderate**, primarily driven by increases in turbidity and sedimentation due to anchoring and cable emplacement, and alteration of water currents and increased sedimentation due to the presence of structures. BOEM has considered the possibility of a moderate impact resulting from accidental releases; this level of impact could occur if there was a large-volume, catastrophic release. While it is an impact that should be considered, it is unlikely to occur.

3.21.7 Proposed Mitigation Measures

No additional measures to mitigate impacts on water quality have been proposed for analysis.

Appendix H. Mitigation and Monitoring

This Final EIS assesses the potential biological, socioeconomic, physical, and cultural impacts that could result from the construction, O&M, and conceptual decommissioning of the Project proposed by Ocean Wind in its COP. The Project described in the COP and this Final EIS would be approximately 1,100 MW in scale and sited 15 miles (13 nm) southeast of Atlantic City, New Jersey within the area of Lease OCS-A 0498 (Lease Area). The Project is designed to serve demand for renewable energy in New Jersey.

As part of the Project, Ocean Wind has committed to implement APMs to avoid, reduce, mitigate, or monitor impacts on the resources discussed in Chapter 3 of the Final EIS. These APMs are described in Table H-1 and assessed as part of the Proposed Action. BOEM considers as part of the Proposed Action only those measures that Ocean Wind has committed to in the COP (Ocean Wind 2023), including measures in Volume III, Appendix AA, *Protected Species Mitigation and Monitoring Plan (PSMMP): Marine Mammals, Sea Turtles, and ESA-Listed Fish Species*, Appendix AB, *Avian and Bat Post-Construction Monitoring Framework*, and Appendix AE, *Fisheries Mitigation Efforts*. Table H-1 also includes mitigation measures that Ocean Wind has proposed in its *Post-Review Discovery Plan*. The *Memorandum of Agreement Among the Bureau of Ocean and Energy Management, the New Jersey State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Ocean Wind Offshore Wind Farm Project* is included as an attachment to Appendix N. The following documents are included as attachments to the Memorandum of Agreement: Attachment 4, *Historic Property Treatment Plan for the Ocean Wind 1 Farm Ancient Submerged Landform Features Subject to Adverse Effect Federal Waters on the Outer Continental Shelf*; Attachment 5, *Historic Properties Treatment Plan for the Ocean Wind 1 Offshore Wind Farm Project Historic Properties Subject to Adverse Effects Cape May and Atlantic Counties, New Jersey*; Attachment 6, *Post-Review Discovery Plan for Terrestrial Resources for the Ocean Wind Offshore Wind Farm for Lease Area OCS A-0498 Construction and Operations Plan*; and Attachment 7, *Post-Review Discovery Plan for Submerged Cultural Resources for the Ocean Wind Offshore Wind Farm for Lease Area OCS A-0498 Construction and Operations Plan.*

BOEM may select alternatives and require additional mitigation or monitoring measures to further protect and monitor these resources. These additional mitigation and monitoring measures are shown in Table H-2 and may result from reviews under several environmental statutes (ESA, MSA, and NHPA) as discussed in Appendix A of the Final EIS, or other sources. Please note that not all of these mitigation measures are within BOEM's statutory and regulatory authority and some may be required by other governmental entities. Table H-2 provides descriptions of these measures as well as measures arising from BOEM's own authorities. Other measures identified during development of this EIS are listed in Table H-3, and Table H-4 identifies measures that may be required by authorizations and permits issued to the Lessee.

If BOEM decides to approve the COP, the ROD will state which of the mitigation and monitoring measures identified by BOEM in Table H-2 and Table H-3 have been adopted, and if not, why they were not. The ROD will describe the specific terms and conditions of these measures for which compliance is required (40 CFR 1505.3). Ocean Wind would be required to certify compliance with these terms and conditions under 30 CFR 285.633(a). Furthermore, BOEM will periodically review the activities conducted under the approved COP, with the frequency and extent of the review based on the significance of any changes in available information and on onshore or offshore conditions affecting, or affected by, the activities conducted under the COP in accordance with 30 CFR 585.634(b).

Monitoring may be required to evaluate the effectiveness of mitigation measures or to identify if resources are responding as predicted to impacts from the Proposed Action. This monitoring would typically be developed in coordination among BOEM and agencies with jurisdiction over the resource to be monitored. The information generated by monitoring may be used to (1) modify how a mitigation measure identified in the COP or ROD is being implemented, (2) revise or develop new mitigation or monitoring measures for which compliance would be required under the Ocean Wind 1 COP in accordance with 30 CFR 585.634(b), (3) develop measures for future projects, or (4) contribute to regional efforts for better understanding of the impacts and benefits resulting from offshore wind energy projects in the Atlantic (e.g., a potential cumulative impact assessment tool). Unless specified as an APM, the proposed mitigation measures described below would not change the impact ratings on the affected resource, as described in Chapter 3 of the Final EIS, but would further reduce expected impacts or inform the development of additional mitigation measures if required.

Table H-1 Applicant-Proposed Measures

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
GEN-01	Site onshore export cable corridors and landfall within existing rights-of-way or previously disturbed/developed lands to the extent practicable.	Multiple	Measure incorporated into project design
GEN-02	Site onshore, cable landfall and offshore facilities to avoid known locations of sensitive habitat (such as known nesting beaches) or species during sensitive periods (such as nesting season); important marine habitat (such as high density, high value fishing grounds as determined by fishing revenues estimate [BOEM Geographical Information System (GIS) Data - see Section 2.3.4 of the Ocean Wind 1 COP]); and sensitive benthic habitat; to the extent practicable. Avoid hard-bottom habitats and seagrass communities, where practicable, and restore any damage to these communities.	Multiple	Measure incorporated into project design
GEN-03	Avoid areas that would require extensive seabed or onshore alterations to the extent practicable.	Multiple	Measure incorporated into project design
GEN-04	Bury onshore and offshore cables below the surface or seabed to the extent practicable and inspect offshore cable burial depth periodically during project operation, as described in the Project Description, to ensure that adequate coverage is maintained to avoid interference with fishing gear/activity.	Multiple	Measure incorporated into project design
GEN-05	Use existing port and onshore operations and maintenance (office, warehouse, and workshop) facilities to the extent practicable and minimize impacts to seagrass by restricting vessel traffic to established traffic routes where these resources are present.	Multiple	Measure incorporated into project design
GEN-06	Develop and implement a site-specific monitoring program to ensure that environmental conditions are monitored during construction, operation, and decommissioning phases, designed to ensure environmental conditions are monitored and reasonable actions are taken to avoid and/or minimize seabed disturbance and sediment dispersion, consistent with permit conditions. The monitoring plan will be developed during the permitting process, in consultation with resource agencies.	Multiple	Measure incorporated into project design
GEN-07	Implement aircraft detection lighting system (ADLS) on wind turbine generators (WTGs). Comply with Federal Aviation Administration (FAA), BOEM, and U.S. Coast Guard (USCG) lighting, marking and signage requirements to aid navigation per USCG navigation and inspection circular (NVIC) 02-07 (USCG 2007) and comply with any other applicable USCG requirements while minimizing the impacts through appropriate application including directional aviation lights that minimize visibility from shore. Information will be provided to allow above water obstructions and underwater cables to be marked in sea charts, aeronautical charts, and nautical handbooks.	Multiple	Measure incorporated into project design
GEN-08	To the extent practicable, use appropriate installation technology designed to minimize disturbance to the seabed and sensitive habitat (such as beaches and dunes, wetlands and associated buffers, streams, hard-bottom habitats, seagrass beds, and the near-shore zone); avoid anchoring on sensitive habitat; and implement turbidity reduction measures to minimize impacts to sensitive habitat from construction activities.	Multiple	Measure incorporated into project design
GEN-09	During pile-driving activities, use ramp up procedures as agreed with National Marine Fisheries Service (NMFS) for activities covered by Incidental Take Authorizations, allowing mobile resources to leave the area before full-intensity pile-driving begins.	Multiple	Measure incorporated into project design
GEN-10	Prepare waste management plans and hazardous materials plans as appropriate for the Project.	Multiple	Measure incorporated into project design
GEN-11	Establish and implement erosion and sedimentation control measures in a Stormwater Pollution Prevention Plan (SWPPP, authorized by the State), and Spill Prevention, Control, and Countermeasures (SPCC) Plan to minimize impacts to water quality (signed/sealed by a New Jersey Professional Engineer and prepared in accordance with applicable regulations such as NJDEP Site Remediation Reform Act, Linear Construction Technical Guidance, and Spill Compensation and Control Act). Development and implementation of an Oil Spill Response Plan (OSRP, part of the SPCC plan) and SPCC plans for vessels.	Multiple	**SWPPP**, NJDEP **SPCC**, BSEE, USCG, USEPA, and NJDEP
GEN-12	Where HDD trenchless technology methods are used, develop, and implement an Inadvertent Return Plan that includes measures to prevent inadvertent returns of drilling fluid to the extent practicable and measures to be taken in the event of an inadvertent return.	Multiple	**Inadvertent Return Plan**, USACE and NJDEP

[1] BOEM and BSEE are in the process of transferring enforcement authorities from BOEM to BSEE.

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
GEN-13	Restore disturbance areas in the Onshore Project Area to preexisting contours (maintaining natural surface drainage patterns) and allow vegetation to become reestablished once construction activities are completed, to the extent practicable.	Multiple	USACE, NJDEP and/or local authorities
GEN-14	Develop and implement a communication plan to inform the USCG, Department of Defense (DOD) headquarters, harbor masters, public, local businesses, commercial and recreational fishers, among others of construction and maintenance activities and vessel movements, as coordinated by the Marine Coordination Center and Marine Affairs.	Multiple	**Communication Plan**
GEN-15	Develop and implement an Onshore Maintenance of Traffic Plan to minimize vehicular traffic impacts during construction. Ocean Wind would designate and utilize onshore construction vehicle traffic routes, construction parking areas, and carpool/bus plans to minimize potential impacts.	Multiple	**Onshore Maintenance of Traffic Plan,** NJDOT and/or local authorities
GEN-16	Prior to the start of operations, Ocean Wind will hold training to establish responsibilities of each involved party, define the chains of command, discuss communication procedures, provide an overview of monitoring procedures, and review operational procedures. This training will include all relevant personnel, crew members and protected species observers (PSO). New personnel must be trained as they join the work in progress. Vessel operators, crew members and protected species observers shall be required to undergo training on applicable vessel guidelines and the standard operating conditions. Ocean Wind will make a copy of the standard operating conditions available to each project-related vessel operator.	Multiple	BOEM and BSEE
GEN-17	Implement Project and site-specific safety plans (Safety Management System, Appendix B).	Multiple	Required measure per 30 CFR 285.811
GEN-18	No permanent exclusion zones during operation	Multiple	BOEM and BSEE
GEO-01	Reduce scouring action by ocean currents around foundations and to seabed topography by taking reasonable measures and employing periodic routine inspections to ensure structural integrity.	Multiple	Measure incorporated into project design.
GEO-02	Take reasonable actions (use BMPs) to minimize seabed disturbance and sediment dispersion during cable installation and construction of project facilities.	Multiple	Measure incorporated into project design.
GEO-03	Conduct periodic and routine inspections to determine if non-routine maintenance is required.	Multiple	Measure incorporated into project design.
GEO-04	In contaminated onshore areas, comply with State regulations requiring the hiring of a Licensed Site Remediation Professional (LSRP) to oversee the linear construction project and adherence to a Materials Management Plan (MMP). The MMP prepared for construction can also be followed as a best management practice when maintenance requires intrusive activities.	Multiple	**[Onshore] Materials Management Plan,** NJDEP
WQ-01	Implement turbidity reduction measures to minimize impacts to hardbottom habitats, including seagrass communities, from construction activities, to the extent practicable.	Water Quality	USACE and NJDEP
WQ-02	All vessels will be certified by the Project to conform to vessel operations and maintenance protocols designed to minimize the risk of fuel spills and leaks.	Water Quality	Measure incorporated into project design.
AQ-01	Use low sulfur fuels to the extent practicable (15 parts per million [ppm] per 40 Code of Federal Regulations [CFR] §80.510(c) as applicable).	Air Quality	Measure incorporated into project design.
AQ-02	Select engines designed to reduce air pollution to the extent practicable (such as U.S. Environmental Protection Agency [USEPA] Tier 3 or 4 certified).	Air Quality	Measure incorporated into project design.

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
AQ-03	Limit engine idling time.	Air Quality	Measure incorporated into project design.
AQ-04	Comply with international standards regarding air emissions from marine vessels.	Air Quality	Measure incorporated into project design.
AQ-05	Implement dust control plan.	Air Quality	Measure incorporated into project design.
AQ-06	Minimize fugitive emissions of sulfur hexafluoride (SF_6) contained in turbine and substation switchgear in the following ways. Follow manufacturer recommendations for service and repair of the affected breakers and switches. Conduct visual inspections of the switchgear and monitoring equipment according to manufacturer recommendations. Create alarms based on the pressure readings in the breakers/switches, so leaks can be detected when substantial SF_6 leakage occurs. Upon a detectable pressure drop that is >10% of the original pressure (accounting for ambient air conditions), perform maintenance to fix seals as soon as feasible. If an event requires removal of SF_6, the affected major component(s) will be replaced with new component(s). Keep a log of all detected leaks and maintenance procedures potentially affecting SF_6 emissions from circuit breakers/switches. Capture and recycle SF_6 removed from breakers and switches during maintenance.	Air Quality	Measure incorporated into project design.
TCHF-01	Coordinate with the New Jersey Department of Environmental Protection (NJDEP) and United States Fish and Wildlife Service (USFWS) to identify unique or protected habitat or known habitat for threatened or endangered and candidate species and avoid these areas to the extent practicable.	Coastal Habitat and Fauna	Measure incorporated into project design.
TCHF-02	Conduct maintenance and repair activities in a manner to avoid or minimize impacts to sensitive species and habitat such as beaches, dunes, and the near-shore zone.	Coastal Habitat and Fauna	BOEM, BSEE, USACE, USFWS, and NJDEP
TCHF-03	Wetland mitigation options are being coordinated with state and federal agencies and may include a mix of banking and onsite restoration, depending on agency preference and availability.	Wetlands	USACE and NJDEP
BIRD-01	Evaluate avian use by conducting pre-construction surveys for raptor nests, wading bird colonies, seabird nests, and shorebird nests during nesting periods. (Focus being listed species or species identified of special concern by the Federal or State government.)	Birds	Measure incorporated into project design.
BIRD-02	An avian post-construction monitoring framework will be developed and coordinated with NJDEP and USFWS and implemented as required	Birds	**Avian and Bat Post-construction Monitoring Framework,** BOEM, BSEE, USFWS and NJDEP
BIRD-03	Cut trees and vegetation, where possible, during the winter months when most migratory birds are not present at the site.	Birds	USFWS and NJDEP
BIRD-04	Use lighting technology that minimizes impacts on avian and bat species to the extent practicable.	Birds	Measure incorporated into project design.
BIRD-06	WTG air gaps (minimum blade tip elevation to the sea surface) to minimize collision risk to marine birds which fly close to ocean surface.	Birds	Measure incorporated into project design.
BIRD-07	Ocean Wind has sited Wind Farm Area facilities in the eastern portion of the original Lease Area, outside the migratory pathway, to reduce exposure to birds.	Birds	Measure incorporated into project design.

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
BAT-01	Onshore, the Project will avoid potential impacts by conducting tree clearing during the winter months, to the extent practicable.	Bats	USFWS and NJDEP
BAT-02	If tree clearing is required in areas with trees suitable for bat roosting during the period when northern long-eared bats may be present, develop avoidance and minimization measures in coordination with USFWS and NJDEP and conduct pre-construction habitat surveys.	Bats	USFWS and NJDEP
BAT-03	A bat post-construction monitoring framework will be developed and coordinated with NJDEP and USFWS and implemented as required.	Bats	**Avian and Bat Post-construction Monitoring Framework,** BOEM, BSEE, USFWS, and NJDEP
BENTH-01	Ocean Wind is conducting appropriate pre-siting surveys to identify and characterize potentially sensitive seabed habitats and topographic features.	Benthic Resources	Measure incorporated into project design.
BENTH-02	Use standard underwater cables which have electrical shielding to control the intensity of electromagnetic fields (EMF). EMF will be further refined as part of the design or cable burial risk assessment.	Benthic Resources	Measure incorporated into project design.
BENTH-03	Conduct a submerged aquatic vegetation (SAV) survey of the proposed inshore export cable route.	Benthic Resources	Measure incorporated into project design.
FISH-01	Evaluate geotechnical and geophysical survey results to identify sensitive habitats (e.g., shellfish and SAV beds) and avoid these areas during construction, to the extent practicable.	Fish and EFH	BOEM, BSEE, NJDEP, and USACE
FISH-02	Ocean Wind will coordinate with NJDEP, NMFS and USACE regarding time of year restrictions for winter flounder and river herring, as well as summer flounder habitat areas of particular concern (HAPC).	Fish and EFH	Measure incorporated into project design.
MMST-01	Vessels related to project planning, construction, and operation shall travel at speeds in accordance with National Oceanic and Atmospheric Administration (NOAA) requirements or the agreed to adaptive management plan per to Project PSMMP when assemblages of cetaceans are observed. Vessels will also maintain a reasonable distance from whales, small cetaceans, and sea turtles, as determined through site-specific consultations (specifics to be added based on consultations).	Marine Mammals, Sea Turtles	BOEM, BSEE, EPA, NMFS, and USACE
MMST-02	Project-related vessels will be required to adhere to NMFS Regional Viewing Guidelines for vessel strike avoidance measures during construction and operation to minimize the risk of vessel collision with marine mammals and sea turtles. Operators shall be required to undergo training on applicable vessel guidelines.	Marine Mammals, Sea Turtles	BOEM, BSEE, EPA, NMFS, and USACE
MMST-03	Vessel operators will monitor NMFS North Atlantic right whale (NARW) reporting systems (e.g., the Early Warning System, Sighting Advisory System) [daily] for the presence of NARW during planning, construction, and operations within or adjacent to Seasonal Management Areas and/or Dynamic Management Areas.	Marine Mammals, Sea Turtles	BOEM, BSEE, EPA, NMFS, and USACE
MMST-04	Ocean Wind will post a qualified observer as agreed to during the NMFS incidental take authorization process, on site during construction activities to avoid and minimize impacts to marine species and habitats in the Project Area.	Marine Mammals, Sea Turtles	BOEM, BSEE, EPA, NMFS, and USACE
MMST-05	Obtain necessary permits to address potential impacts on marine mammals from underwater noise, and establish appropriate and practicable mitigation and monitoring measures in coordination with regulatory agencies.	Marine Mammals, Sea Turtles	BOEM, BSEE, EPA, NMFS, and USACE
MMST-06	Develop and implement a PSMMP.	Marine Mammals, Sea Turtles	**PSMMP,** BOEM, BSEE, EPA, NMFS, and USACE

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
SOC-01	Comply with NJDEP noise regulations (New Jersey Administrative Code [N.J.A.C.] 7:29), which limit noise from industrial facilities received at residential property lines to 50 decibels during nighttime (10:00 p.m. to 7:00 a.m.) and 65 decibels during daytime as well as specific octave band noise limits, and comply with any local noise regulations, to the extent practicable, to minimize impacts on nearby communities.	Demographics, Employment, and Economics, Environmental Justice	NJDEP and/or local authorities
CUL-01	Develop and implement a Post-Review Discovery Plan.	Cultural Resources	**Post-review Discovery Plan,** BOEM, BSEE, and NJDEP
CUL-02	Use the results of geotechnical and geophysical surveys to identify potential cultural resources. Any cultural resources found will be avoided to the extent practicable. Where avoidance is not practicable, coordinate with relevant agencies and affected tribes to determine minimization and mitigation as necessary.	Cultural Resources	Measure incorporated into project design
CUL-03	Conduct background research and consult with the State Historic Preservation Office (SHPO) to determine the need for cultural resource surveys onshore. Any cultural resources found will be avoided to the extent practicable. Where avoidance is not practicable, coordinate with SHPO and affected tribes to determine minimization and mitigation as necessary.	Cultural Resources	Measure incorporated into project design
CUL-04	The Project has been designed to minimize visual impacts to historic and cultural properties to the extent feasible. The Project's layout was adjusted to align turbines at the eastern portion of the lease area, so that closest turbines are at least 15 miles from shore. Visibility of the turbine array from all identified properties within the Preliminary Area of Potential Effect would be minimized and mitigated further by measures adopted in this table including ADLS and markings (GEN-07), and as in COP Appendix F-4.	Cultural Resources	Measure incorporated into project design.
CUL-05	Mitigation in the form of documentation, planning, or educational materials will be coordinated with stakeholders, as in COP Appendix F-4.	Cultural Resources	BOEM, BSEE, EPA, USACE
CUL-06	Develop an anchoring plan for vessels prior to construction to identify avoidance/no anchorage areas.	Cultural Resources	BOEM, BSEE, EPA, USACE
REC-01	Develop a construction schedule to minimize activities in the onshore export cable route during the peak summer recreation and tourism season, where practicable.	Recreation and Tourism	NJDEP
REC-02	Coordinate with local municipalities to minimize impacts to popular events in the area during construction, to the extent practicable.	Recreation and Tourism	NJDEP and local municipalities
CFHFISH-01	Work cooperatively with commercial/recreational fishing entities and interests to ensure that the construction and operation of the Project will minimize potential conflicts with commercial and recreational fishing interests. Review planned activities with potentially affected fishing organizations and port authorities to prevent unreasonable fishing gear conflicts.	Commercial Fisheries and For-Hire Recreational Fishing	Measure incorporated into project design.
CFHFISH-02	Develop and implement a Fisheries Communication and Outreach Plan. (COP Appendix O) The plan includes the appointment of a dedicated fisheries liaison as well as fisheries representatives who will serve as conduits for providing information to, and gathering feedback from, the fishing industry, as well as Project-specific details on fisheries engagements.	Commercial Fisheries and For-Hire Recreational Fishing	Measure incorporated into project design.
CFHFISH-03	Implement Ørsted's corporate policy and procedure to compensate commercial/recreational fishing entities for gear loss as a result of Project activities (Appendix AE).	Commercial Fisheries and For-Hire Recreational Fishing	Measure incorporated into project design.

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
CFHFISH-04	Ocean Wind will develop a Navigational Safety Fund by providing eligible commercial, charter, and for-hire fishing vessels operating in and near the Wind Farm Area with reimbursement for new radar equipment and/or training courses (Appendix AE).	Commercial Fisheries and For-Hire Recreational Fishing	Measure incorporated into project design.
LU-01	Develop crossing and proximity agreements with utility owners prior to utility crossings. (Crossing agreements in U.S. waters are supported by the International Cable Protection Committee (ICPC), which provides a framework for establishing cable crossing agreements.)	Land Use and Coastal Infrastructure	Measure incorporated into project design.
NAV-01	Ocean Wind has engaged and will continue to engage with FAA and DOD with regards to potential effects to aviation and radar.	Navigation and Vessel Traffic	Measure incorporated into project design.
NAV-02	Site facilities to avoid unreasonable interference with major ports and USCG-designated Traffic Separation Schemes.	Navigation and Vessel Traffic	Measure incorporated into project design.
NAV-03	Select structures within the proposed Wind Farm Area will be equipped with strategically located Automatic Identification System (AIS) transponders.	Navigation and Vessel Traffic	BOEM, BSEE, and USCG
NAV-04	WTGs will be arranged in equally spaced rows on a northwest to southeast orientation to aid the safe navigation of vessels operating within the Wind Farm Area.	Navigation and Vessel Traffic	Measure incorporated into project design.
OUSE-01	Evaluate geotechnical and geophysical survey results to identify existing conditions, existing infrastructure, and other marine uses. Areas of other marine uses will be avoided to the extent practicable, and Ocean Wind will coordinate with other users where avoidance is not practicable.	Other Uses	Measure incorporated into project design.
VIS-01	Address key design elements, including visual uniformity, use of tubular towers, and proportion and color of turbines.	Scenic and Visual Resources	Measure incorporated into project design.
VIS-02	Ocean Wind has used appropriate viewshed mapping, photographic and virtual simulations, computer simulation, and field inventory techniques to determine the visibility of the proposed project. Simulations illustrate sensitive and scenic viewpoints.	Scenic and Visual Resources	Measure incorporated into project design.
VIS-03	Seek public input in evaluating the visual site design elements of proposed wind energy facilities.	Scenic and Visual Resources	Measure incorporated into project design.
VIS-04	Security lighting for onshore facilities will be downshielded to mitigate light pollution.	Scenic and Visual Resources	NJDEP and local municipalities
VIS-05	Where substation components may be visible and highly contrasting with their surroundings, the Project would provide supplemental plantings and other landscape elements to screen the substation from public view.	Scenic and Visual Resources	Measure incorporated into project design.
VIS-06	Consideration will be given to visually adapt the buildings and other substation components into their physical context. The forms, lines, colors, and textures of these components will be influenced by their immediate surroundings and selected to minimize visual contrast and potential visual impact. Non-reflective paint will be used on all Project components.	Scenic and Visual Resources	Measure incorporated into project design.
Applicant-Proposed Measures in the MMPA LOA Application, dated February 2022, the PSMMP (COP Appendix AA; Ocean Wind 2023), and the LOA Update Memo (August 2022)			
PSO/Passive acoustic monitoring (PAM) training and requirements	• PSOs must be provided by a third-party provider. • PSO and PAM operators will have completed PSO training, and have team leads with experience in the northwestern Atlantic Ocean on similar projects; remaining PSOs and PAM operators will have previous experience on similar projects and the ability to work with the relevant software; PSOs and PAM operators will complete a Permits and Environmental Compliance (PECP) training and a two-day training and refresher session with the PSO provider and the Project compliance representatives before the anticipated start of Project activities.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
	• No individual PSO will work more than 4 consecutive hours without a 2-hour break, or longer than 12 hours during a 24-hour period. • Each PSO will be provided one 8-hour break per 24-hour period to sleep. • Observations will be conducted from the best available vantage point(s) on the vessels (stable, elevated platform from which PSOs have an unobstructed 360-degree view of the water). • PSOs will systematically scan with the naked eye and a 7 x 50 reticle binocular, supplemented with night-vision equipment when needed. • When monitoring at night or in low visibility conditions, PSOs will monitor for marine mammals and other protected species using night-vision goggles with thermal clip-ons, a hand-held spotlight, and/or a mounted thermal camera system. • Activities with larger monitoring zones will use 25 x 150 mm "big eye" binoculars. • Vessel personnel will be instructed to report any sightings to the PSO team as soon as they are able and it is safe to do so. • Members of the monitoring team will consult with NMFS' North Atlantic right whale reporting system for the presence of North Atlantic right whales in the Project area. • Any NARW sightings will be reported as soon as possible, and no later than within 24 hours, to the NMFS Right Whale Sighting Advisory System (RWSAS) hotline.		
Vessel Strike Avoidance Policy – General Measures	• The Project will implement a vessel strike avoidance policy for all vessels under contract to Ørsted to reduce the risk of vessel strikes, and the likelihood of death and/or serious injury to marine mammals that may result from collisions with vessels. • Vessel operators and crews shall receive protected species identification training. This training will cover sightings of marine mammals and other protected species known to occur or which have the potential to occur in the Project area. It will include training on making observations in both good weather conditions (i.e., clear visibility, low wind, low sea state) and bad weather conditions (i.e., fog, high winds, high sea states, in glare). Training will include not only identification skills but information and resources available regarding applicable federal laws and regulations for protected species. It will also cover any Critical Habitat requirements, migratory routes, seasonal variations, behavior identification, etc. • All attempts shall be made to remain parallel to the animal's course when a traveling marine mammal is sighted in proximity to the vessel in transit. All attempts shall be made to reduce any abrupt changes in vessel direction until the marine mammal has moved beyond its associated separation distance (as described above). • If an animal or group of animals is sighted in the vessel's path or in proximity to it, or if the animals are behaving in an unpredictable manner, all attempts shall be made to divert away from the animals or, if unable due to restricted movements, reduce speed and shift gears into neutral until the animal(s) has moved beyond the associated separation distance (except for voluntary bow riding dolphin species). • All vessels will comply with NMFS regulations and speed restrictions and state regulations as applicable for NARW (see vessel speed restriction Standard Plan and Adaptive Plan outlines below). • All vessels will comply with the approved adaptive speed plan which will include additional measures including travel within established NARW Slow zones • Ocean Wind will submit a final NARW Vessel Strike Avoidance Plan at least 90 days prior to commencement of vessel use that details the Adaptive Plan and specific monitoring equipment to be used. The plan will, at minimum, describe how PAM, in combination with visual observations, will be conducted to ensure the transit corridor is clear of NARWs. The plan will also provide details on the vessel-based observer protocols on transiting vessels. • All attempts shall be made to remain parallel to the animal's course when a traveling marine mammal is sighted in proximity to the vessel in transit. All attempts shall be made to reduce any abrupt changes in vessel direction until the marine mammal has moved beyond its associated separation distance (as described above). • If an animal or group of animals is sighted in the vessel's path or in proximity to it, or if the animals are behaving in an unpredictable manner, all attempts shall be made to divert away from the animals or, if unable due to restricted movements, reduce speed and shift gears into neutral until the animal(s) has moved beyond the associated separation distance (except for voluntary bow riding dolphin species).	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
Vessel separation distances	Vessels will maintain, to the extent practicable, separation distances of: • >500 m distance from any sighted North Atlantic right whale or unidentified large marine mammals; • >100 m from all other large whales; • >50 m for dolphins, porpoises, seals, and sea turtles.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
Vessel speed restrictions – Standard Plan	• All vessels will comply with NMFS regulations and speed restrictions and state regulations as applicable for NARW. • All vessels 65 ft (20 m) or longer subject to the jurisdiction of the U.S. will comply with a 10-knot speed restriction when entering or departing a port or place subject to U.S. jurisdiction, and in any SMA during NARW migratory and calving periods from November 1 to April 30 (Mid-Atlantic SMAs specific to the Project area: ports of New York/New Jersey and the entrance to the Delaware Bay in the vicinity of the Project area); also, in the following feeding areas as follows: from January 1 to May 15 in Cape Cod Bay; from March 1 to April 30 off Race Point; and from April 1 to July 31 in the Great South Channel. • **Between November 1 and April 30:** Vessels of all sizes will operate port to port (from ports in NJ, NY, MD, DE, and VA) at 10 knots or less. Vessels transiting from other ports outside those described will operate at 10 knots or less when within any active SMA or within the Offshore Wind Area including the lease area and export cable route. • **Year Round**: Vessels of all sizes will operate at 10 knots or less in any DMAs. • **Between May 1 and October 31:** All underway vessels (transiting or surveying) operating at >10 knots will have a dedicated visual observer (or NMFS approved automated visual detection system) on duty at all times to monitor for marine mammals within a 180° direction of the forward path of the vessel (90° port to 90° starboard). Visual observers must be equipped with alternative monitoring technology for periods of low visibility (e.g., darkness, rain, fog). The dedicated visual observer must receive prior training on protected species detection and identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. Visual observers may be third-party observers (i.e., NMFS-approved PSOs) or crew members. • A complete vessel speed plan for sea turtles and ESA-listed fish will be included in the Protected Species Mitigation and Monitoring Plan (PSMMP).	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS

Vessel speed restrictions – Adaptive Plan	• The Standard Plan outlined above will be adhered to except in cases where crew safety is at risk, and/or labor restrictions, vessel availability, costs to the project, or other unforeseen circumstance make these measures impracticable. To address these situations, an Adaptive Plan will be developed in consultation with NMFS to allow modification of speed restrictions for vessels. Should Ocean Wind choose not to implement this Adaptive Plan, or a component of the Adaptive Plan is offline (e.g., equipment technical issues), Ocean Wind will default to the Standard Plan (described above).
	• The Adaptive Plan will not apply to vessel subject to speed reductions in SMAs as designated by NOAA's Vessel Strike Reduction Rule.
	• **Year Round:** A semi-permanent acoustic network comprising near real-time bottom mounted and/or mobile acoustic monitoring platforms will be installed such that confirmed NARW detections are regularly transmitted to a central information portal and disseminated through the situational awareness network.
	  ○ The transit corridor and Offshore Wind Area will be divided into detection action zones.
	  ○ Localized detections of NARWs in an action zone would trigger a slow-down to 10 knots or less in the respective zone for the following 12 h. Each subsequent detection would trigger a 12-h reset. A zone slow-down expires when there has been no further visual or acoustic detection in the past 12 h within the triggered zone.
	  ○ The detection action zones size will be defined based on efficacy of PAM equipment deployed and subject to NMFS approval as part of the NARW Vessel Strike Avoidance Plan.
	• **Year Round**: All underway vessels (transiting or surveying) operating >10 knots will have a dedicated visual observer (or NMFS approved automated visual detection system) on duty at all times to monitor for marine mammals within a 180° direction of the forward path of the vessel (90° port to 90° starboard). Visual observers must be equipped with alternative monitoring technology for periods of low visibility (e.g., darkness, rain, fog). The dedicated visual observer must receive prior training on protected species detection and identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. Visual observers may be third-party observers (i.e., NMFS-approved PSOs) or crew members.
	• **Year-round:** any DMA is established that overlaps with an area where a project vessel would operate, that vessel, regardless of size when entering the DMA, may transit that area at a speed of >10 knots. Any active action zones within the DMA may trigger a slow down as described above.
	• If PAM and/or automated visual systems are offline, the Standard Plan measures will apply for the respective zone (where PAM is offline) or vessel (if automated visual systems are offline).
		Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS

Situational Awareness System/ Common Operating Picture	• Ocean Wind will establish a situational awareness network for marine mammal and sea turtle detections through the integration of sighting communication tools such as Mysticetus, Whale Alert, WhaleMap, etc. • Sighting information will be made available to all project vessels through the established network. • Ocean Wind's Marine Coordination Center will serve to coordinate and maintain a Common Operating Picture. • Systems within the Marine Coordination Center, along with field personnel, will: ○ monitor the NMFS North Atlantic right whale reporting systems daily;	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
	○ monitor the U.S. Coast Guard VHF Channel 16 throughout the day to receive notifications of any sighting; and ○ monitor any existing real-time acoustic networks.		
PSO/PAM data recording	• All data will be recorded using industry-standard software. • Data recorded will include information related to ongoing operations, observation methods and effort, visibility conditions, marine mammal detections, and any mitigation actions requested and enacted.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
Long-term Monitoring	• Pre-construction marine mammal surveys will provide a baseline set of data for comparison against the monitoring efforts during construction. • Post-construction marine mammal surveys will provide for an assessment of the potential long-term impacts of the Project. • Survey will involve a combination of visual and acoustic monitoring techniques.	Marine Mammals	BOEM, BSEE, and NMFS
Operational Monitoring	• Visual monitoring and PAM for marine mammals will occur during vessel transits to and from the Project area as described above under vessel speed restrictions (standard and adaptive plans).	Marine Mammals	BOEM, BSEE, and NMFS
Impact Pile Driving			
Impact pile-driving time-of-year restriction	• No pile installation will occur from 01 January to 30 April.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
Noise mitigation systems (NMS) during impact pile driving	• The Project will use a dual NMS-system for all impact piling events. The NMS will be a combination of two devices (e.g., bubble curtain, hydro-damper) to reduce noise propagation during monopile foundation pile driving. The Project is committed to achieving ranges associated with 10 dB of noise attenuation.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
PAM for impact pile driving	• 4-hour PAM operator rotations for 24-hour operation vessels. • There will be a PAM operator on duty conducting acoustic monitoring in coordination with the visual PSOs during all pre-start clearance periods, piling, and post-piling monitoring periods. • Passive acoustic monitoring will include and extend beyond the largest shutdown zone for low- and mid-frequency cetaceans. • The NARW pre-clearance zone will be monitored visually out to the extent of the low-frequency cetacean clearance/shutdown zone and acoustically out to 3,800 m in winter and 3,500 m in summer (see Table 1-5C).	Marine Mammals	BOEM, BSEE, and NMFS
Visual monitoring for impact pile driving	• Six to eight visual PSOs and PAM operators (may be located on shore) on the pile driving vessel and four to eight visual PSOs and PAM operators on any secondary marine mammal monitoring vessel. • Two visual PSOs will hold watch on each construction and secondary vessel during pre-start clearance, throughout pile driving, and 30 minutes after piling is completed. • PSOs will visually monitor the harbour porpoise, pinniped, and dolphin shutdown zones. • The secondary vessel will be positioned and circling at the outer limit of the low-frequency and mid-frequency cetacean shutdown zone (Table 1-5B). PSOs stationed on the secondary vessel will ensure the outer portion of the shutdown zones and prestart clearance zone are visually monitored.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
Daytime visual monitoring for impact pile driving (daytime visual monitoring is defined by the period between nautical twilight rise and set for the region)	• Visual PSOs should begin surveying the monitoring zone at least 60 minutes prior to the start of pile driving. • PSOs will monitor for 30 minutes after each piling event. • PSOs will monitor the shutdown zone with the naked eye and reticle binoculars while one PSO periodically scans outside the shutdown zone using the mounted big eye binoculars. • The secondary vessel will be positioned and circling at the outer limit of the low-frequency and mid-frequency cetacean shutdown zones (Table 1-5B). • Monitoring equipment planned for use during standard daytime and low-visibility and nighttime piling is presented in Table 1-5A.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS

<table>
<tr><th>Measure Number/Name</th><th>Table H-1. Description of Applicant-Proposed Measures</th><th>Resource Area Mitigated</th><th>BOEM's Identification of the Anticipated Enforcing Agency[1]</th></tr>
<tr><td></td><td>
Table 1-5A. Monitoring equipment planned for use during standard daytime and low-visibility and nighttime piling.
<table>
<tr><th rowspan="2">Item</th><th colspan="2"></th><th colspan="2"></th></tr>
<tr><th>Number on Construction Vessel</th><th>Number on Secondary Vessel</th><th>Number on Construction Vessel</th><th>Number on Secondary Vessel</th></tr>
<tr><td>Visual PSOs on watch</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>PAM operators on duty[1]</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Reticle binoculars</td><td>2</td><td>2</td><td>0</td><td>0</td></tr>
<tr><td>Mounted thermal/IR camera system[2]</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Mounted "big-eye" binocular</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>Monitoring station for real time PAM system[3]</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Hand-held or wearable NVDs</td><td>0</td><td>0</td><td>2</td><td>2</td></tr>
<tr><td>IR spotlights</td><td>0</td><td>0</td><td>2</td><td>2</td></tr>
<tr><td>Data collection software system</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>PSO-dedicated VHF radios</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Digital single-lens reflex camera equipped with 300-mm lens</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
</table>
[1] PAM operator may be stationed on the vessel or at an alternative monitoring location.
[2] The camera systems will be automated with detection alerts that will be checked by a PSO on duty; however, cameras will not be manned by a dedicated observer.
[3] The selected PAM system will transmit real time data to PAM monitoring stations on the vessels and/or a shore side monitoring station.
</td><td></td><td></td></tr>
<tr><td>Daytime periods of reduced visibility for impact pile driving</td><td>

If the monitoring zone is obscured, the two PSOs on watch will continue to monitor the shutdown zone using thermal camera systems, handheld night-vision devices (NVD) and mounted IR camera (as able).
All PSOs on duty will be in contact with the on-duty PAM operator who will monitor the PAM systems for acoustic detections of marine mammals that are vocalizing in the area.

</td><td>Marine Mammals, Sea Turtles</td><td>BOEM, BSEE, and NMFS</td></tr>
<tr><td>Nighttime visibility for construction and secondary vessels</td><td>

Pile driving during nighttime hours could potentially occur when a pile installation is started during daylight and, due to unforeseen circumstances, would need to be finished after dark. New piles could be initiated after dark to meet schedule requirements.
Visual PSOs will rotate in pairs: one observing with a handheld NVD and one monitoring the infrared (IR) thermal imaging camera system. There will also be a PAM operator on duty conducting acoustic monitoring in coordination with the visual PSOs.
The mounted thermal cameras may have automated detection systems or require manual monitoring by a PSO.
PSOs will focus their observation effort during nighttime watch periods within the shutdown zones and waters immediately adjacent to the vessel.
Deck lights will be extinguished or dimmed during night observations when using night-vision devices; however, if the deck lights must remain on for safety reasons, the PSO will attempt to use the NVD in areas away from potential interference by these lights. If a PSO is unable to monitor the visual clearance or shutdown zones with available NVDs. Piling will not commence or will be halted (as safe to do so).

</td><td>Marine Mammals, Sea Turtles</td><td>BOEM, BSEE, and NMFS</td></tr>
<tr><td>Acoustic monitoring during impact pile driving</td><td>

PAM should begin at least 30 minutes prior to the start of piling.
One PAM operator on duty during both daytime and nighttime/low visibility monitoring.
Since visual observations within the applicable shutdown zones can become impaired at night or during daylight hours due to fog, rain, or high sea states, visual monitoring with thermal and NVDs will be supplemented by PAM during these periods
PAM operator will monitor during all pre-start clearance periods, piling, and post-piling monitoring periods (daylight, reduced visibility, and nighttime monitoring).
Real-time PAM systems require at least one PAM operator to monitor each system by viewing data or data products that are streamed in real-time or near real-time to a computer workstation and monitor located on a Project vessel or onshore.
PSOs will acoustically monitor a zones outlined in Table 1.5-C for all marine mammals, as well as the NARW specific clearance zones.
It is expected there will be a PAM operator stationed on at least one of the dedicated monitoring vessels in addition to the PSOs or located remotely/onshore.
PAM operators will complete specialized training for operating PAM systems prior to the start of monitoring activities.
All on-duty PSOs will be in contact with the PAM operator on duty, who will monitor the PAM systems for acoustic detections of marine mammals that are vocalizing in the area.

</td><td>Marine Mammals</td><td>BOEM, BSEE, and NMFS</td></tr>
</table>

<table>
<tr><th>Measure Number/Name</th><th>Table H-1. Description of Applicant-Proposed Measures</th><th>Resource Area Mitigated</th><th>BOEM's Identification of the Anticipated Enforcing Agency[1]</th></tr>
<tr><td></td><td>The PAM operator will inform the Lead PSO on duty of animal detections approaching or within applicable ranges of interest to the pile-driving activity via the data collection software system (i.e., Mysticetus or similar system) who will be responsible for requesting the designated crewmember to implement the necessary mitigation procedures.
Acoustic monitoring during nighttime and low visibility conditions during the day will complement visual monitoring (e.g., PSOs and thermal cameras) and will cover an area of at least the PAM Clearance Zone presented in Table 1.5-C around each foundation.</td><td></td><td></td></tr>
<tr><td>Shutdown zones for impact pile driving</td><td>Shutdown zones and pre-clearance zones for Project impact pile driving activities are presented in Tables 1-5B and 1-5C for winter and summer seasons separately as sound speed profiles are faster during winter conditions and therefore have larger corresponding shutdown zones. The NARW pre-start clearance zones presented in Table 1-5C are equal to the Level B zone to avoid any unnecessary takes related to behavioral disturbance.
Noise mitigation systems (NMS; e.g., bubble curtains) are expected to reduce source levels below Level A (PTS) take zones (beyond the NMS minimum of 10 dB of Attenuation) for the following mid-frequency cetaceans: Atlantic white-sided dolphin, Atlantic spotted dolphin, short-beaked common dolphin, Risso's dolphin, bottlenose dolphin - coastal, bottlenose dolphin - offshore, long-finned pilot whale, and short-finned pilot whales therefore shut-down zones for those species are not required.
Table 1-5B. Mitigation and Monitoring Zones[1,2] during Impact Pile Driving for Summer and Winter (adapted from PSMMP dated February 2022) with 10 dB broadband sound attenuation
<table>
<tr><th rowspan="2">Species</th><th colspan="2">Summer (May through November)</th><th colspan="2">Winter (December only)</th></tr>
<tr><th>Pre-start Clearance Zone (m)[4]</th><th>Shutdown Zone (m)[5]</th><th>Pre-start Clearance Zone (m)[4]</th><th>Shutdown Zone (m)[5]</th></tr>
<tr><td>Low-frequency cetaceans (see Table 1-5C below for NARW)</td><td>1,650</td><td>1,650</td><td>2,490</td><td>2,490</td></tr>
<tr><td>Mid-Frequency Cetaceans (sperm whale only)</td><td>1,650</td><td>1,650</td><td>2,490</td><td>2,490</td></tr>
<tr><td>High-Frequency Cetaceans</td><td>880</td><td>880</td><td>1,430</td><td>1,430</td></tr>
<tr><td>Seals</td><td>80</td><td>80</td><td>240</td><td>240</td></tr>
<tr><td>Turtles</td><td colspan="4">500</td></tr>
</table>
1. The shutdown zones for large whales, porpoise, and seals are based upon the maximum Level A zone for each group.
[1] Zones are based upon the following modeling assumptions:
• 8/11-m (tapered) monopile with 10 dB broadband sound attenuation.
• Either one or two monopiles driven per day, and either two or three pin piles driven per day. When modeled injury (Level A) threshold distances differed among these scenarios, the largest for each species group was chosen for conservatism.
[2] Zone monitoring will be achieved through a combined effort of passive acoustic monitoring and visual observation (but not to monitor vessel separation distance).
[3] Zones are derived from modeling that considered animal movement and aversion parameters (see more details in Section 4.3.5)
[4] The pre-start clearance zones for large whales, porpoise, and seals are based upon the maximum Level A zone for each group.
[5] The shutdown zones for large whales, porpoise, and seals are based upon the maximum Level A zone for each group.
[6] No Level A exposures were calculated for blue whales resulting in no expected Level A exposure range; therefore, the exposure range for fin whales was used as a proxy due to similarities in species.
Table 1-5C. NARW Clearance and Real-time PAM Monitoring Zones[1] during Impact Piling in Summer and Winter (adapted from PSMMP dated February 2022)
<table>
<tr><th>Season</th><th>Minimum Visibility Zone[2]</th><th>PAM Clearance Zone (m)[3]</th><th>Visual Clearance Delay or Shutdown Zone (m)</th><th>PAM Clearance Delay or Shutdown Zone (m)</th></tr>
<tr><td>Summer</td><td>1,650</td><td>3,500</td><td>Any Distance</td><td>1,650</td></tr>
<tr><td>Winter</td><td>2,490</td><td>3,800</td><td>Any Distance</td><td>2,490</td></tr>
</table>
[1] Ocean Wind may request modification to zones based on results of sound field verification
[2] The minimum visibility zones for NARWs are based upon the maximum Level A zones for the whale group.
[3] The PAM pre-start clearance zone was set equal to the Level B zone to avoid any unnecessary take. </td><td>Marine Mammals, Sea Turtles</td><td>BOEM, BSEE, and NMFS</td></tr>
<tr><td>Pre-start clearance for impact pile driving</td><td>Piling may be initiated at any time within a 24-hour period.
Prior to the beginning of each pile driving event, PSOs and PAM operators will monitor for marine mammals and sea turtles for a minimum of 30 minutes and continue at all times during pile driving.</td><td>Marine Mammals, Sea Turtles</td><td>BOEM, BSEE, and NMFS</td></tr>
</table>

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
	• All shutdown zones will be confirmed to be free of marine mammals and sea turtles prior to initiating ramp-up and the low-frequency cetacean shutdown zone will be fully visible, and the NARW acoustic zone monitored for at least 30 minutes prior to commencing ramp-up. • If a marine mammal or sea turtle is observed entering or within the relevant shutdown zones prior to the initiation of pile driving activity, pile driving activity will be delayed and will not begin until either the marine mammal(s) or sea turtle(s) has voluntarily left the respective shutdown zones and been visually or acoustically confirmed beyond that shutdown zone, or when the additional time period has elapsed with no further sighting or acoustic detection (i.e., 15 minutes for dolphins, porpoises, and seals, 30 minutes for whales, 30 minutes for sea turtles). • A PSO will observe a behavioral monitoring zone of 1,200 m for all species of sea turtle, however the shutdown zone remains 500 m.		
Ramp-up (soft start) for impact pile driving	• Each monopile installation will begin with a minimum of 20-minute soft-start procedure. • Soft-start procedure will not begin until the shutdown zone has been cleared by the visual PSO or PAM operators. • If a marine mammal is detected within or about to enter the applicable shutdown zone, prior to or during the soft-start procedure, pile driving will be delayed until the animal has been observed exiting the shutdown zone or until an additional time period has elapsed with no further sighting (i.e., 15 minutes for dolphins, porpoises, and seals, 30 minutes for whales, and 60 minutes for sea turtles).	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
Shutdowns for impact pile driving	• If a marine mammal or sea turtle is detected entering or within the respective shutdown zones after pile driving has commenced, an immediate shutdown of pile driving will be implemented unless determined shutdown is not feasible due to an imminent risk of injury or loss of life to an individual (as described in the PSMMP dated February 2022). • If shutdown is called for but it is determined that shutdown is not feasible due to risk of injury or loss of life, there will be a reduction of hammer energy. • Following shutdown, pile driving will only be initiated once all shutdown zones are confirmed by PSOs to be clear of marine mammals and sea turtles for the minimum species-specific time periods. • The shutdown zone will be continually monitored by PSOs and PAM operators during any pauses in pile driving. • If a marine mammal or sea turtle is sighted within the shutdown zones during a pause in piling, piling will be delayed until the animal(s) has moved outside the shutdown zone and no marine mammals are sighted for a period of 30 minutes or sea turtles for 30 minutes.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
Post-impact piling monitoring	• PSOs will continue to survey the shutdown zones throughout the duration of pile installation and for a minimum of 30 minutes after piling has been completed.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
Sound measurements for impact pile driving	• Received sound measurements will be collected during driving of the first three monopiles installed over the course of the Project using an NMS. • The goals of the of field verification measurements using an NMS include verification of modeled ranges; and providing sound measurements of impact pile driving using International Organization for Standardization (ISO)-standard methodology to build data that are comparable among projects. • Based on the sound field measurement results the Project may request a modification of the clearance and/or Shutdown zones.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
Impact Pile Driving Reporting	• All data recording will be conducted using Mysticetus or similar software. • Operations, monitoring conditions, observation effort, all marine mammal detections, and any mitigation actions will be recorded. • Members of the monitoring team must consult NMFS' NARW reporting systems for the presence of NARWs in the Project area. • DMAs will be reported across all Project vessels. • Additional details regarding reporting are provided below under "Reporting."		
Vibratory Pile Driving			

Visual monitoring for vibratory pile driving	• All observations will take place from one of the construction vessel stationed at or near the vibratory piling location.
	• Two PSOs on duty on the construction vessel.
	• PSOs will continue to survey the shutdown zone using visual protocols throughout the installation of each cofferdam sheet pile and for a minimum of 30 minutes after piling has been completed.
	• Monitoring Equipment shall include:
	  ○ Two sets of 7 x 50 reticle binoculars
	  ○ Two hand-held or wearable NVDs
		Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS

<table>
<tr><th>Measure Number/Name</th><th>Table H-1. Description of Applicant-Proposed Measures</th><th>Resource Area Mitigated</th><th>BOEM's Identification of the Anticipated Enforcing Agency[1]</th></tr>
<tr><td></td><td>o Two IR spotlights
o One data collection software system
o Two PSO-dedicated VHF radios
o One digital single-lens reflex camera equipped with 300-mm lens
o One Mounted thermal/IR camera system
o One Mounted "big-eye" binocular</td><td></td><td></td></tr>
<tr><td>Daytime visual monitoring for vibratory pile driving</td><td>• Two PSOs will concurrently maintain watch from the construction or support vessel during the pre-start clearance period, throughout vibratory pile driving, and 30 minutes after piling is completed.
• Two PSOs will conduct observations concurrently.
• One observer will monitor the shutdown zones with the naked eye and reticle binoculars; one PSO will monitor in the same way but will periodically scan outside the shutdown zones.</td><td>Marine Mammals, Sea Turtles</td><td>BOEM, BSEE, and NMFS</td></tr>
<tr><td>Daytime visual monitoring during periods of low visibility for vibratory pile driving</td><td>• One PSO will monitor the shutdown zone with the mounted infrared camera while the other maintains visual watch with the naked eye/binoculars.</td><td>Marine Mammals, Sea Turtles</td><td>BOEM, BSEE, and NMFS</td></tr>
<tr><td>Nighttime visual monitoring for vibratory pile driving</td><td>• No PAM operations will be utilized due to the likelihood of masking effects of the vibratory sheet pile driving activities which will result in ineffective acoustic monitoring opportunities.</td><td>Marine Mammals, Sea Turtles</td><td>BOEM, BSEE, and NMFS</td></tr>
<tr><td>Shutdown zones for vibratory pile driving</td><td>• Shutdown zones and pre-clearance zones for Project vibratory pile driving activities are presented in Table 1-5D.
Table 1-5D. Mitigation and Monitoring Zones during Project Vibratory Sheet Pile Driving (adapted from PSMMP dated February 2022)
<table><tr><th>Species</th><th>Pre-start Clearance Zone[1] (m)</th><th>Shutdown Zone[2] (m)</th></tr><tr><td>Low-Frequency Cetaceans including NARW and Sperm whales</td><td>150</td><td>100</td></tr><tr><td>Medium-Frequency Cetaceans</td><td>150</td><td>50</td></tr><tr><td>High-Frequency Cetaceans</td><td>150</td><td>150</td></tr><tr><td>Pinnipeds in-water</td><td>150</td><td>60</td></tr><tr><td>Turtles</td><td>500</td><td>500</td></tr></table>Notes: Zones are based on modeling with no animal movement or aversions applied.
[1] The pre-start clearance zones for large whales, porpoise, and seals are based upon the maximum Level A zone (128.2 m) and rounded up for PSO clarity.
[2] The shutdown zones for low-frequency cetaceans (including NARW) and high-frequency cetaceans are based upon the maximum Level A zone for each group and rounded up for PSO clarity. Shutdown zones for mid-frequency cetaceans (e.g., other dolphins and pilot whales) were set using precautionary distances.</td><td>Marine Mammals, Sea Turtles</td><td></td></tr>
<tr><td>Pre-start clearance for vibratory pile driving</td><td>• PSOs will monitor the shutdown zone for 30 minutes prior to the start of vibratory pile driving.
• If a marine mammal or sea turtle is observed entering or within the respective shutdown zones, piling cannot commence until the animal(s) has exited the shutdown zone or time has elapsed since the last sighting (30 minutes for large whales (low-frequency cetaceans and sperm whales), 15 minutes for dolphins (mid-frequency cetaceans), porpoises (high-frequency cetaceans), and pinnipeds, 60 minutes for sea turtles).
• A PSO will observe a behavioral monitoring zone of 1,200 m for all species of sea turtle, however the shutdown zone remains 500 m.</td><td>Marine Mammals, Sea Turtles</td><td>BOEM, BSEE, and NMFS</td></tr>
<tr><td>Ramp-up (soft start) for vibratory pile driving</td><td>• Ramp-up will be initiated if the shutdown zone cannot be adequately monitored (i.e., obscured by fog, inclement weather, poor lighting conditions) for a 30-minute period.</td><td>Marine Mammals, Sea Turtles</td><td>BOEM, BSEE, and NMFS</td></tr>
<tr><td>Shutdowns for vibratory pile driving</td><td>• If a marine mammal or sea turtle is observed entering or within the respective shutdown zones after sheet pile installation has commenced, a shutdown will be implemented as long as health and safety is not compromised.
• The shutdown zone must be continually monitored by PSOs during any pauses in vibratory pile driving, activities will be delayed until the animal(s) has moved outside the shutdown zone and no marine mammals are sighted for a period of 30 minutes for whales, 15 minutes for dolphins, porpoises and pinnipeds, and 60 minutes for sea turtles.</td><td>Marine Mammals, Sea Turtles</td><td>BOEM, BSEE, and NMFS</td></tr>
</table>

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
Reporting	• All data recording will be conducted using Mysticetus or similar software. • Operations, monitoring conditions, observation effort, all marine mammal detections, and any mitigation actions will be recorded. • Members of the monitoring team must consult NMFS' NARW reporting systems for the presence of NARWs in the Project area. • DMAs will be reported across all Project vessels. • Additional details regarding reporting are provided below under "Reporting."		
HRG Surveys			

General visual monitoring methods for HRG surveys	• The following mitigation and monitoring measures for HRG surveys apply only to sound sources with operating frequencies below 180 kHz. There are no mitigation or monitoring protocols required for sources operating >180 kHz.
	• Shutdown, pre-start clearance, and ramp-up procedures will not be conducted during HRG survey operations using only non-impulsive sources (e.g., Ultra-Short BaseLine (USBL) and parametric SBPs) other than non-parametric SBPs (e.g., CHIRPs).
	• Pre-clearance and ramp-up, but not shutdown, will be conducted when using non-impulsive, non-parametric SBPs.
	• Shutdowns will be conducted for impulsive, non-parametric HRG survey equipment other than CHIRP SBPs operating at frequencies <180 kHz.
	• Monitoring Equipment:
	  ○ Two pairs of 7x50 reticle binoculars
	  ○ One mounted thermal/ IR camera system during nighttime and low visibility conditions
	  ○ Two hand-held or wearable NVDs
	  ○ Two IR spotlights
	  ○ One data collection software system
	  ○ Two PSO-dedicated VHF radios
	  ○ One digital single-lens reflex camera equipped with a 300-mm lens
	• The PSOs will be responsible for visually monitoring and identifying marine mammals approaching or entering the established zones during survey activities.
	• Visual monitoring of the established Shutdown zones and monitoring zone will be performed by PSO teams on each survey vessel:
	  ○ Four to six PSOs on all 24-hour survey vessels.
	  ○ Two to three PSOs on all 12-hour survey vessels.
	  ○ PSOs will work in shifts such that no one PSO will work more than 4 consecutive hours without a 2-hour break or longer than 12 hours during any 24-hour period.
	• Table X provides the list of the personnel on watch and monitoring equipment available onboard each HRG survey vessel.
	• Observations will take place from the highest available vantage point on all the survey vessels. General 360° scanning will occur during the monitoring periods, and target scanning by the PSO will occur if cued to a marine mammal. PSOs will adjust their positions appropriately to ensure adequate coverage of the entire shutdown and monitoring zones around the respective sound sources.
	• It will be the responsibility of the Lead PSO on duty to communicate the presence of marine mammals as well as to communicate and enforce the action(s) that are necessary to ensure mitigation and monitoring requirements are implemented as appropriate.
	• The PSOs will begin observation of the shutdown zones prior to initiation of HRG survey operations and will continue throughout the survey activity and/or while equipment operating below 180 kHz is in use.
	• PSOs will monitor Mysticetus (or similar data system) and/or appropriate data systems for Dynamic Management Areas established within their survey area.
	• PSOs will also monitor the NMFS North Atlantic right whale reporting systems including Whale Alert and RWSAS once every 4-hour shift during Project-related activities within, or adjacent to, Seasonal management Areas and/or Dynamic Management Areas.
		Marine Mammals	BOEM, BSEE, and NMFS

<table>
<tr><th>Measure Number/Name</th><th>Table H-1. Description of Applicant-Proposed Measures</th><th>Resource Area Mitigated</th><th>BOEM's Identification of the Anticipated Enforcing Agency[1]</th></tr>
<tr><td></td><td>Table X. Personnel and Equipment Compliment for Monitoring Vessels during HRG Surveys
<table>
<tr><th>Item</th><th>Number on Survey Vessel</th></tr>
<tr><td>PSOs on watch (Daytime)</td><td>1</td></tr>
<tr><td>PSOs on watch (Nighttime)</td><td>2</td></tr>
<tr><td>Reticle binoculars</td><td>2</td></tr>
<tr><td>Mounted thermal/IR camera system</td><td>1</td></tr>
<tr><td>Hand-held or wearable NVD</td><td>2</td></tr>
<tr><td>IR spotlights</td><td>2</td></tr>
<tr><td>Data collection software system</td><td>1</td></tr>
<tr><td>PSO-dedicated VHF radios</td><td>2</td></tr>
<tr><td>Digital single-lens reflex camera equipped with 300-mm lens</td><td>1</td></tr>
</table>
IR = infrared; NVD = night vision devices; PSO = protected species observer; VHF = very high frequency</td><td></td><td></td></tr>
<tr><td>Autonomous Surface Vehicle/ (ASV) Operations for HRG Surveys</td><td>

Mobile and hybrid PAM systems utilizing autonomous surface vehicles (ASVs) and radio-linked autonomous acoustic recorders (AARs) shall be considered when they can meet monitoring and mitigation requirements in a cost-effective manner.
Should an ASV be utilized during surveys, the following procedures will be implemented:

PSOs will be stationed aboard the mother vessel to monitor the ASV in a location which will offer a clear, unobstructed view of the ASV's shutdown and monitoring zones.
When in use, the ASV will be within 800 m (2,625 ft) of the primary vessel while conducting survey operations.
For monitoring around an ASV, if utilized, a dual thermal/high definition (HD) camera will be installed on the mother vessel facing forward and angled in a direction so as to provide a field of view ahead of the vessel and around the ASV.
PSOs will be able to monitor the real-time output of the camera on hand-held iPads. Images from the cameras can be captured for review and to assist in verifying species identification.
A monitor will also be installed on the bridge displaying the real-time picture from the thermal/HD camera installed on the front of the ASV itself, providing an additional forward field of view of the craft.
Night-vision goggles with thermal clip-ons, as mentioned above, and a hand-held spotlight will be provided such that PSOs can focus observations in any direction around the mother vessel and/or the ASV.

</td><td>Marine Mammals</td><td>BOEM, BSEE, and NMFS</td></tr>
<tr><td>Daytime visual monitoring for HRG surveys (period between nautical twilight rise and set for the region)</td><td>

One PSO on watch during all pre-clearance periods and all source operations.
PSOs will use reticle binoculars and the naked eye to scan the monitoring zone for marine mammals and sea turtles
</td><td>Marine Mammals</td><td>BOEM, BSEE, and NMFS</td></tr>
<tr><td>Nighttime and low visibility visual monitoring for HRG surveys</td><td>

The lead PSO will determine if conditions warrant implementing reduced visibility protocols.
Two PSOs on watch during all pre-clearance periods and operations.
Each PSO will use the most appropriate available technology (i.e., infrared camera and night-vision device) and viewing locations to monitor the shutdown zones and maintain vessel separation distances.
</td><td>Marine Mammals</td><td>BOEM, BSEE, and NMFS</td></tr>
<tr><td>Pre-start clearance for HRG surveys</td><td>

Pre-start clearance survey will only be conducted for non-impulsive, non-parametric SBPs and impulsive, non-parametric HRG survey equipment other than CHIRP SBPs operating at frequencies <180 kHz
Prior to the initiation of equipment ramp-up, PSOs and PAM operators will conduct a 30-minute watch of the shutdown zones to monitor for marine mammals.
The shutdown zones must be visible using the naked eye or appropriate visual technology during the entire clearance period for operations to start; if the shutdown zones are not visible, source operations <180 kHz will not commence.
If a marine mammal is observed within its respective shutdown zone during the pre-clearance period, ramp-up will not begin until the animal(s) has been observed exiting its respective shutdown zone or until an additional time period has elapsed with no further sighting (i.e., 15 minutes for small odontocetes, 30 minutes for all other marine mammals).
</td><td>Marine Mammals</td><td>BOEM, BSEE, and NMFS</td></tr>
</table>

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
Ramp-up (soft start) for HRG surveys	• Ramp-ups will only be conducted for non-impulsive, non-parametric SBPs and impulsive, non-parametric HRG survey equipment other than CHIRP SBPs operating at frequencies <180 kHz. • Where technically feasible, a ramp-up procedure will be used for HRG survey equipment capable of adjusting energy levels at the start or re-start of HRG survey activities. Ramp-up procedures provide additional protection to marine mammals near the Project area by allowing them to vacate the area prior to the commencement of survey equipment use. • Ramp-up will not be initiated during periods of inclement conditions or if the shutdown zones cannot be adequately monitored by the PSOs, using the appropriate visual technology for a 30-minute period. • Ramp-up will begin by powering up the smallest acoustic HRG equipment at its lowest practical power output appropriate for the survey followed by a gradual increase in power and addition of other acoustic sources (as able). • If a marine mammal is detected within or about to enter its respective shutdown zone, ramp-up will be delayed. • Ramp-up will continue once the animal(s) has been observed exiting its respective shutdown zone or until an additional time period has elapsed with no further sighting (i.e., 15 minutes for small odontocetes, 30 minutes for all other marine mammal species, and 30 minutes for sea turtles).	Marine Mammals	BOEM, BSEE, and NMFS
Shutdowns for HRG surveys	• Shutdowns will only be conducted for impulsive, non-parametric HRG survey equipment other than CHIRP SBPs operating at frequencies <180 kHz if a marine mammal or sea turtle is sighted at or within its respective shutdown zone. • Shutdowns will not be implemented for dolphins that voluntarily approach the survey vessel. • An immediate shutdown of the applicable HRG survey equipment (i.e., select sources operating <180 kHz) will be required if a marine mammal is sighted at or within its respective shutdown zone. • The vessel operator must comply immediately with any call for shutdown by the Lead PSO. Any disagreement between the Lead PSO and vessel operator should be discussed only after shutdown has occurred. • Subsequent restart of the survey equipment can be initiated if the animal has been observed exiting its respective shutdown zone within 30 minutes of the shutdown or until an additional time period has elapsed with no further sighting (i.e., 15 minutes for small odontocetes and 30 minutes for all other species). Survey vessels may power down electromechanical equipment to lowest power output that is technically feasible for these species. • If the acoustic source is shut down for reasons other than mitigation (e.g., mechanical difficulty) for less than 30 minutes, it will be reactivated without ramp-up if PSOs have maintained constant observation and no detections of any marine mammal have occurred within the respective shutdown zones. • If the acoustic source is shut down for a period longer than 30 minutes or PSOs were unable to maintain constant observation, then ramp-up and pre-start clearance procedures will be initiated.	Marine Mammals	BOEM, BSEE, and NMFS

Shutdown zones for HRG surveys	• Shutdowns will only be conducted for impulsive, non-parametric HRG survey equipment other than CHIRP SBPs operating at frequencies <180 kHz.
	• Shutdown Zones:
	  ○ North Atlantic right whale: 500 meters (547 yards).
	  ○ Fin whale, minke whale, sei whale, humpback whale, blue whale, sperm whale, Risso's dolphin, long & short-finned pilot whales, harbor porpoise, gray seal, harbor seal, and all species of sea turtles: 100 meters (110 yards).
	  ○ Delphinids (Atlantic white sided dolphin, Atlantic spotted dolphin, short-beaked common dolphin, and bottlenose dolphin [coastal and offshore stocks]): no shutdown zone.
		Marine Mammals	BOEM, BSEE, and NMFS

Post-construction HRG survey reporting	• All data recording will be conducted using Mysticetus or similar software. • Operations, monitoring conditions, observation effort, all marine mammal detections, and any mitigation actions will be recorded. • Post construction, Ocean Wind will provide to BOEM and NMFS a final report annually for HRG survey activities. The final report must address any comments on the draft report provided to Ocean Wind by BOEM and NMFS. The report must include a summary of survey activities, all PSO and incident reports, and an estimate of the number of listed marine mammals observed and/or taken during these survey activities. • Additional details regarding reporting are provided below under "Reporting."	Marine Mammals	BOEM, BSEE, and NMFS
UXO			
Visual monitoring during UXO detonations (vessel-based)	• Monitoring Equipment ○ 2 visual PSOs and 1 PAM operator will be on watch on each PSO vessel.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
	○ There will be a team of six to eight visual and acoustic PSOs on UXO monitoring vessels. ○ A single vessel is anticipated to adequately cover a radius of 2,000 m. The number of vessels will depend on the size of the zones to be monitored. ○ PAM operators may be located remotely/onshore. ○ 2 reticle binoculars ○ 1 pair of mounted "big eye" binoculars ○ Data collection software system ○ PSO-dedicated VHF radios ○ Digital single-lens reflex camera equipped with 300-mm lens. • Daytime visual monitoring is defined by the period between civil twilight rise and set for the region. • During the 60-minute pre-start clearance period and 60 minutes after the detonation event, two PSOs will always maintain watch on the primary vessel; likewise, two PSOs will also maintain watch during the same time periods from a secondary vessel. • The total number of observers will be dictated by the personnel necessary to adhere to standard shift schedule and rest requirements while still meeting mitigation monitoring requirements for the Project. • During daytime observations, two PSOs on each vessel will monitor the clearance zones with the naked eye and reticle binoculars. One PSO will periodically scan outside the clearance zones using the mounted big eye binoculars. • PSOs will visually monitor the maximum low-frequency (Large Whale) pre-start clearance zones. This zone encompasses the maximum Level A exposure ranges for all marine mammal species except harbor porpoise, where Level A take has been requested due to the large zone sizes associated with high-frequency cetaceans. • The number of vessels deployed will depend on monitoring zone size and safety set back distance from detonation. Enough vessels will be deployed to cover the clearance and shutdown zones 100% and be determined by: the detonation category and associated clearance zone size, use of NMS, and minimum distance allowed to the detonation location. • Visual monitoring will be conducted from the primary monitoring vessel, and an additional vessel in cases where the monitoring zone is greater than 2,000 m (see Table 1-5E below). • There will be a PAM operator on duty conducting acoustic monitoring in coordination with the visual PSOs during all pre-start clearance periods and post-detonation monitoring periods. • Acoustic monitoring will include, and extend beyond, the pre-start clearance zones identified in Table 1-5E.		
Visual Monitoring during UXO detonations (Aerial Alternative)	• Aerial surveys are typically limited by low cloud ceilings, aircraft availability, survey duration, and HSE considerations and therefore are not considered feasible or practical for all detonation monitoring. However, some scenarios may necessitate the use of an aerial platform. For unmitigated detonations with clearance zones greater than 5 km, deployment of sufficient vessels may not be feasible or practical. For these events, visual monitoring will be conducted from an aerial platform. • During the 60 minute pre-start clearance period and 60-minutes after the detonation event as flight time allows, two PSOs will be deployed on an aerial platform. • Surveys will be conducted in a grid with 1 km line spacing, encompassing the clearance zone. • PSOs will monitor the clearance zones with the naked eye and reticle binoculars. • Aerial PSOs may exceed 4-hour watch duration but will be limited by total flight duration not likely to exceed 6 hours. • PSOs will visually monitor the maximum low-frequency cetacean pre-start clearance zones (Table 1.5-E). This zone encompasses the maximum Level A exposure ranges for all marine mammal species except harbor porpoise, where Level A take has been requested due to the large zone sizes associated with high-frequency cetaceans (e.g., up to 16 km for an E12 detonation). • There will be a PAM operator on duty conducting acoustic monitoring in coordination with the visual PSOs during all pre-start clearance periods and post-detonation monitoring periods. • Acoustic monitoring, will include, and extend beyond, the low-frequency cetaceans pre-start clearance zone.	Marine Mammals, Sea Turtles	
Time of Year/Nighttime Restrictions	• No UXO detonations are planned between January and April. • No UXO will be detonated during nighttime hours.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
Passive acoustic monitoring during UXO detonations	• Acoustic monitoring will be conducted prior to any UXO detonation event in addition to visual monitoring in order to ensure that no marine mammals are present in the designated pre-clearance zones. • PAM operators will acoustically monitor a zone that encompasses a minimum of a 10 km radius around the source. • PAM will be conducted in daylight as no UXO will be detonated during nighttime hours. • One PAM operator may be stationed on the vessel or at an alternative monitoring location • It is expected there will be a PAM operator stationed on at least one of the dedicated monitoring vessels in addition to the PSOs; or located remotely/onshore. • PAM operators will complete specialized training for operating PAM systems prior to the start of monitoring activities. • All on-duty PSOs will be in contact with the PAM operator on-duty, who will monitor the PAM systems for acoustic detections of marine mammals that are vocalizing in the area. • For real-time PAM systems, at least one PAM operator will be designated to monitor each system by viewing data or data products that are streamed in real-time or near real-time to a computer workstation and monitor located on a Project vessel or onshore. • The PAM operator will inform the Lead PSO on duty of animal detections approaching or within applicable ranges of interest to the detonation activity via the data collection software system (i.e., Mysticetus or similar system) who will be responsible for requesting the designated crewmember to implement the necessary mitigation procedures.	Marine Mammals	BOEM, BSEE, and NMFS
Pre-start clearance for UXO detonations	• A 60-minute pre-start clearance period will be implemented prior to any UXO detonation. Visual PSOs will begin surveying the monitoring zone at least 60 minutes prior to the detonation event. PAM will also begin 60 minutes prior to the detonation event. • The pre-clearance zones (Table 1-5E) must be fully visible for at least 60 minutes prior to commencing detonation. • All marine mammals and sea turtles must be confirmed to be out of the clearance zone prior to initiating detonation. • If a marine mammal or sea turtle is observed entering or within the relevant clearance zones prior to the initiation of detonation activity, the detonation must be delayed. • The detonation may commence when either the marine mammal(s) has voluntarily left the respective clearance zone and been visually confirmed beyond that clearance zone, or, when 60 minutes have elapsed without redetection for whales, including the NARW, or 15 minutes have elapsed without redetection of dolphins, porpoises, and seals. **Table 1-5E. Mitigation and Monitoring Zones Associated with Mitigated** (10 dB attenuation) **UXO Detonation of Binned Charge Weights (adapted from PSMMP dated April 2022).** (table below)	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS

Species	E4 (2.3 kg) Pre-Start Clearance Zone[2] (m)	E6 (9.1 kg) Pre-Start Clearance Zone[2] (m)	E8 (45.5 kg) Pre-Start Clearance Zone[2] (m)	E10 (227 kg) Pre-Start Clearance Zone[2] (m)	E12 (454 kg) Pre-Start Clearance Zone[2] (m)
Low-Frequency Cetaceans	552	982	1,730	2,970	3,780
Mid-Frequency Cetaceans	50	75	156	337	461
High-Frequency Cetaceans	1,820	2,590	3,900	5,400	6,200
Phocid Pinnipeds	182	357	690	1,220	1,600
Turtles	<50	54	159	348	472

Notes: kg = kilograms; m = meters; PK = peak pressure level; SEL = sound exposure level.
[1] UXO charge weights are groups of similar munitions defined by the U.S. Navy and binned into five categories (E4-E12) by weight (equivalent weight in TNT). Four project sites (S1-S4) were chosen and modeled (see Hannay and Zykov 2022, **Appendix C**) for the detonation of each charge weight bin.
[2] Pre-start clearance zones were calculated by selecting the largest Level A threshold (the larger of either the PK or SEL noise metric) for marine mammals and the largest distance to the Permanent Threshold Shift (PTS) threshold for sea turtles. Auditory injury thresholds (PTS PK or SEL noise metrics) were larger than modeled distances to mortality and non-auditory injury criteria. The chosen values were the most conservative per charge weight bin across each of the four modeled sites.

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
Noise attenuation for UXO detonations	• Ocean Wind will use an NMS for all UXO detonation events. Although the exact level of noise mitigation that can be achieved by these systems is unknown, based on available data (Bellman et al. 2020, Bellman and Betke 2021) it is reasonable to expect the NMS to achieve 10 dB attenuation.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
Fisheries Monitoring			
General Measures	• Fisheries Monitoring for the Project will consist of regular surveys carried out by academic partners from Rutgers University, Monmouth University, and Delaware State University. • Fisheries monitoring was designed in accordance with recommendations set forth in "Guidelines for Providing Information on Fisheries for Application for Renewable Energy Development on the Atlantic Outer Continental Shelf" (BOEM 2019) and consideration to the Responsible Offshore Science Alliance (ROSA) Offshore Wind Project Monitoring Framework and Guidelines. • All vessels will comply with the vessel speed plan as outlined above for vessel speed restrictions – standard and adaptive plans. • Marine mammal watches and monitoring will occur during daylight hours prior to deployment of gear (e.g., trawls, longline gear) and will continue until gear is brought back on board. • If marine mammals are sighted in the area within 15 minutes prior to deployment of gear and are considered to be at risk of interaction with the research gear, then the sampling station is either moved or canceled or the activity is suspended until there are no sightings of nay marine mammal for 15 minutes within 1 nautical mile (1852 m) of sampling location.	Marine Mammals	BOEM, BSEE, and NMFS
Trawl Surveys	• Marine mammal monitoring will be conducted by the captain and/or a member of the scientific crew before, during, and after haul back. • Trawl operations will commence as soon as possible once the vessel arrives on station; the target tow time will be limited to 20 minutes. • Ocean Wind will initiate marine mammal watches (visual observation) within 1 nautical mile (1852 m) of the site 15 minutes prior to sampling. • If a marine mammal is sighted within 1 nautical mile (1852 m) of the planned sampling station in the 15 minutes before gear deployment, Ocean Wind will delay setting the trawl until marine mammals have not been resighted for 15 minutes or Ocean Wind may move the vessel away from the marine mammal to a different section of the sampling area. If, after moving on, marine mammals are still visible from the vessel, Ocean Wind may decide to move again or to skip the sampling station. • Ocean Wind will maintain visual monitoring effort during the entire period of time that trawl gear is in the water (i.e., throughout gear deployment, fishing, and retrieval). If marine mammals are sighted before the gear is fully removed from the water, (i.e. prior to haul back) the vessel will slow its speed and steer away from the sighted animal in order to minimize potential interactions. Further mitigating actions can be taken following consultation with and guidance from the NMFS Protected Resources Division. • Ocean Wind will open the codend of the net close to the deck/sorting area to avoid damage to animals that may be caught in gear. • Gear will be emptied as close to the deck/sorting area and as quickly as possible after retrieval. • Trawl nets will be fully cleaned and repaired (if damaged) before setting again. • Ocean Wind does not anticipate and is not requesting take of marine mammals incidental to research trawl surveys but, in the case of a marine mammal interaction, the Marine Mammal Stranding Network will be contacted immediately.	Marine Mammals	BOEM, BSEE, and NMFS
Structured Habitat Surveys (Chevron traps and Baited Remote Underwater Video [BRUVs])	• The chevron traps and BRUVs will be deployed on a limited soak duration (90 minutes or less), and the vessel will remain on location with the gear while it is sampling. • Buoy/end lines with a breaking strength of <1,700 pounds (lbs) will be used. All buoy line will use weak links that are chosen from the list of NMFS approved gear. This may be accomplished by using whole buoy line that has a breaking strength of 1,700 lbs; or buoy line with weak inserts that result in line having an overall breaking strength of 1,700 lbs. • All buoys will be labeled as research gear, and the scientific permit number will be written on the buoy. All markings on the buoys and buoy lines will be compliant with the regulations, and all buoy markings will comply with any specific marking instructions received by staff at NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division. • Any lines that go missing will be reported to the NOAA Greater Atlantic Regional Fisheries Office Protected Resources Division as soon as possible. • The Project Team will not deploy either the chevron traps or the BRUVs if marine mammals are sighted near the proposed sampling station. Gear will not be deployed if marine mammals are observed within the area and if a marine mammal is deemed to be at risk of interaction, all gear will be immediately removed.	Marine Mammals	BOEM, BSEE, and NMFS

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
Acoustic Telemetry Surveys	• No specific mitigation relevant to this type of survey. • Vessel mitigation measures outlined above for all Project vessels will be employed while collecting samples.	Marine Mammals	BOEM, BSEE, and NMFS
eDNA Sampling	• Will coincide with the bottom trawl survey and associated mitigation measures. No specific mitigation relevant to this type of survey. • Vessel mitigation measures outlined above for all Project vessels will be employed while collecting samples.	Marine Mammals	BOEM, BSEE, and NMFS
Rod and reel surveys	• No specific mitigation relevant to this type of survey. • Vessel mitigation measures outlined above for all Project vessels will be employed while collecting samples.	Marine Mammals	BOEM, BSEE, and NMFS
Clam Survey	• No specific mitigation relevant to this type of survey. • Vessel mitigation measures outlined above for all Project vessels will be employed while collecting samples.	Marine Mammals	BOEM, BSEE, and NMFS
Glider – Oceanography	• No specific mitigation relevant to this type of survey. • Vessel mitigation measures outlined above for all Project vessels will be employed while retrieving equipment	Marine Mammals	BOEM, BSEE, and NMFS
Pelagic Fish	• Similar mitigation will be applied as described above for Structured Habitat Surveys. • Vessel mitigation measures outlined above for all Project vessels will be employed while retrieving equipment and collecting samples	Marine Mammals	BOEM, BSEE, and NMFS
Reporting Requirements			
Injured protected species reporting	• Any potential strikes, stranded, entangled, or dead/injured protected species regardless of cause, should be reported by the vessel captain or the PSO onboard to the Greater Atlantic (Northeast) Region Marine Mammal and Sea Turtle Stranding and Entanglement Hotline (866-755-NOAA [6622]) within 24 hours of a sighting. • If the injury or death was caused by a Project activities, the vessel captain or PSO on board will ensure that NMFS is notified immediately to the NMFS Office of Protected Resources and Greater Atlantic Regional Fisheries Office and no later than within 24 hours. The notification will include date and location (latitude and longitude) of the incident, name of the vessel/platform involved, and the species identification or a description of the animal, if possible. If the Project activity is responsible for the injury or death, Ocean Wind will supply a vessel to assist in any salvage effort as requested by NMFS. • If a NARW is involved in any of the above-mentioned incidents then the vessel captain or PSO onboard should also notify the Right Whale Sighting Advisory System (RWSAS) hotline immediately and no later than within 24 hours.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
Reporting observed impacts on species	• PSOs/PAM operators will report any observations concerning impacts on marine mammals to NMFS within 48 hours. • BOEM and NMFS will be notified within 24 hours if any evidence of an injured or dead sea turtle or ESA-listed fish species during construction activity is observed. • Any NARW sightings will be reported as soon as possible, and no later than within 24 hours, to the NMFS RWSAS hotline or via the Whale Alert Application.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
Report of activities and observations	• Ocean Wind will provide NMFS with a report within 90 calendar days following the completion of construction and HRG surveys, including a summary of the activities and an estimate of the number of marine mammals taken.	Marine Mammals	BOEM, BSEE, and NMFS
Report information	• Data on all marine mammal observations will be recorded and based on standards of marine mammal observer collection data by the PSOs. This information will include dates, times, and locations of survey operations; time of observation, location and weather; details of marine mammal sightings (e.g., species, numbers, behavior); and details of any observed taking (e.g., behavioral disturbances or injury). • All vessels will utilize a standardized data entry format. • A QA/QC'd database of all sightings and associated details (e.g., distance from vessel, behavior, species, group size/composition) within and outside of the designated shutdown zones, monitoring effort, environmental conditions, and Project-related activity will be provided after field operations and reporting are complete. This database will undergo thorough quality checks and include all variables required by the NMFS-issued Incidental Take Authorization (ITA) and BOEM Lease OCS-A 0498 and will be required for the Final Technical Report due to BOEM and NMFS. • During construction, weekly reports briefly summarizing sightings, detections and activities will be provided to NMFS and BOEM on the Wednesday following a Sunday-Saturday period. • Final reports will follow a standardized format for PSO reporting from activities requiring marine mammal mitigation and monitoring. • An annual report summarizing the prior year's activities will be provided to NMFS and to BOEM on April 1 every calendar year summarizing the prior year's activities.	Marine Mammals	BOEM, BSEE, and NMFS

Measure Number/Name	Table H-1. Description of Applicant-Proposed Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[1]
SAV/Seabed Disturbance			
Siting	• Site cable landfall and offshore facilities to avoid known locations of sensitive benthic habitat, to the extent practicable. Avoid SAV communities, where practicable and restore any damage to these communities.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
Port construction and vessel traffic	• Use existing port and onshore operations and maintenance facilities to the extent practicable and minimize impacts to seagrass by restricting vessel traffic to established traffic routes where these resources are present.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
Monitoring	• Develop and implement a site-specific monitoring program to ensure environmental conditions are monitored during construction, operation, and decommissioning phases, designed to ensure environmental conditions are monitored and reasonable actions are taken to avoid and/or minimize seabed disturbance and sediment dispersion, consistent with permit conditions. The monitoring plan will be developed during the permitting process, in consultation with resource agencies.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
Construction	• To the extent practicable, use appropriate installation technology designed to minimize disturbance to seagrass beds; avoid anchoring on sensitive habitat; and implement turbidity reduction measures to minimize impacts to sensitive habitats from construction. • Take reasonable actions (use BMPs) to minimize seabed disturbance and sediment dispersion during cable installation and construction of Project facilities	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
Mitigation	• Implement the SAV Preliminary Mitigation Plan dated November 2022 (Ocean Wind 2022), which includes mapping efforts, monitoring activities, restoration of documented activities at an in-situ 1:1 ratio, annual reporting, as well as additional research to improve SAV mitigation in the future.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
BOEM PDCs/BMPs			
BOEM PDCs/BMPs	• Lessees and grantees should evaluate marine mammal use of the proposed project area and should design the project to minimize and mitigate the potential for mortality or disturbance. The amount and extent of ecological baseline data required should be determined on a project basis.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
BOEM PDCs/BMPs	• Vessels related to project planning, construction, and operation should travel at reduced speeds when assemblages of cetaceans are observed. Vessels also should maintain a reasonable distance from whales, small cetaceans, and sea turtles, and these should be determined during site-specific consultations.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
BOEM PDCs/BMPs	• Lessees and grantees should minimize potential vessel impacts to marine mammals and turtles by having project-related vessels follow the National Marine Fisheries Service (NMFS) Regional Viewing Guidelines while in transit. Operators should undergo training on applicable vessel guidelines.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
BOEM PDCs/BMPs	• Lessees and grantees should take efforts to minimize disruption and disturbance to marine life from sound emissions, such as pile driving, during construction activities.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS
BOEM PDCs/BMPs	• Lessees and grantees should avoid and minimize impacts to marine species and habitats in the project area by posting a qualified observer on site during construction activities. These observers are approved by NMFS.	Marine Mammals, Sea Turtles, ESA-listed Fish	BOEM, BSEE, and NMFS

Table H-2 Mitigation and Monitoring Measures Resulting From Consultations

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
BOEM-proposed Bird and Bat Mitigation Measures in the USFWS BA					
5	O&M	Adaptive mitigation for birds and bats	BOEM will require that Ocean Wind develops and implements an Avian and Bat Post-Construction Monitoring Plan based on COP Appendix III, Appendix AB Avian and Bat Post-Construction Monitoring Framework in coordination with USFWS, NJDEP, and other relevant regulatory agencies. Annual monitoring reports will be used to determine the need for adjustments to monitoring approaches, consideration of new monitoring technologies, and/or additional periods of monitoring. Prior to commencing offshore construction activities, Ocean Wind must submit an Avian and Bat Post-Construction Monitoring Plan for BOEM and USFWS review. BOEM and USFWS will review the Avian and Bat Post-Construction Monitoring Plan and provide any comments on the plan within 30 calendar days of its submittal. Ocean Wind must resolve all comments on the Avian and Bat Post-Construction Monitoring Plan to BOEM and USFWS's satisfaction before implementing the plan. a. Monitoring. Ocean Wind must conduct monitoring as outlined in COP Appendix III, Appendix AB Avian and Bat Post-Construction Monitoring Framework (March 24, 2023), which will include acoustic monitoring of bats and nocturnally migrating birds, use by ESA-listed birds, and movement of marine around the turbines. b. Annual Monitoring Reports. Ocean Wind must submit to BOEM (at renewable_reporting@boem.gov), USFWS, and BSEE (at OSWSubmittals@bsee.gov) a comprehensive report after each full year of monitoring (pre- and post-construction) within 6 months of completion of the last avian survey. The report must include all data, analyses, and summaries regarding ESA-listed and non-ESA-listed birds and bats. BOEM, USFWS, and BSEE will use the annual monitoring reports to assess the need for reasonable revisions (based on subject matter expert analysis) to the Avian and Bat Post-Construction Monitoring Plan. BOEM, BSEE, and USFWS reserve the right to require reasonable revisions to the Avian and Bat Post-Construction Monitoring Plan and may require new technologies as they become available for use in offshore environments. c. Post-Construction Quarterly Progress Reports. Ocean Wind must submit quarterly progress reports during the implementation of the Avian and Bat Post-Construction Monitoring Plan to BOEM (at renewable_reporting@boem.gov) and the USFWS by the 15th day of the month following the end of each quarter during the first full year that the Project is operational. The progress reports must include a summary of all work performed, an explanation of overall progress, and any technical problems encountered. d. Monitoring Plan Revisions. Within 15 calendar days of submitting the annual monitoring report, Ocean Wind must meet with BOEM and USFWS to discuss the following: the monitoring results; the potential need for revisions to the Avian and Bat Post-Construction Monitoring Plan, including technical refinements or additional monitoring; and the potential need for any additional efforts to reduce impacts. If BOEM or USFWS determines after this discussion that revisions to the Avian and Bat Post-Construction Monitoring Plan are necessary, BOEM may require Ocean Wind to modify the Avian and Bat Post-Construction Monitoring Plan. If the reported monitoring results deviate substantially from the impact analysis included in the Final EIS, Ocean Wind must transmit to BOEM recommendations for new mitigation measures and/or monitoring methods. e. Operational Reporting. Ocean Wind must submit to BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWSubmittals@bsee.gov) an annual report summarizing monthly operational data calculated from 10-minute SCADA data for all turbines together in tabular format: the proportion of time the turbines were operational (spinning at >x rpm) each month, the average rotor speed (monthly revolutions per minute [rpm]) of spinning turbines plus 1 standard deviation, and the average pitch angle of blades (degrees relative to rotor plane) plus 1 standard deviation. BOEM and BSEE will use this information as inputs for avian collision risk models to assess whether the results deviate substantially from the impact analysis included in the Final BA. f. Raw Data. The Lessee must store the raw data from all avian and bat surveys and monitoring activities according to accepted archiving practices. Such data must remain accessible to BOEM, BSEE and USFWS, upon request for the duration of the Lease. The Lessee must work with BOEM to ensure the data are publicly available.	Birds and Bats	BOEM, BSEE, and USFWS
6	C, O&M, D	Annual bird and bat mortality reporting	Annual Bird Mortality Reporting during construction and operation, and decommissioning. The Lessee must submit an annual report covering each calendar year, due by January 31 of the following year, documenting any dead (or injured) birds or bats found on vessels and structures during construction, operations, and decommissioning. The report must be submitted to BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWSubmittals@bsee.gov) and USFWS. The report must contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with Federal or research bands must be reported to the United States Geological Survey Bird Band Laboratory. Any occurrence of dead ESA birds or bats must be reported to BOEM, BSEE, and USFWS as soon as practicable (taking into account	Birds and Bats	BOEM, USFWS, BSEE

[2] Enforcement by BOEM and BSEE will be conducted in accordance with Reorganization of Title 30 – Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf final rule, 88 *Federal Register* 6376.

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
			crew and vessel safety), but no later than 24 hours after the sighting, and if practicable, carefully collect the dead specimen and preserve the material in the best possible state.		
3	C	Monitoring	BOEM will require that Ocean Wind implements monitoring and/or other conservation measures to minimize disturbance of rufa red knots and other ESA-listed birds, in coordination with USFWS and NJDEP.	Birds	BOEM, USFWS, NJDEP
3a	O&M	Bird Perching Deterrent	To minimize attracting birds (e.g. roseate terns) to operating turbines, Ocean Wind must install bird perching-deterrent devices where such devices can be safely deployed on WTGs and OSSs. Ocean Wind must submit for BOEM and USFWS approval a plan to deter perching on offshore infrastructure by roseate terns and other marine birds. The plan must include the type(s) and locations of bird perching deterrent devices, include a maintenance plan for the life of the project, allow for modifications and updates as new information and technology becomes available, and track the efficacy of the deterrents. The location of bird perching-deterrent devices must be proposed by Ocean Wind based on best management practices applicable to the appropriate operation and safe installation of the devices. Ocean Wind must confirm the locations of bird perching-deterrent devices as part of the documentation it must submit with the FDR.	Birds	BOEM, USFWS
3b	O&M	Light Impact Reduction	Ocean Wind must use an FAA-approved vendor for the Aircraft Detection Lighting System (ADLS), which will activate the FAA hazard lighting only when an aircraft is in the vicinity of the wind facility to reduce visual impacts at night. Ocean Wind must confirm the use of an FAA-approved vendor for ADLS on WTGs and OSSs in the FIR.	Birds	FAA, BOEM
3c	O&M	Light Impact Reduction	Ocean Wind must light each WTG and OSS in a manner that is visible by mariners in a 360-degree arc around the WTG and OSS. To minimize the potential of attracting migratory birds, the top of each light shall be shielded to minimize upward illumination (Conditional on USCG approval). BOEM must provide USFWS with a copy of Ocean Wind's application to USCG to establish Private Aids to Navigation (PATON), which includes a lighting, marking, and signaling plan. The PATON application will include design specifications for maritime navigational lighting. Upon approval of the PATON by USCG, BOEM and USFWS will work together to determine the color, intensity, and duration of any light from maritime lanterns that is likely to reach the typical flight heights of listed birds, and will assess the degree to which the lighting is likely to attract or disorient birds.	Birds	USCG, BOEM
3d	O&M	Collision Reduction	For overhead power lines, Ocean Wind must follow best practices from the Avian Power Line Interaction Committee.	Birds	USFWS
3e	C, O&M, D	Habitat Impact Reduction	Both during and after construction, Ocean Wind must avoid Project-related intrusion (i.e., access through or disturbance from personnel or equipment) into any beach or dune from March 1 to August 31. In the event that emergency access to this area is needed during the restricted season, Ocean Wind must coordinate with the USFWS and the NJDEP's Endangered and Nongame Species Program to seek approval.	Birds	USFWS, NJDEP
3f	C, O&M, D	Species Disturbance Reduction	Both during and after construction, Ocean Wind must avoid Project activities within 500 feet of any beach or dune from March 15 to August 31. In the event that essential access to this area is needed during the restricted season, Ocean Wind must coordinate with the USFWS and the NJDEP's Endangered and Nongame Species Program to seek approval.	Birds	USFWS, NJDEP
3g	C	Habitat Impact Reduction	Rufa red knot: Along onshore export cable routes, Ocean Wind must avoid permanent modification of suitable red knot habitats. Where temporary habitat disturbance is unavoidable, Ocean Wind must develop a restoration plan in coordination with USFWS for BOEM and USFWS approval.	Birds	USFWS, BOEM
3h	C, O&M	Species Disturbance Reduction	Roseate tern: Ocean Wind must avoid disturbing roosting terns to the extent practicable during construction and operations and maintenance, affording at least a 300-foot buffer for people on foot and for vehicles to avoid flushing the birds. USFWS anticipates most staging flocks of terns will occur from July through September.	Birds	USFWS
3i	C, O&M, D	Surveys, Avoidance, and Minimization	Eastern black rail and saltmarsh sparrow: No planned or routine Project entry or intrusion into Wetlands A, B, or C (adjacent to Roosevelt Blvd.) either during or after construction will occur. Emergency access must be coordinated with USFWS and NJDEP. If Ocean Wind elects to construct an Oyster Creek onshore cable route option other than the Holtec property route, Ocean Wind must retain a species expert to conduct a desktop and field assessment and to map suitable eastern black rail and saltmarsh sparrow habitat within the limits of disturbance. Ocean Wind must provide the assessment, mapping and associated spatial files in an ESRI ArcMap/ArcPro compatible format, and qualifications of the expert to BOEM and USFWS for review no later than 30 calendar days after the assessment has been completed. BOEM and USFWS will complete their reviews and identify any deficiencies that require a report revision by Ocean Wind within 30 calendar days of receipt of the assessment. If areas of suitable eastern black rail and/or saltmarsh sparrow habitat will be impacted by Project activities, Ocean Wind must coordinate with USFWS to develop appropriate conservation measures that Ocean Wind is required to implement to avoid adverse effects to these species. Conservation measures will include that construction activities and other Project-related intrusions into areas of suitable habitat will be seasonally restricted from April 1 through September 30 (April 1 through September 30 for eastern black rail and May 1 to September 30 for saltmarsh sparrow) in order to minimize the risk of directly disturbing or injuring adults, eggs, or chicks during sensitive periods of the breeding season.	Birds	BOEM, USFWS, NJDEP

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
4	C	Survey (ESA-listed bats)	BOEM will require that Ocean Wind conducts pre-construction surveys for ESA-listed bats and implements avoidance and minimization measures in coordination with USFWS and NJDEP.	Bats	USFWS, NJDEP
4a	C	Bat habitat impact reduction	GEN-13 will be modified to enhance bat habitat in coordination with USFWS and NJDEP. Ocean Wind must develop and implement a replanting plan in areas of temporary deforestation. The replanting plan must include the identification of specific tree species and densities, timing of planting, protection of saplings from herbivory, monitoring, and invasive species control in order to provide high-quality bat habitat and must be provided to BOEM and USFWS for approval prior to commencing onshore construction activities.	Bats	USFWS, NJDEP
4b	C	Surveys, Avoidance, and Minimization (bat acoustic surveys)	If Ocean Wind elects to construct an Oyster Creek onshore cable route option other than the Holtec route, Ocean Wind must coordinate with BOEM, USFWS, and NJDEP prior to commencing onshore construction activities. After coordination with BOEM, USFWS, and NJDEP, Ocean Wind must retain the services of a USFWS Recognized and Qualified Bat Surveyor to conduct presence/absence surveys (acoustic or mist netting) along the proposed route that are consistent with the USFWS' Rangewide Indiana Bat and Northern Long-eared Bat Survey Guidelines. A survey work plan must be submitted to USFWS for approval before commencing the survey. A survey report, including maps and associated spatial files in an ESRI ArcGIS/ArcPro compatible format, must be provided to BOEM and USFWS for review no later than 30 calendar days after the survey has been completed. BOEM and USFWS will complete their reviews and identify any deficiencies that require a report revision by Ocean Wind. Based on the results of the presence/absence surveys, USFWS may recommend additional field investigations, such as a tree survey to assess roost habitat suitability and/or a mist netting/bat tracking effort to locate occupied roosts. If potential NLEB or tricolored bat roosting habitat will be impacted by Project activities, Ocean Wind must coordinate with USFWS to develop appropriate conservation measures that Ocean Wind is required to implement to avoid adverse effects to this species. Conservation Measures may include a seasonal restriction on tree clearing and avoidance of likely or known roost trees.	Bats	USFWS, NJDEP, BOEM
4c	O&M	Bat habitat impact reduction (non-routine tree clearing)	Ocean Wind will coordinate with the USFWS prior to any clearing of trees (> 3 inches dbh) required during operation and maintenance.	Bats	USFWS
4d	O&M	Bat habitat impact reduction (building/structure demolition)	Ocean Wind must contact USFWS to assess the potential risk to ESA-listed bat species should any abandoned or dilapidated buildings or structures require demolition during the O&M phase. If USFWS determines that adverse effects exist, Ocean Wind must notify BOEM and coordinate with USFWS to develop appropriate mitigation measures that Ocean Wind is required to implement to avoid adverse effects to listed bat species.	Bats	BOEM, USFWS
BOEM-proposed Plant Mitigation Measures in the USFWS BA					
1	C	Surveys, Avoidance, and Minimization (ESA-listed plants)	Ocean Wind must conduct pre-construction habitat surveys for ESA-listed plants and implement avoidance and minimization measures in coordination with USFWS and NJDEP.	Coastal Habitat and Fauna	BOEM/USACE, USFWS, NJDEP
1a	C	Surveys, Avoidance, and Minimization (ESA-listed plants; swamp pink)	Swamp Pink: If Ocean Wind elects to construct an Oyster Creek onshore cable route option other than the Holtec property route, Ocean Wind must retain a USFWS qualified surveyor to conduct a survey in accordance with USFWS swamp pink survey guidelines of all suitable habitats (i.e., forested wetlands) that will be subject to temporary disturbance or permanent modification as a result of Project activities, both during construction and from post-construction O&M activities, including areas crossed by HDD. The survey area will also include all forested wetlands within 300 feet of upland disturbance. Ocean Wind must submit the survey area(s), timing, methods, and qualifications of the surveyor(s) for BOEM/USACE and USFWS approval prior to the start of the survey. A survey report, including maps and associated spatial files in an ESRI ArcMap/ArcPro compatible format, must be provided to BOEM/USACE and USFWS for review no later than 30 calendar days after the survey has been completed. BOEM/USACE and USFWS will complete their reviews and identify any deficiencies that require a report revision by Ocean Wind within 30 calendar days of receipt of the survey report. If any swamp pink is found during the survey, the surveyor must document the distribution and abundance of plants and submit both the full survey report and a completed Natural Heritage Rare Plant Species Reporting Form (https://www.nj.gov/dep/parksandforests/natural/docs/NHRPSR_Form.pdf) to BOEM/USACE, USFWS, and the New Jersey Natural Heritage Program. If swamp pink is present in or adjacent to Project activities, Ocean Wind must coordinate with USFWS to develop appropriate conservation measures that Ocean Wind is required to implement to avoid adverse effects to this species including through direct and indirect effects to its habitat and seek any required authorizations to perform such activities.	Coastal Habitat and Fauna	USFWS, NJDEP, USACE
1b	C	Surveys, Avoidance, and Minimization (ESA-listed plants; Knieskern's beaked-rush)	Knieskern's beaked-rush: If Ocean Wind elects to construct an Oyster Creek onshore cable route option other than the Holtec property route, Ocean Wind must retain a USFWS qualified surveyor to conduct a survey between July and September and in accordance with USFWS Knieskern's beaked-rush survey guidelines of all suitable habitats that will be subject to temporary disturbance or permanent modification as a result of Project activities, both during construction and from post-construction O&M activities, including areas crossed by HDD. Survey areas must not be mowed for at least one month prior to the survey. Ocean Wind must submit the survey area(s), timing, methods, and qualifications of the surveyor(s) for BOEM/USACE and USFWS approval prior to the start of the survey. A survey report,	Coastal Habitat and Fauna	USFWS, NJDEP, USACE

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
			including maps and associated spatial files in an ESRI ArcGIS/ArcPro compatible format, must be provided to BOEM/USACE and USFWS for review no later than 30 calendar days after the survey has been completed. BOEM/USACE and USFWS will complete their reviews and identify any deficiencies that require a report revision by Ocean Wind within 30 calendar days of receipt of the survey report. If any Knieskern's beaked-rush is found during the survey, the surveyor must document the distribution and abundance of plants, and submit both the full survey report and a completed Natural Heritage Rare Plant Species Reporting Form to BOEM/USACE, USFWS and the New Jersey Natural Heritage Program. If Knieskern's beaked-rush is present in or adjacent to Project activities, Ocean Wind must coordinate with USFWS to develop appropriate conservation measures that Ocean Wind is required to implement to avoid adverse effects to this species and seek any required authorizations to perform such activities.		
1c	C	Surveys, Avoidance, and Minimization (ESA-listed plants, American chaffseed)	American chaffseed: Ocean Wind must retain a USFWS qualified surveyor to conduct a survey of all suitable American chaffseed habitats between June 1 and August 15 that will be subject to temporary disturbance or permanent modification as a result of Project activities, both during construction and from post-construction O&M activities, including areas crossed by HDD. Survey areas must not be mowed for at least one month prior to the survey and the survey will cover all areas of suitable habitat, not just transects. Ocean Wind must submit the survey area(s), timing, methods, and qualifications of the surveyor(s) for BOEM and USFWS approval prior to the start of the survey. A survey report, including maps and associated spatial files in an ESRI ArcGIS/ArcPro compatible format, must be provided to BOEM/USACE and USFWS for review no later than 30 calendar days after the survey has been completed. BOEM/USACE and USFWS will complete their reviews and identify any deficiencies that require a report revision by Ocean Wind within 30 calendar days of receipt of the survey report. If any American chaffseed is found during the survey, the surveyor must document the distribution and abundance of plants and submit both the full survey report and a completed Natural Heritage Rare Plant Species Reporting Form to BOEM/USACE, USFWS, and the New Jersey Natural Heritage Program. If American chaffseed is present in or adjacent to Project activities, Ocean Wind must coordinate with USFWS to develop appropriate conservation measures that Ocean Wind is required to implement to avoid adverse effects to this species and to seek any required authorizations to perform such activities.	Coastal Habitat and Fauna	USACE, USFWS, NJDEP
2	C	Restoration with Native Vegetation	GEN-13 will be modified to clarify that disturbed areas would be reestablished with native vegetation, and in areas that are permanently landscaped (e.g., substation site), Ocean Wind would coordinate with NJDEP Fish & Wildlife to determine if wildlife friendly habitats could be created.	Coastal Habitat and Fauna	USFWS, NJDEP
BOEM-proposed Monarch Butterfly Mitigation Measures in the USFWS BA					
2	C	Surveys, Avoidance, and Minimization (monarch butterfly)	Ocean Wind must conduct pre-construction surveys for milkweed (*Asclepias* spp.) and implement monarch butterfly avoidance and minimization measures in coordination with USFWS and NJDEP.	Coastal Habitat and Fauna	USFWS, NJDEP
2a	C, O&M	Surveys, Avoidance, and Minimization (monarch butterfly; avoid in-season milkweed clearing)	For areas where vegetation disturbance will occur during Project construction or post-construction operations and maintenance activities, Ocean Wind must survey the affected area for milkweed (*Asclepias* spp.) before the start of work. Ocean Wind must avoid clearing milkweed to the extent practical from May 15 through September 30 when monarch caterpillars may be present. If/when the monarch is proposed for federal listing, Ocean Wind will coordinate with the USFWS prior to initiating any in-season vegetation disturbance that may involve milkweed.	Coastal Habitat and Fauna	USFWS
2b	C	Revegetation Plan	GEN-13 will be modified to enhance monarch butterfly habitat in coordination with USFWS and NJDEP. BOEM will require that Ocean Wind develops a Revegetation Plan to enhance monarch butterfly habitat for areas of temporary disturbance and incidental to other Project activities. Ocean Wind must consult the New Jersey Monarch Butterfly Conservation Guide in developing the plan and submit the plan for USFWS review.	Coastal Habitat and Fauna	USFWS, NJDEP
2c	O&M	Milkweed Habitat Impact Reduction	Ocean Wind will not use herbicide for right-of way maintenance and in other portions of the Project where milkweed is likely to occur.	Coastal Habitat and Fauna	USFWS
DOD Measure Resulting from Military Aviation and Installation Assurance Siting Clearinghouse Review					
1	O&M	Fiber-optic sensing technology	Distributed fiber-optic sensing (DOFS) technology proposed for the wind energy project or associated transmission cables would be reviewed by the DOD to ensure that DOFS is not used to detect sensitive data from DOD activities, conduct any other type of surveillance of U.S. Government operations, or to otherwise pose a threat to national security.	Other Uses	BOEM, BSEE, and DOD
NHPA Section 106 Mitigation Measures from the Memorandum of Agreement					
1	C	Avoid or mitigate impacts on identified archaeological resources	The lessee must avoid any identified archaeological resource or TCP, including avoidance of 50-meter buffers for identified archaeological resources. If the lessee cannot avoid the resource, it must perform additional investigations for the purpose of determining eligibility for listing in the NRHP. Of those resources determined eligible, BOEM would require Phase III data recovery investigations for the purpose of resolving adverse effects per 36 CFR 800.6. If the lessee determines it cannot avoid an archaeological resource or TCP after the ROD has been issued, additional Section 106 consultation will be required.	Cultural Resources	BOEM, BSEE, USACE, NJDEP

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
2	C	Terrestrial archaeological monitoring and Terrestrial Post-Review Discovery Plan	Implementation of terrestrial archaeological monitoring and terrestrial post-review discovery plan for terrestrial archaeology, which include training and orientation for construction staff, designation of a Cultural Resources Compliance Manager, and post-review discovery procedures and contacts, to reduce potential impacts on any previously undiscovered archaeological resources (if present) encountered during construction.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
3	Prior to C	Historic Properties Treatment Plans	BOEM, with the assistance of the lessee, will develop and implement two Historic Property Treatment Plans in consultation with consulting parties who have demonstrated interest in specific historic properties and property owners to address impacts on archaeological resources and ancient submerged landforms if they cannot be avoided. A Historic Properties Treatment Plan for ancient submerged landforms will provide details an specification for actions to resolve adverse effects on 13 ancient submerged landforms (Targets 21-26, 28-31, and 33-35). A Historic Properties Treatment Plan for historic properties subject to adverse visual effects will also provide details and specification for actions consisting of mitigation measures to resolve adverse visual effects and cumulative adverse visual effects on: Brigantine Hotel, Brigantine City; Absecon Lighthouse, Atlantic City; Atlantic City Boardwalk, Atlantic City; Atlantic City Convention Hall, Atlantic City; Ritz-Carlton Hotel, Atlantic City; Riviera Apartments, Atlantic City; Vassar Square Condominiums, Ventnor City; 114 South Harvard Avenue, Ventnor City; Lucy the Margate Elephant, Margate City; Great Egg Coast Guard Station, Longport Borough; Ocean City Boardwalk, Ocean City; Ocean City Music Pier, Ocean City; The Flanders Hotel, Ocean City; Hereford Inlet Lighthouse, North Wildwood; North Wildwood Lifesaving Station, North Wildwood; U.S. Lifesaving Station #35, Stone Harbor Borough; Little Egg Harbor U.S. Lifesaving Station #23, Little Egg Harbor Township.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
4	Prior to C, C	Mitigation to resolve adverse effects to Ancient Submerged Land Forms (Targets 21–26, 28–31, and 33–35)	Preconstruction Geoarchaeology. The lessee will fulfill the following commitments: collaborative review of existing geophysical and geotechnical data with consulting Tribes; selection of coring locations in consultation with consulting Tribes; collection of two to three vibracores within each affected ASLF that has not been previously sampled, with a sampling focus on areas that will be disturbed by Project construction activities; written verification to BOEM that the samples collected are sufficient for the planned analyses and consistent with the agreed scope of work; collaborative laboratory analyses at a laboratory located in Rhode Island or New Jersey; screening of recovered sediments for debitage or micro-debitage associated with indigenous land uses; third-party laboratory analyses, including micro- and macro-faunal analyses, micro- and macro-botanical analyses, radiocarbon dating of organic subsamples, and chemical analyses for potential indirect evidence of indigenous occupations; temporary curation of archival core sections; draft reports for review by consulting Tribes; and final reporting. Signatories will be notified of completion of this measure. The collection of vibracores must be completed prior to commencing seabed disturbing activities.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
5	C, post-C	Mitigation to resolve adverse effects to Ancient Submerged Land Forms (Targets 21–26, 28–31, and 33–35)	Open-Source GIS and Story Maps. The lessee will fulfill the following commitments: consultation with the Tribes to determine the appropriate open-source GIS platform; review of candidate datasets and attributes for inclusion in the GIS; data integration; development of custom reports or queries to assist in future research or tribal maintenance of the GIS; work Sessions with consulting Tribes to develop Story Maps content, and inclusion of stories associated with other federally recognized Tribes; training session with Tribes to review GIS functionality; review of Draft Story Maps with Tribes; delivery of GIS to Tribes; and delivery of Final Story Maps. Signatories will be notified of completion of this measure. This measure may be completed during or post-construction.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
6	C, post-C	Mitigation to resolve adverse effects to Ancient Submerged Land Forms (Targets 21–26, 28–31, and 33–35)	ASLF Post-Construction Seafloor Impact Inspection. The lessee will fulfill the following commitments: development of a 3D model throughout ASLFs designated for review; development of the remotely operated vehicle (ROV) investigation methodology, including consultation with BOEM; ROV inspection of the seafloor along impacted portions of the selected ASLFs; review of candidate datasets and attributes for inclusion in the GIS; delivery of data interpretive technical report draft; delivery of final technical report. The lessee will provide consulting Tribes and BOEM, draft and final technical reports including 3D models and resulting seafloor impact assessments. Signatories will be notified of completion of this measure. This measure must be completed as early as possible and no later than one-month post-construction. If unanticipated issues arise during the course of offshore construction that prevent this measure from being completed within one-month post-construction, the lessee must notify BOEM and propose an alternate completion timeframe for consulting Tribes and BOEM approval.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
7	C, post-C	Mitigation to resolve adverse effects to Ancient Submerged Land Forms (Targets 21–26, 28–31, and 33–35)	Ethnographic Study. The lessee will fulfill the following commitments: funding ethnographic researcher selected by DTI for 2-year period; funding for researcher travel to New Jersey for research and site visits; funding for Delaware Tribe of Indians, Delaware Nation, and Stockbridge-Munsee Community Band of Mohican Indians technology upgrades associated with analysis of GIS data; funding for Delaware Tribe of Indians historic preservation oversight and indirect costs; funding for Stockbridge-Munsee Community Band of Mohican Indians THPO collaboration; provide relevant ASLF GIS data layers to Delaware Tribe of Indians for use in this study as well as provide a tutorial on the data; hold quarterly progress update calls lasting approximately one-half hour with Delaware Tribe of Indians until the final technical reports are issued; delivery of Final deliverables consisting of one confidential report that may contain sensitive resource information and one report that could be made available to the public (both reports will be distributed by the Tribes, at their discretion);	Cultural Resources	BOEM, BSEE, USACE, NJDEP

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
			and funding for a presentation to highlight the results of the study to be coordinated and executed by Delaware Tribe of Indians. Other consulting parties will be notified of completion of this measure. This measure may be completed pre, during or post-construction.		
8	C, post-C	Multi-property and Multi-county mitigation	Historic Context addressing early 20th century New Jersey Shore Hotels. To resolve adverse effects to Brigantine Hotel, Atlantic County, Ritz-Carlton Hotel, Atlantic County, Haddon Hall/Resorts Casino Hotel, Atlantic County, and Flanders Hotel, Cape May County, the lessee will coordinate with BOEM to consult with New Jersey SHPO and interested Consulting Parties and property owners to determine what properties or areas will be the subject of the historic context and appropriate information to include. Tasks associated with the Historic Context Mitigation Measures can occur during and/or after construction, but must be completed within four years of MOA execution, unless the MOA is amended to reflect a different timeline.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
9	C, post-C	Multi-property and Multi-county mitigation	Historic Context addressing Mid-century High-rise residential buildings at the New Jersey shore. To resolve adverse effects on Riviera Apartments, Atlantic City, Atlantic County and Vassar Square Condominiums, Ventnor City, Atlantic County, the lessee will coordinate with BOEM to consult with New Jersey SHPO and interested Consulting Parties and property owners to determine what properties or areas will be the subject of the historic context and appropriate information to include. Tasks associated with the Historic Context Mitigation Measures can occur during and/or after construction, but must be completed within four years of MOA execution, unless the MOA is amended to reflect a different timeline.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
10	C, post-C	Multi-property and Multi-county mitigation	Historic Context addressing Boardwalks of the New Jersey Shore, with Surveys and Evaluations of Atlantic City Boardwalk, Ocean City Boardwalk, and Wildwood Boardwalk. To resolve adverse effects on Atlantic City Boardwalk, and Ocean City Boardwalk, the lessee will prepare a historic context and complete surveys and evaluations of Atlantic City Boardwalk, Ocean City Boardwalk, and Wildwood Boardwalk. The historic context will consider significance of historic boardwalks as potential cultural landscapes. the lessee, in coordination with BOEM, will consult with New Jersey SHPO and interested Consulting Parties and property owners to determine what properties or areas will be the subject of survey and evaluation, and appropriate information to include. Tasks associated with the Historic Context Mitigation Measures can occur during and/or after construction, but must be completed within four years of MOA execution, unless the MOA is amended to reflect a different timeline.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
11	C, post-C	Mitigation to resolve adverse effects on Lucy the Margate Elephant	Funding for Visitor Experience and Public Access for Lucy the Margate Elephant. The lessee will: determine priority projects in collaboration with the representatives for the property owner; use already available plans or develop plans appropriate to the identified project, and submit plans for review by BOEM and representatives of the property owner; take necessary steps to ensure the project is carried out by qualified contractors, including staff who meet SOI Professional Qualifications for Architecture or Architectural History, who will execute plans; and take necessary steps to ensure planned work is completed.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
12	C, post-C	Mitigation to resolve adverse effects on Absecon Lighthouse, Atlantic City	Funding for Visitor Experience and Public Access for Absecon Lighthouse. The lessee will: determine priority projects in collaboration with the representatives for the property owner; use already available plans or develop plans appropriate to the identified project, and submit plans for review by BOEM and representatives of the property owner; take necessary steps to ensure the project is carried out by qualified contractors, including staff who meet SOI Professional Qualifications for Architecture or Architectural History, who will execute plans; and take necessary steps to ensure planned work is completed.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
13	C, post-C	Mitigation to resolve adverse effects on Atlantic City Boardwalk, Atlantic City	Funding for Visitor Experience and Public Access for Atlantic City Boardwalk. The lessee will: determine priority projects in collaboration with the representatives for the property owner; use already available plans or develop plans appropriate to the identified project, and submit plans for review by BOEM and representatives of the property owner; take necessary steps to ensure the project is carried out by qualified contractors, including staff who meet SOI Professional Qualifications for Architecture or Architectural History, who will execute plans; and take necessary steps to ensure planned work is completed.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
14	Within 90 days of initiating C	Mitigation to resolve adverse effects on 14 historic properties	Lessee will contribute funding to a mitigation fund to resolve visual adverse effects to the following 15 historic properties: Brigantine Hotel, Brigantine City; Atlantic City Convention Hall, Atlantic City; Ritz-Carlton Hotel, Atlantic City; Haddon Hall/Resorts Casino Hotel, Atlantic City; Riviera Apartments, Atlantic City; Vassar Square Condominiums, Ventnor City; House at 114 South Harvard Avenue, Ventnor City; Great Egg Coast Guard Station, Longport Borough; Ocean City Boardwalk, Ocean City; Ocean City Music Pier, Ocean City; Hereford Lighthouse, North Wildwood; North Wildwood Life Saving Station, North Wildwood; U.S. Lifesaving Station #35, Stone Harbor Borough; Flanders Hotel, Ocean City; and Little Egg Harbor U.S. Life Saving Station #23 (U.S. Coast Guard Station #119), Little Egg Harbor Township. Funding from the lessee will be deposited into a compensatory mitigation fund to be managed by a third-party administrator for the purpose of providing grants in support of preservation, interpretation, or commemoration of historic sites, buildings, or events.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
15	Prior to C	Phased Identification	If Alternative B-1, B-2, C-1, C-2, or D is selected, BOEM will implement steps for phased identification and evaluation of historic properties within the Marine APE in accordance with BOEM's existing Guidelines for Providing Archaeological and Historic Property Information Pursuant to Title 30 Code of Federal Regulations Part 585. The final identification and evaluation of historic properties within the APE may occur after publication of the Final EIS, but prior to the initiation of construction.	Cultural Resources	BOEM, BSEE, USACE, NJDEP

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
16	C and post-C	Comply with the stipulations of the Section 106 MOA	The lessee will comply with the stipulations included in the executed Memorandum of Agreement developed with consulting parties during Section 106 consultation.	Cultural Resources	BOEM, BSEE, USACE, NJDEP
BOEM-proposed Mitigation and Monitoring Measures in the NMFS BA as Amended					
1	C and post-C	Incorporate LOA requirements	The measures required by the final MMPA LOA would be incorporated into COP approval, and BOEM and/or BSEE will monitor compliance with these measures.	Marine Mammals	BOEM and BSEE
2	C, post-C monitoring	PAM Plan	BOEM, BSEE, and USACE would ensure that Ocean Wind prepares a PAM Plan that describes all proposed equipment, deployment locations, detection review methodology and other procedures, and protocols related to the required use of PAM for monitoring.	ESA-listed Fish, Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
3	C	Pile driving monitoring plan	BOEM would ensure that Ocean Wind prepare and submit a *Pile Driving Monitoring Plan* to NMFS and BSEE (at OSWsubmittals@bsee.gov) for review and concurrence at least 90 days before start of pile driving. The plan would detail all plans and procedures for sound attenuation as well as for monitoring ESA-listed whales and sea turtles during all impact and vibratory pile driving. The plan would also describe how BOEM, BSEE, and Ocean Wind would determine the number of whales exposed to noise above the Level B harassment threshold during pile driving with the vibratory hammer to install the cofferdam at the sea to shore transition. Ocean Wind would obtain NMFS' concurrence with this plan prior to starting any pile driving.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
4	C	PSO Coverage	BOEM, BSEE, and USACE would ensure that PSO coverage is sufficient to reliably detect whales and sea turtles at the surface in clearance and shutdown zones to execute any pile driving delays or shutdown requirements. If, at any point prior to or during construction, the PSO coverage that is included as part of the proposed action is determined not to be sufficient to reliably detect ESA-listed whales and sea turtles within the clearance and shutdown zones, additional PSOs and/or platforms would be deployed. Determinations prior to construction would be based on review of the *Pile Driving Monitoring Plan*. Determinations during construction would be based on review of the weekly pile driving reports and other information, as appropriate.	Marine Mammals, Sea Turtles	BOEM, BSEE, and USACE
5	C	Shutdown zones	BOEM, BSEE, and USACE would ensure that if the clearance and/or shutdown zones are expanded, PSO coverage is sufficient to reliably monitor the expanded clearance and/or shutdown zones. Additional observers would be deployed on additional platforms for every 1,500 m that a clearance or shutdown zone is expanded beyond the distances modeled prior to verification.	Marine Mammals, Sea Turtles	BOEM, BSEE, and USACE
6	C	Sound field verification	BOEM, BSEE, and USACE may consider reductions in the pre-start clearance and/or shutdown zones based on the sound field verification measurements. BOEM and BSEE would ensure that Ocean Wind submits a Sound Field Verification Plan for review and approval at least 90 days prior to the planned start of pile driving.	Marine Mammals, Sea Turtles	BOEM, BSEE, and USACE
7	C	UXO detonations – Atlantic sturgeon	Ocean Wind would extend the APM seasonal restriction of UXO detonations (January to April) to include months of increased Atlantic sturgeon presence in the offshore wind area. No UXOs can be detonated from November to April in the offshore areas greater than 3 nautical miles (state waters). UXO surveys are expected in Fall of 2022 which defines the exact location and size of UXO.	ESA-listed Fish	BOEM, BSEE, and NMFS
8	C	Monitoring zone for sea turtles	BOEM, BSEE, and USACE would ensure that Ocean Wind monitors the full extent of the area where noise would exceed the 175 dB rms threshold for sea turtles for the full duration of all pile driving activities and for 30 minutes following the cessation of pile driving activities and record all observations in order to ensure that all take that occurs is documented.	Sea Turtles	BOEM, BSEE, and USACE
9	C, O&M, D	Look out for sea turtles and reporting	Between June 1 and November 30, Ocean Wind would have a trained lookout posted on all vessel transits during all phases of the project to observe for sea turtles. The trained lookout would communicate any sightings, in real time, to the captain so that the requirements in (e) below can be implemented. a. The trained lookout would monitor https://seaturtlesightings.org/ prior to each trip and report any observations of sea turtles in the vicinity of the planned transit to all vessel operators/captains and lookouts on duty that day. b. The trained lookout would maintain a vigilant watch and monitor a Vessel Strike Avoidance Zone (500 m) at all times to maintain minimum separation distances from ESA-listed species. Alternative monitoring technology (e.g., night vision, thermal cameras, etc.) would be available to ensure effective watch at night and in any other low visibility conditions. If the trained lookout is a vessel crew member, this would be their designated role and primary responsibility while the vessel is transiting. Any designated crew lookouts would receive training on protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. c. If a sea turtle is sighted within 100 m or less of the operating vessel's forward path, the vessel operator would slow down to 4 knots (unless unsafe to do so) and then proceed away from the turtle at a speed of 4 knots or less until there is a separation distance of at least 100 m at which time the vessel may resume normal operations. If a sea turtle is sighted within 50 m of the forward path of the	Sea Turtles	BOEM, BSEE, and USACE

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
			operating vessel, the vessel operator would shift to neutral when safe to do so and then proceed away from the turtle at a speed of 4 knots. The vessel may resume normal operations once it has passed the turtle. d. Vessel captains/operators would avoid transiting through areas of visible jellyfish aggregations or floating sargassum lines or mats. In the event that operational safety prevents avoidance of such areas, vessels would slow to 4 knots while transiting through such areas. e. All vessel crew members would be briefed in the identification of sea turtles and in regulations and best practices for avoiding vessel collisions. Reference materials would be available aboard all project vessels for identification of sea turtles. The expectation and process for reporting of sea turtles (including live, entangled, and dead individuals) would be clearly communicated and posted in highly visible locations aboard all project vessels, so that there is an expectation for reporting to the designated vessel contact (such as the lookout or the vessel captain), as well as a communication channel and process for crew members to do so. f. The only exception is when the safety of the vessel or crew necessitates deviation from these requirements on an emergency basis. If any such incidents occur, they must be reported to NMFS and BSEE within 24 hours. g. If a vessel is carrying a PSO or trained lookout for the purposes of maintaining watch for North Atlantic right whales, an additional lookout is not required and this PSO or trained lookout must maintain watch for whales and sea turtles.		
10	C, post-C monitoring	Sampling gear	All sampling gear would be hauled at least once every 30 days, and all gear would be removed from the water and stored on land between survey seasons to minimize risk of entanglement.	ESA-listed Fish, Marine Mammals, Sea Turtles	BOEM and BSEE
11	C, post-C monitoring	Gear identification	To facilitate identification of gear on any entangled animals, all trap/pot gear used in the surveys would be uniquely marked to distinguish it from other commercial or recreational gear. Using yellow and black striped duct tape, place a 3-foot-long mark within 2 fathoms of a buoy. In addition, using black and white paint or duct tape, place 3 additional marks on the top, middle and bottom of the line. These gear marking colors are proposed as they are not gear markings used in other fisheries and are therefore distinct. Any changes in marking would not be made without notification and approval from NMFS.	ESA-listed Fish, Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
12	C, post-C monitoring	Lost survey gear	If any survey gear is lost, all reasonable efforts that do not compromise human safety would be undertaken to recover the gear. All lost gear would be reported to NMFS (nmfs.gar.incidental-take@noaa.gov) and BSEE (OSWIncidentReporting@bsee.gov) within 24 hours of the documented time of missing or lost gear. This report would include information on any markings on the gear and any efforts undertaken or planned to recover the gear.	ESA-listed Fish, Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
13	C, O&M, D	Marine debris awareness training	The Lessee would ensure that vessel operators, employees, and contractors engaged in offshore activities pursuant to the approved COP complete marine trash and debris awareness training annually. The training consists of two parts: (1) viewing a marine trash and debris training video or slide show (described below); and (2) receiving an explanation from management personnel that emphasizes their commitment to the requirements. The marine trash and debris training videos, training slide packs, and other marine debris related educational material may be obtained at https://www.bsee.gov/debris or by contacting BSEE. The training videos, slides, and related material may be downloaded directly from the website. Operators engaged in marine survey activities would continue to develop and use a marine trash and debris awareness training and certification process that reasonably assures that their employees and contractors are in fact trained. The training process would include the following elements: • Viewing of either a video or slide show by the personnel specified above; • An explanation from management personnel that emphasizes their commitment to the requirements; • Attendance measures (initial and annual); and • Recordkeeping and the availability of records for inspection by DOI. By January 31 of each year, the Lessee would submit to DOI an annual report that describes its marine trash and debris awareness training process and certifies that the training process has been followed for the previous calendar year. The Lessee would send the reports via email to BOEM (at renewable_reporting@boem.gov) and to BSEE (at marinedebris@bsee.gov).	ESA-listed Fish, Marine Mammals, Sea Turtles	BOEM and BSEE
14	C, post-C monitoring	Training	At least one of the survey staff onboard the trawl surveys and ventless trap surveys would have completed NEFOP observer training (within the last 5 years) or other training in protected species identification and safe handling (inclusive of taking genetic samples from Atlantic sturgeon). Reference materials for identification, disentanglement, safe handling, and genetic sampling procedures would be available on board each survey vessel. BOEM and BSEE would ensure that Ocean Wind prepares a training plan that addresses how this requirement would be met and that the plan is submitted to NMFS in advance of any trawl or trap surveys. This requirement is in place for any trips where gear is set or hauled.	ESA-listed Fish	BOEM, BSEE, and NMFS

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15	C, post-C monitoring	Sea turtle disentanglement	Vessels deploying fixed gear (e.g., pots/traps) would have adequate disentanglement equipment (i.e., knife and boathook) onboard. Any disentanglement would occur consistent with the Northeast Atlantic Coast STDN Disentanglement Guidelines at https://www.reginfo.gov/public/do/DownloadDocument?objectID=102486501 and the procedures described in "Careful Release Protocols for Sea Turtle Release with Minimal Injury" (NOAA Technical Memorandum 580; https://repository.library.noaa.gov/view/noaa/3773).	Sea Turtles	BOEM, BSEE, and NMFS
16	C, post-C monitoring	Sea turtle/Atlantic sturgeon identification and data collection	Any sea turtles or Atlantic sturgeon caught and/or retrieved in any fisheries survey gear would first be identified to species or species group. Each ESA-listed species caught and/or retrieved would then be properly documented using appropriate equipment and data collection forms. Biological data, samples, and tagging would occur as outlined below. Live, uninjured animals should be returned to the water as quickly as possible after completing the required handling and documentation. a. The Sturgeon and Sea Turtle Take Standard Operating Procedures would be followed (https://media.fisheries.noaa.gov/dammigration/sturgeon_&_sea_turtle_take_sops_external.pdf). b. Survey vessels would have a passive integrated transponder (PIT) tag reader onboard capable of reading 134.2 kHz and 125 kHz encrypted tags (e.g., Biomark GPR Plus Handheld PIT Tag Reader) and this reader be used to scan any captured sea turtles and sturgeon for tags. Any recorded tags would be recorded on the take reporting form (see below). c. Genetic samples would be taken from all captured Atlantic sturgeon (alive or dead) to allow for identification of the DPS of origin of captured individuals and tracking of the amount of incidental take. This would be done in accordance with the Procedures for Obtaining Sturgeon Fin Clips (https://media.fisheries.noaa.gov/dammigration/sturgeon_genetics_sampling_revised_june_2019.pdf). i. Fin clips would be sent to a NMFS approved laboratory capable of performing genetic analysis and assignment to DPS of origin. To the extent authorized by law, BOEM is responsible for the cost of the genetic analysis. Arrangements would be made for shipping and analysis in advance of submission of any samples; these arrangements would be confirmed in writing to NMFS within 60 days of the receipt of this ITS. Results of genetic analysis, including assigned DPS of origin would be submitted to NMFS within 6 months of the sample collection. ii. Subsamples of all fin clips and accompanying metadata forms would be held and submitted to a tissue repository (e.g. the Atlantic Coast Sturgeon Tissue Research Repository) on a quarterly basis. The Sturgeon Genetic Sample Submission Form is available for download at: https://www.fisheries.noaa.gov/new-england-midatlantic/consultations/section-7-take-reporting-programmaticsgreater-atlantic). d. All captured sea turtles and Atlantic sturgeon would be documented with required measurements and photographs. The animal's condition and any marks or injuries would be described. This information would be entered as part of the record for each incidental take. A NMFS Take Report Form would be filled out for each individual sturgeon and sea turtle (download at: https://media.fisheries.noaa.gov/2021-41507/Take%20Report%20Form%2007162021.pdf?null) and submitted to NMFS as described below.	ESA-listed Fish, Sea Turtles	BOEM, BSEE, and NMFS
17	C, post-C monitoring	Sea turtle/Atlantic sturgeon handling and resuscitation guidelines	Any sea turtles or Atlantic sturgeon caught and retrieved in gear used in fisheries surveys would be handled and resuscitated (if unresponsive) according to established protocols and whenever at-sea conditions are safe for those handling and resuscitating the animal(s) to do so. Specifically: a. Priority would be given to the handling and resuscitation of any sea turtles or sturgeon that are captured in the gear being used, if conditions at sea are safe to do so. Handling times for these species should be minimized (i.e., kept to 15 minutes or less) to limit the amount of stress placed on the animals. b. All survey vessels would have copies of the sea turtle handling and resuscitation requirements found at 50 CFR 223.206(d)(1) prior to the commencement of any on-water activity (download at: https://media.fisheries.noaa.gov/dammigration/sea_turtle_handling_and_resuscitation_measures.pdf). These handling and resuscitation procedures would be carried out any time a sea turtle is incidentally captured and brought onboard the vessel during the proposed actions. c. If any sea turtles that appear injured, sick, or distressed, are caught and retrieved in fisheries survey gear, survey staff would immediately contact the Greater Atlantic Region Marine Animal Hotline at 866-755-6622 for further instructions and guidance on handling the animal, and potential coordination of transfer to a rehabilitation facility. If unable to contact the hotline (e.g., due to distance from shore or lack of ability to communicate via phone), the USCG should be contacted via VHF marine radio on Channel 16. If required, hard-shelled sea turtles (i.e., non-leatherbacks) may be held on board for up to 24 hours following handling instructions provided by the Hotline, prior to transfer to a rehabilitation facility. d. Attempts would be made to resuscitate any Atlantic sturgeon that are unresponsive or comatose by providing a running source of water over the gills as described in the Sturgeon Resuscitation Guidelines (https://media.fisheries.noaa.gov/dammigration-miss/Resuscitation-Cards-120513.pdf).	ESA-listed Fish, Sea Turtles	BOEM, BSEE, and NMFS

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			e. Provided that appropriate cold storage facilities are available on the survey vessel, following the report of a dead sea turtle or sturgeon to NMFS, and if NMFS requests, any dead sea turtle or Atlantic sturgeon would be retained on board the survey vessel for transfer to an appropriately permitted partner or facility on shore as safe to do so. f. Any live sea turtles or Atlantic sturgeon caught and retrieved in gear used in any fisheries survey would ultimately be released according to established protocols and whenever at-sea conditions are safe for those releasing the animal(s) to do so.		
18	C, post-C monitoring	Take notification	GARFO PRD would be notified as soon as possible of all observed takes of sea turtles, and Atlantic sturgeon occurring as a result of any fisheries survey. Specifically: a. GARFO PRD would be notified within 24 hours of any interaction with a sea turtle or sturgeon (nmfs.gar.incidental-take@noaa.gov and BSEE at protectedspecies@bsee.gov). The report would include at a minimum: (1) survey name and applicable information (e.g., vessel name, station number); (2) GPS coordinates describing the location of the interaction (in decimal degrees); (3) gear type involved (e.g., bottom trawl, gillnet, longline); (4) soak time, gear configuration and any other pertinent gear information; (5) time and date of the interaction; and (6) identification of the animal to the species level. Additionally, the e-mail would transmit a copy of the NMFS Take Report Form (download at: https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null) and a link to or acknowledgement that a clear photograph or video of the animal was taken (multiple photographs are suggested, including at least one photograph of the head scutes). If reporting within 24 hours is not possible due to distance from shore or lack of ability to communicate via phone, fax, or email, reports would be submitted as soon as possible; late reports would be submitted with an explanation for the delay. b. At the end of each survey season, a report would be sent to NMFS that compiles all information on any observations and interactions with ESA-listed species. This report would also contain information on all survey activities that took place during the season including location of gear set, duration of soak/trawl, and total effort. The report on survey activities would be comprehensive of all activities, regardless of whether ESA-listed species were observed.	ESA-listed Fish, Sea Turtles	BOEM, BSEE, and NMFS
19	C, O&M, D	Monthly/annual reporting requirements	BOEM and BSEE would ensure that Ocean Wind submits regular reports (in consultation with NMFS) necessary to document the amount or extent of take that occurs during all phases of the proposed action. Details of reporting would be coordinated between Ocean Wind, NMFS, BOEM and BSEE. All reports would be sent to: nmfs.gar.incidental-take@noaa.gov and BSEE at OSWsubmittals@bsee.gov.	ESA-listed Fish, Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
20	O&M	BOEM/NMFS meeting requirements for sea turtle take documentation	To facilitate monitoring of the incidental take exemption for sea turtles, through the first year of operations, BOEM and NMFS would meet twice annually to review sea turtle observation records. These meetings/conference calls would be held in September (to review observations through August of that year) and December (to review observations from September to November) and would use the best available information on sea turtle presence, distribution, and abundance, project vessel activity, and observations to estimate the total number of sea turtle vessel strikes in the action area that are attributable to project operations. These meetings would continue on an annual basis following year 1 of operations. Upon mutual agreement of NMFS and BOEM, the frequency of these meetings can be changed.	Sea Turtles	BOEM, BSEE, and NMFS
21	C, O&M, D	Data Collection BA BMPs	BOEM would ensure that all Project Design Criteria and Best Management Practices incorporated in the Atlantic Data Collection consultation for Offshore Wind Activities (June 2021) shall be applied to activities associated with the construction, maintenance and operations of the Ocean Wind project as applicable.	ESA-listed Fish, Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
22	C	Alternative Monitoring Plan (AMP) for Pile Driving	The Lessee must not conduct pile driving operations at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state) prevent visual monitoring of the full extent of the clearance and shutdown zones. The Lessee must submit an AMP to BOEM and NMFS for review and approval at least 6 months prior to the planned start of pile-driving. This plan may include deploying additional observers, alternative monitoring technologies such as night vision, thermal, and infrared technologies, or use of PAM and must demonstrate the ability and effectiveness to maintain all clearance and shutdown zones during daytime as outlined below in Part 1 and nighttime as outlined in Part 2 to BOEM's and NMFS's satisfaction. The AMP must include two stand-alone components as described below: • Part 1 – Daytime when lighting or weather (e.g., fog, rain, sea state) conditions prevent visual monitoring of the full extent of the clearance and shutdown zones. Daytime being defined as one hour after civil sunrise to 1.5 hours before civil sunset. • Part 2 – Nighttime inclusive of weather conditions (e.g., fog, rain, sea state). Nighttime being defined as 1.5 hours before civil sunset to one hour after civil sunrise. If a protected marine mammal or sea turtle is observed entering or found within the shutdown zones after impact pile-driving has commenced, the Lessee would follow the shutdown procedures outlined in Section 2.4.2.5.4 of the Protected Species Mitigation Monitoring Plan (PSMMP). The Lessee would notify BOEM and NMFS of any shutdown occurrence during piling driving operations with 24 hours of the occurrence unless otherwise authorized by BOEM and NMFS.	Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
			The AMP should include, but is not limited to the following information: • Identification of night vision devices (e.g., mounted thermal/IR camera systems, hand-held or wearable NVDs, IR spotlights), if proposed for use to detect protected marine mammal and sea turtle species. • The AMP must demonstrate (through empirical evidence) the capability of the proposed monitoring methodology to detect marine mammals and sea turtles within the full extent of the established clearance and shutdown zones (i.e., species can be detected at the same distances and with similar confidence) with the same effectiveness as daytime visual monitoring (i.e., same detection probability). Only devices and methods demonstrated as being capable of detecting marine mammals and sea turtles to the maximum extent of the clearance and shutdown zones will be acceptable. • Evidence and discussion of the efficacy (range and accuracy) of each device proposed for low visibility monitoring must include an assessment of the results of field studies (e.g., Thayer Mahan demonstration), as well as supporting documentation regarding the efficacy of all proposed alternative monitoring methods (e.g., best scientific data available). • Procedures and timeframes for notifying NMFS and BOEM of Ocean Wind's intent to pursue nighttime pile-driving. • Reporting procedures, contacts and timeframes. BOEM may request additional information, when appropriate, to assess the efficacy of the AMP.		
23	O&M	Periodic Underwater Surveys, Reporting of Monofilament and Other Fishing Gear Around WTG Foundations	The Lessee must monitor indirect impacts associated with charter and recreational fishing gear lost from expected increases in fishing around WTG foundations by surveying at least 10 of the WTGs located closest to shore in the Ocean Wind 1 Lease Area (OCS-A 0498) annually. Survey design and effort may be modified with review and concurrence by DOI. The Lessee may conduct surveys by remotely operated vehicles, divers, or other means to determine the frequency and locations of marine debris. The Lessee must report the results of the surveys to BOEM (at renewable_reporting@boem.gov) and BSEE (at marinedebris@bsee.gov) in an annual report, submitted by April 30, for the preceding calendar year. Annual reports must be submitted in Word format. Photographic and videographic materials must be provided on a portable drive in a lossless format such as TIFF or Motion JPEG 2000. Annual reports must include survey reports that include: the survey date; contact information of the operator; the location and pile identification number; photographic and/or video documentation of the survey and debris encountered; any animals sighted; and the disposition of any located debris (i.e., removed or left in place). Annual reports must also include claim data attributable to the Ocean Wind 1 project from Ørsted's corporate gear loss compensation policy and procedures. Required data and reports may be archived, analyzed, published, and disseminated by BOEM	ESA-listed Fish, Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
24	C, O&M, D	PDC Minimize Vessel Interactions with Listed Species (from HRG Programmatic)	All vessels associated with survey activities (transiting [i.e., travelling between a port and the survey site] or actively surveying) must comply with the vessel strike avoidance measures specified below. The only exception is when the safety of the vessel or crew necessitates deviation from these requirements. • If any ESA-listed marine mammal is sighted within 500 meters of the forward path of a vessel, the vessel operator must steer a course away from the whale at <10 knots (18.5 km/hr) until the minimum separation distance has been established. Vessels may also shift to idle if feasible. • If any ESA-listed marine mammal is sighted within 200 meters of the forward path of a vessel, the vessel operator must reduce speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 500 meters. If stationary, the vessel must not engage engines until the large whale has moved beyond 500 meters.	ESA-listed Fish, Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
25	O&M	Operational Sound Field Verification Plan	BOEM would require the Lessee to develop an operational sound field verification plan to determine the operational noises emitted from the Offshore Wind Area. The plan would be reviewed and approved by BOEM and NMFS.	ESA-listed Fish, Marine Mammals, Sea Turtles	BOEM, BSEE, and NMFS
BOEM-proposed Mitigation and Monitoring Measures in the NMFS EFH Assessment					
1	C and post-C	Live and Hard Bottom Impact Monitoring	The Lessee would develop and implement a monitoring plan for live and hard-bottom features that may be affected by proposed activities. The monitoring plan would also include assessing the recovery time for these sensitive habitats. BOEM recommends that all monitoring reports classify substrate conditions following the Coastal and Marine Ecological Classification Standards (CMECS), including live bottoms (e.g., submerged aquatic vegetation and corals and topographic features). The plan would also include a means of recording observations of any increased coverage of invasive species in the affected hard-bottom areas.	EFH	BOEM, BSEE, and NMFS
2	C, O&M, D	Live and Hard Bottom Mapping and Avoidance	Vessel operators would be provided with maps of sensitive hard-bottom habitat in OSW project area, as well as a proposed anchoring plan that would avoid or minimize impacts on the hard-bottom habitat to the greatest extent practicable. These plans would be provided for all anchoring activity, including construction, maintenance, and decommissioning.	EFH	BOEM, BSEE, and NMFS

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
3	C, O&M	Intake Screens on Pump Intakes for In-shore Hydraulic Dredges	All hydraulic dredge intakes should be covered with a mesh screen or screening device that is properly installed and maintained to minimize potential for impingement or entrainment of fish species. The screening device on the dredge intake should prevent the passage of any material greater than 1.25" in diameter, with a maximum opening of 1.25"x 6". Water intakes should be positioned at an appropriate depth to avoid or minimize the entrainment of eggs and larvae. Intake velocity should be limited to less than 0.5 ft/sec.	EFH	BOEM, BSEE, and NMFS
4	C	Scour and Cable Protection	To the extent technically and economically feasible, the Lessee must ensure that all materials used for scour and cable protection consist of natural or engineered stone that does not inhibit epibenthic growth. The materials selected for protective purposes should mirror the natural environment and provide similar habitat functions.	EFH	BOEM, BSEE, and NMFS
EFH Conservation Recommendations[3] BOEM and USACE Intend to Adopt or Partially Adopted					
EFH Conservation Recommendations for Activities within the OCS - BOEM					
CR #1	C	WTG Removal and Relocation	Avoid installing WTGs in high relief sand ridge and trough complex areas and areas [on small to medium spatial scales] of high habitat heterogeneity (diversity of structural elements, including bathymetric features) and complexity. Specifically, the following eight (8) WTGs should be removed: a. A06; B07; A07; A09; B09; C09; D09, which are included in the Sand Ridge and Trough Avoidance Alternative (D) area; b. D10, which was not included in the original 15 potential WTGs for removal, but meets the intent and purpose of the alternative, as it is located in the broad sand ridge and trough complex area (east portion of the lease area). i. Should D10 not be removed, it should be shifted (microsited) the maximum allowable distance1 west-southwest to avoid the habitats described above.	EFH	BOEM, BSEE, and NMFS
CR #2	C	Micrositing of WTGs or Rerouting of IACS: B08, E07, F07, G09, G03, J03, D02, B06/B05 IAC, F01, D10/Z01 IAC, F09/F08 IAC, F07/F06 IAC, G09/G08 IAC, J03-I03 IAC	Microsite WTGs and interarray and export cables to avoid high relief sand ridge and trough complex area and/or areas of high habitat heterogeneity (diversity of structural elements, including bathymetric features) and complexity. Specifically, the following WTG and inter-array should be microsited: a. B08 should be shifted the maximum allowable distance east or east-northeast. b. E07 should be shifted north or northeast. c. F07 should be shifted the maximum allowable distance south. d. G09 should be shifted the maximum allowable distance north or northwest. e. G03 should be shifted the maximum allowable distance south. f. J03 should be shifted the maximum allowable distance north-northeast. g. D02 should be shifted south to fulfill the goals mentioned above and to minimize impacts to the New Jersey Prime Fishing Ground known as "Triple Lumps." h. B06 should be shifted east or east-southeast and B05 should be shifted east or east-northeast to fulfill the goals mentioned above and to minimize impacts to the N.J. Prime Fishing Ground known as "Atlantic City Bluefish Lump." i. F01 should be shifted the maximum allowable distance south or southeast to fulfill the goals mentioned above and to minimize impacts to the N.J. Prime Fishing Ground known as "The Ham." j. The inter-array cable connecting B06 to B05 should be re-routed to avoid intersection/overlap with "Atlantic City Bluefish Lump." k. The inter-array cable connecting D10 to substation ZO1 should be re-routed to fulfill the goals mentioned above, including benthic features found in the seafloor disturbance footprint area of D09. l. The inter-array cable connecting F09 to F08 should be re-routed to fulfill the goals mentioned above; the cable should avoid areas of complex habitat ("NOAA Complexity Category" displayed on various maps/online viewers). When avoidance is not feasible, the cable should cross these areas perpendicularly and at the narrowest point (s). m. The inter-array cable connecting F07 to F06 should be re-routed first west then east (in an arc) of the current route to avoid bathymetric features and areas of high rugosity/bottom heterogeneity that occur in the proposed west-northwest linear route. The cable should avoid areas of complex habitat ("NOAA Complexity Category"). When avoidance is not feasible, the cable should cross these areas perpendicularly and at the narrowest point(s).	EFH	BOEM, BSEE, and NMFS

[3] NMFS EFH Consultation letter dated February 24, 2023 provided EFH Conservation Recommendations for activities under BOEM's jurisdiction and activities under USACE's jurisdiction.

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			n. The inter-array cable connecting G09 to G08 should be re-routed to fulfill the goals mentioned above; the cable should avoid areas of complex habitat ("NOAA Complexity Category"). When avoidance is not feasible, the cable should cross these areas perpendicularly and at the narrowest point(s). o. The inter-array cable connection J03 to I03 should be re-routed to fulfill the goals mentioned above; the cable should avoid areas of complex habitat ("NOAA Complexity Category"). When avoidance is not feasible, the cable should cross these areas perpendicularly and at the narrowest point(s).		
CR #3	C	Inter-array and Export Cable Micrositing Plan	For cables not mentioned above (in #2), an inter-array and export cable micrositing plan should be developed to avoid long-term to permanent adverse impacts to complex habitats and benthic features within the lease area. Cables should be microsited around all identified large boulders/habitat elements (i.e., >/= 0.5 m in diameter) and into low multibeam backscatter return areas without benthic features (i.e., sand ripples, waves). a. At a minimum, the micrositing plan should include: 1) depictions of the microsited cables (i.e., include a figure depicting large boulder locations, multibeam backscatter returns, and the proposed microsited cable); 2) information describing how the microsited locations were selected (i.e., what information other than multibeam backscatter and boulder locations was used to determine the cable path); and 3) for any cables that are identified to be infeasible to be fully microsited around large boulders and within low multibeam backscatter areas, detailed information supporting the feasibility issues encountered, calculated impact areas of large boulders and/or medium to high multibeam backscatter area, and impact minimization measures to be used should be provided. b. The micrositing plan should be submitted for our review and comment (including comments that may change the plan and on-the-ground activities) at least 120 days prior to in-water site-preparation activities. BOEM should provide a response to NMFS comments and an updated copy of the plan at least 30 days before in-water work begins.	EFH	BOEM, BSEE, and NMFS
CR #4	C	Scour Protection and Scour Protection Plan	In order to minimize permanent adverse impacts from the elimination/conversion of existing habitats from scour protection, the project should: a. Avoid and minimize the use of scour protection by fully burying cables (this can be done by siting cables in appropriate substrates) and using the minimum amount of scour protection to accomplish the purpose/intent of the scour protection; b. Use natural, rounded stone of consistent grain size in the entirety of the sand ridge and trough complex area and any areas of complex habitat; c. Avoid the use/placement of engineered stone (e.g., riprap; cut, crushed, or graded stone; etc.) or concrete mattresses within complex habitats or the sand ridge and trough complex area. If the use of engineered stone or concrete mattresses is required within these areas, the impact should be mitigated through the addition of a natural, rounded stone veneer. At a minimum, the exposed surface layer should be designed and selected to provide three-dimensional structural complexity that creates a diversity of crevice sizes (e.g., mixed stone sizes, natural rounded stone veneer) and rounded edges (e.g., tumbled stone, or natural round stone veneer); d. Develop a scour and cable protection plan for all complex habitat areas. At a minimum, the plan should include: 1) a clear depiction of the location and extent of proposed scour or cable protection within complex habitat (i.e., figures displaying existing areas with large boulders and/or medium to high multibeam backscatter returns and the extent of scour or cable protection proposed within each area); 2) all available habitat information for each identified areas (e.g., plan view imagery, video transects); and 3) detailed information on the proposed scour or cable protection materials for each area. e. The scour and cable protection plan should be submitted to NMFS for our review and comment (including comments that may change the plan and on-the-ground activities) at least 120 days prior to in-water work. BOEM should provide a response to NMFS comments and an updated copy of the plan at least 30 days before in-water work begins.	EFH	BOEM, BSEE, and NMFS
CR #5	C, O&M, D	Anchoring Plan	Avoid anchoring in complex habitats and areas of high habitat heterogeneity and complexity during all phases of the project including any area where large boulders (>/= 0.5 m in diameter), medium to high multibeam backscatter returns occur, or large benthic features occur (not inclusive of ripples/megaripples): a. If anchoring is necessary in complex habitats and areas of high habitat heterogeneity during cable installation, extend the anchor lines to the extent practicable to minimize the number of times the anchors must be raised and lowered to reduce the amount of habitat disturbance. This should not be done if the anchor chain sweep area includes benthic features that will be impacted. b. An anchoring plan should be developed to demonstrate how anchoring will be avoided and minimized in these habitats during all phases of the project. . c. For any area where large boulders or medium to high multibeam backscatter returns occur and vessels must remain stationary, dynamic positioning systems (DPS) or mid-line buoys on anchor chains should be required.	EFH	BOEM, BSEE, and NMFS

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			d. At a minimum, the anchoring plan to be developed should include: 1) depictions of the lease and export cable areas that clearly identify areas, using GPS location coordinates, where large boulders and/or medium to high backscatter returns occur, and either: a) DPS, or b) mid-lines buoys are required for anchoring; 2) information describing the operations and number of vessels that will be necessary to maintain vessel position using DPS or mid-line buoys within complex areas (i.e., large boulder and medium to high multibeam backscatter areas); and 3) for any complex habitat area that is identified for it to be infeasible to be fully avoid anchoring within or using mid-line buoys, detailed information supporting the feasibility issues encountered, calculated impact areas of large boulders and/or medium to high multibeam backscatter area, and impact minimization measures to be used should be provided. e. A copy of the anchoring plan, with complex habitat coordinates, should be provided to all vessel operators. f. The anchoring plan should be submitted to NMFS for our review and comment (including comments that may change the plan and on-the-ground activities) at least 120 days prior to in-water work. BOEM should provide a response to NMFS comments and an updated copy of the plan at least 30 days before in-water work begins.		
CR #6	C	Boulder Relocation	For boulder/cobble removal/relocation activities, boulders and cobble should be moved as close to the impact area as practicable in areas immediately adjacent to existing similar complex bottom and placed in a manner that does not hinder navigation or impede commercial fishing and avoids impacts to existing complex habitats: a. In order to minimize impacts to complex habitats, boulders that will be relocated using boulder "pick" methods should be relocated outside the area necessary to clear and placed along the edge of existing complex habitats such that the placement of the relocated boulders will result in a marginal expansion of complex habitats into soft-bottom habitats (i.e., boulders should be placed outside the relocation area and in an area of low multibeam backscatter return immediately adjacent to medium or high return areas) and reduce risk to navigation and fishing operations in the area. b. A boulder relocation plan should be developed that identifies where boulders will be removed from and where they will be placed. We recommend resource agencies and the fishing industry be consulted in preparation of the boulder relocation plan. The plan should identify all areas where a boulder plow will be used during site-preparation. At a minimum, the plan should include: 1) a clear depiction (i.e., figures) of the location of boulder relocation activities specified by activity type (e.g., pick or plow, removal or placement) and overlaid on multibeam acoustic backscatter data; 2) a detailed methodology for each type of boulder relocation activity and technical feasibility constraints; 3) any proposed measures to minimize impacts to attached epifaunal assemblages on boulder surfaces; 4) measures taken to avoid further adverse impacts to complex habitat and fishing operations; and 5) a summary of any consultation with resources agencies and the fishing industry in development of the plan. c. The boulder relocation plan should be submitted to NMFS for our review and comment (including comments that may change the plan and on-the-ground activities) at least 120 days prior to in-water work. BOEM should provide a response to NMFS comments and an updated copy of the plan at least 30 days before in-water work begins.	EFH	BOEM, BSEE, and NMFS
CR #7	C and post-C	Benthic Feature Removal/Clearance Avoidance or Remediation	In all offshore/nearshore areas where seafloor preparation activities will occur, benthic feature removal/clearance (i.e., sand wave clearance) via dredging, plowing, use of mass flow excavators, or other methods should be avoided through micrositing WTGs and re-routing cables. Where plows, jets, grapnel runs or other similar methods are used, post-construction surveys capable of detecting bathymetry changes of 0.5 ft. or less should be completed to determine the height and width of any created berms. In any area where the berm height exceeds one foot above the existing grade, the created berm should be restored to match that of the existing grade/pre-construction conditions.	EFH	BOEM, BSEE, and NMFS
CR #8	C	Noise Mitigation Measures	Noise mitigating measures should be required during construction, such as soft start procedures and the deployment of noise dampening equipment such as bubble curtains. BOEM should require the development of a specific plan outlining noise mitigation procedures in consultation with the resource agencies prior to any construction activities (BOEM's documents outline potential noise mitigation options but does not currently specify which will be used): a. The noise mitigation plan should be filed with BOEM for approval before construction commences. This should include a minimum of 90 days for the resource agencies to review and provide comments. BOEM should provide a response to NMFS comments and an updated copy of the plan at least 30 days before in-water work begins. The noise mitigation plan should include a process for notifying resource agencies within 24 hours if any evidence of a fish kill during construction activity is observed, and contingency plans to resolve issues. b. Additional noise dampening/mitigation measures, beyond what is currently proposed, should be used during pile installation for WTGs and OSSs near discrete, specific sensitive sites, such as known artificial reef sites to avoid and minimize potential impacts. c. For WTGs and OSSs—including most WTGs of Rows 1 through 8 and OSSs 1 and 2—with the potential to impact artificial reefs and species using those reefs within the Atlantic City Reef and Great Egg Harbor artificial reef sites, additional noise dampening devices	EFH	BOEM, BSEE, and NMFS

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			that result in greater noise dampening should be included to avoid and minimize impacts to habitats and species. Devices may include, but are not limited to isolation casings, isolation casings with bubble curtains inside, and double-walled isolation casings.		
CR #9	Prior to C, C, O&M	Benthic Habitat Monitoring Plan	The Benthic Habitat Monitoring Plan should be revised to address our concerns (expressed in various RAI requests mentioned above) related to the adequacy of the proposed methods to detect changes in the existing benthic community structure in the offshore and inshore project areas. The plan should be required to address potential changes to macrobenthic communities across and within each habitat type in the project area, including the artificial substrates to be constructed. a. The plan should include pre-construction/baseline monitoring data, which should be collected for a minimum of three years for each survey conducted. b. The plan should include post-construction monitoring of the existing, natural soft and hard bottom benthic community structure within the lease and export cable corridor, post-construction benthic community development and invasive species (e.g., Didemnum vexillum) growth on: 1) constructed habitats, 2) natural habitats within the expected area of project impacts, and 3) within adjacent areas outside the area of impact. c. The monitoring plan should also include measures to evaluate: 1) physical changes to the benthic habitat including depth, hardness, rugosity, slope, and other morphometrics through the regular collection of acoustic data (bathymetry and backscatter), 2) demersal juvenile fish species response to habitat impacts, 3) shellfish and SAV responses to habitat impacts, and 4) invasive species distribution and abundance with associated plans for removing/managing invasives. d. The applicant should consult with the resource agencies in the revision and refinement of this plan and give the resource agencies a minimum of 90 days to review and comment on the plan. The applicant should ultimately file the plan with BOEM for approval. BOEM should ensure that the applicant's filing addresses, and includes, all resource agency comments, as well as the applicant's response to those comments.	EFH	BOEM, BSEE, and NMFS
CR #10	Prior to C, C, O&M	Fisheries Monitoring Plan	The Fisheries Monitoring Plan should be revised to address our concerns expressed in our September 10, 2021, letter that have not yet been resolved, including examining specific impact producing factors, addressing survey design issues, assessing early life history stages (e.g. eggs, larvae, juveniles) composition and distribution, and ensuring sufficient baseline data are collected (e.g., the trawl survey has yet to begin). We also recommend the examination of stomach contents to assess dietary changes that may result from habitat conversion and changes to predator/prey relationships. Note regarding surveys: a. The plan should state clear hypotheses and the specific experimental approaches and analytical methods planned to address each hypothesis. b. Baseline monitoring data should be collected for a minimum of three years for each survey conducted. c. Data should be collected using standardized methods that are consistent with those used by regional surveys. d. Control locations should be sited outside of the likely zone of impact from wind development and have similar habitat types as the project area. e. Experimental designs capable of detecting effects of impact producing factors should be used. f. Specific studies on early life history stages (e.g., eggs, larvae, and juveniles), including transport and settlement, should be included in the plan. g. Potential changes to inshore-offshore transport and settlement of larvae and juveniles (e.g., through altered hydrodynamics) should be evaluated through monitoring. It is important to note that the large, highly productive estuarine system of Great Bay and Little Egg Harbor/Inlet are adjacent to the export cable and wind farm area. h. Response variables should include changes in abundance and distribution, size distribution, condition, and stomach contents. i. Transparent protocols for data storage, access, and sharing should be part of the plan.	EFH	BOEM, BSEE, and NMFS
CR #12	Pre-D	Decommissioning	The EFH consultation should be reinitiated prior to decommissioning turbines to ensure that the impact to EFH as a result of the decommissioning activities have been fully evaluated and minimized to the extent practicable.	EFH	BOEM, BSEE, and NMFS
EFH Conservation Recommendations - USACE jurisdiction					
CR #1	C and post-C	Benthic Feature Removal/Clearance Avoidance or Remediation	In all nearshore areas where seafloor preparation activities will occur, benthic feature removal/clearance (i.e., sand wave clearance) via dredging, plowing, use of mass flow excavators, or other methods should be avoided through micrositing and re-routing cables. Where plows, jets, grapnel runs or other similar methods are used, post-construction surveys capable of detecting bathymetry changes of 0.5 ft. or less should be completed to determine the height and width of any created berms. In any area where the berm height exceeds one foot above the existing grade, the created berm should be restored to match that of the existing grade/pre-construction conditions.	EFH	USACE and NMFS

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CR #3	C	Winter Flounder Time-of-Year Restriction	Dredging, plowing, or other extractive or turbidity/sediment-generating activities should be avoided in Barnegat Bay/estuarine areas from January 1 to May 31 of any given year to avoid and minimize impacts to EFH for winter flounder early life stages (eggs, larvae).	EFH	USACE and NMFS
CR #4	C and post-C	HDD, Micrositing, and Re-routing to Avoid/Minimize SAV, Shellfish Bed and Benthic Feature Impacts	In all inshore/estuarine areas (i.e. Barnegat Bay, Great Egg Harbor Bay) where seafloor preparation and cable installation activities will occur, impacts to SAV, shellfish beds, and benthic features should be avoided and minimized through the use of horizontal directional drilling (HDD), micrositing and re-rerouting, to the maximum extent practicable. a. All disturbed areas should be restored to pre-construction conditions, inclusive of bathymetry, contours, and sediment types. b. Pre-construction surveys to determine bathymetry, contours and sediment types and post-construction surveys should be conducted to verify restoration has occurred. Survey results should be provided to NMFS.	EFH	USACE and NMFS
CR #5	C	Floating Vessels	All vessels should float at all stages of the tide.	EFH	USACE and NMFS
CR #6	Pre-C	Inadvertent Return Contingency Plans	Detailed frac-out plans should be developed for all areas where HDD is proposed to be used. These plans should be shared with us at a minimum 60 days prior to construction.	EFH	USACE and NMFS
CR #7	C	Open Trenching Restoration	Avoid trenching in open waters, especially areas supporting SAV and shellfish, and wetlands. a. If open trenching is used, excavated materials should not be sidecast or placed in the aquatic environment. All materials should be stored on uplands and placed back into the trench to restore the excavated areas, or removed to a suitable upland disposal site. Trenched areas should be restored to pre-construction conditions with native and/or clean, compatible material.	EFH	USACE and NMFS
CR #8	Pre-C, C and post-C	SAV Surveys, Impact Avoidance, and Mitigation	Avoid cable installation, dredging or other construction activities in submerged aquatic vegetation (SAV), particularly in Barnegat Bay. a. Post-construction surveys should be conducted to document the recovery of areas temp b. Barges should not be moored in SAV or SAV habitat. Maps derived from updated surveys should be provided to vessels/captains to ensure SAV is avoided; c. Dredging, plowing, or other extractive or turbidity/sediment-generating activities should be avoided during the growing season (April 15 to October 15) of any given year to avoid and minimize impacts to SAV. d. Should the applicant need to dredge/plow during the growing season of any given year, a minimum 500-ft. buffer between dredging/plowing area(s) and the edge of any SAV bed should be maintained between April 15 and October 15 of any year. The appropriate buffer is 250-ft. if the sediments are greater than 95% sand. Sequencing of dredging/plowing can be used to accommodate this buffer. e. Provide compensatory mitigation for all areas of SAV impacted by construction activities including cable installation and dredging at a minimum ratio of 3:1. Based upon the information in various plans, documents, GIS viewing tools, the area of unavoidable SAV impact appears to be at least 2.9 acres (minimum). However, we are not yet certain that is accurate given the various export cable alignments.	EFH	USACE and NMFS
CR #9	Pre-C, C and post-C	Shellfish Surveys and Mitigation	Avoid installing cables, dredging, or other construction activities in high and moderate densities of shellfish in Barnegat and Great Egg Harbor Bay and surrounding estuarine waters. Project-specific surveys should be conducted to complement existing NJDEP mapping efforts. a. Systematic visual pre-construction surveys should be conducted to document occurrence and abundance/density of shellfish. Three years of pre-construction surveys are recommended to account for yearly variations in SAV presence. However, at a minimum, one survey should be done during the growing season in the same calendar year construction commences (i.e., if cable installation is scheduled to begin July 1, 2023, surveys should take place in 2023, prior to June 30). Visual surveys should be conducted within 5,000 ft. (2,500 ft. on both sides of cable centerline or 2,500 ft. of a unified centerline between both cables) of any area to be dredged/plowed/jetted. b. Provide compensatory mitigation for impacts to areas of soft clams, oysters, and high and moderate densities of hard clams that cannot be avoided. Mitigation should be coordinated with the New Jersey Department of Environmental Protection's Bureau of Shellfisheries.	EFH	USACE and NMFS
CR #10	Pre-C, C and post-C	Shellfish and SAV Monitoring Plan	An inshore/estuarine shellfish and SAV-specific monitoring plan should be developed to monitor potential construction-related (trenching/sedimentation) and operational impacts (heat, EMF) to SAV and shellfish in Barnegat Bay. At a minimum, monitoring should be conducted within 5,000 ft. (2,500 ft. on both sides of cable centerline or 2,500 ft. of a unified centerline between both cables) of any area to be dredged/plowed/jetted. A before–after-gradient (BAG) survey design should be employed for any monitoring. This monitoring can be included in Benthic Habitat or Fisheries Monitoring plans (mentioned above).	EFH	USACE and NMFS
CR #11	C	HDD Wetlands	Use horizontal directional drilling in areas where the export cable crosses wetlands.	EFH	USACE and NMFS

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CR #12	C	Equipment Staging	Do not stage equipment in wetlands.	EFH	USACE and NMFS
CR #13	C	Construction Mats	Use construction mats if work in wetlands is unavoidable.	EFH	USACE and NMFS
CR #14	C and post-C	Wetland Restoration and Monitoring	Restore all impacted wetlands to pre-construction conditions and monitor the restored areas for a minimum of five years to ensure successful restoration. a. Provide NMFS with a copy of the restoration plan for review and comment at least 60 days prior to the issuance of a DA permit. b. The restoration plan should be approved prior to the issuance of the DA permit and be included as a special condition of the permit.	EFH	USACE and NMFS
CR #15	C	Compensatory Wetland Mitigation	Provide compensatory mitigation for all permanent impacts to wetlands and short-term/temporary impacts lasting more than 12 months. a. Quantify all permanent and short-term/temporary impacts and provide project plans delineating the areas impacted prior to the issuance of the DA permit. b. Compensatory mitigation ratios should be as follows: i. A minimum 3:1 ratio if the mitigation is the enhancement or restoration/rehabilitation of existing wetlands. ii. A minimum 2:1 ratio if the mitigation is the creation of wetlands from uplands or the restoration/rehabilitation of areas that are currently uplands but were once wetlands.	EFH	USACE and NMFS
CR #16	Pre-C	Compensatory Mitigation Plan	Compensatory mitigation should be provided for any unavoidable direct, indirect and individual, cumulative, synergistic impacts to SAV, shellfish, and wetlands. A compensatory mitigation plan that satisfies each element of a complete compensatory mitigation plan as identified in the published regulations 33 CFR Parts 325 and 332 “Compensatory Mitigation for Losses of Aquatic Resources,” (Mitigation Rule) should be provided for NMFS review prior to project authorization. This plan should be included as a special condition of the permit. a. Compensatory mitigation should occur prior to, or concurrently with, the impacts. b. The compensatory mitigation plans should be made special conditions of the DA permit.	EFH	USACE and NMFS
FWCA #2	Pre-C, C and post-C	Communication Plan	A communication plan identifying the locations of relocated boulders and any cable protection measures (i.e., concrete mattresses) should be developed to help inform marine users, including, but not limited to the fishing industry and entities conducting scientific surveys, of potential gear obstructions.	EFH	USACE and NMFS
FWCA #3	C and post-C	Artificial Reef Impact Avoidance and Monitoring	Impacts to the Atlantic City and Great Egg harbor artificial reefs should be avoided due to their importance as habitat for a variety of federally and state managed species in addition to strong recreational fisheries. a. Additional noise attenuating devices such as isolation casings should be used during pile driving of WTGs and OSSs that may impact these artificial reef areas through elevated underwater noise. b. Conduct in-situ monitoring of artificial reefs pre-, during, and post-construction to evaluate temporary, short-term and permanent impacts to these habitats and the species (e.g., black sea bass, tautog, weakfish, scup) that use them: i. Hydrophones should be used to monitor/ directly measure noise at various reefs throughout the broader Atlantic City and Great Egg Harbor reef sites. This monitoring will provide insights (validations) on the expected noise levels and distances described in the EFH assessment and other documents and will enable comparisons of “observed” (real world) versus “expected” (modeled/predicted). Monitoring should establish ambient noise levels (pre-construction) and determine noise levels from pile installation activities(during) and operation (post-construction) of the WTGs and farm; ii. Camera systems (e.g., GoPro's) and other relevant methods (e.g., direct observation via divers) should be used to monitor fish behavior. iii. Traps and camera systems should be used to monitor fish species occurrence, community composition, and density/abundance. iv. Monitoring data should be analyzed using statistically rigorous methods to evaluate the potential impacts of elevated underwater noise from pile installation and WTG and wind farm operation on artificial reefs.	EFH	USACE and NMFS
Reasonable and Prudent Measures and Terms and Conditions from the NMFS Biological Opinion Issued April 3, 2023					
RPM 1	C	Pile Driving	Effects to ESA-listed whales and sea turtles must be minimized during pile driving. This includes adherence to the mitigation measures specified in the final MMPA ITA.	ESA-listed marine mammals, sea turtles	BOEM, BSEE, and NMFS
RPM 2	C	UXO Detonation	Effects to ESA-listed whales and sea turtles must be minimized during UXO detonation. This includes adherence to the mitigation measures specified in the final MMPA ITA.	ESA-listed marine mammals, sea turtles	BOEM, BSEE, and NMFS

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RPM 3	C, O&M, D	Vessel Operations	Vessels operated by Ocean Wind or under contract to Ocean Wind or its contractors must comply with the RPMs and Terms and Conditions relevant to vessel operations within the Delaware River and Delaware Bay included in the Incidental Take Statements provided with NMFS GARFO's July 19, 2022, Paulsboro Marine Terminal Biological Opinion and February 25, 2022, New Jersey Wind Port Biological Opinion, or any subsequently issued Opinions that replace those Opinions as a result of reinitiation.	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS
RPM 4	C, O&M, D	Reporting Requirements	Effects to, or interactions with, ESA-listed Atlantic sturgeon, whales, and sea turtles must be documented during all phases of the proposed action, and all incidental take must be reported to NMFS GARFO.	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS
RPM 5	C	Review of Plans	All required plans must be submitted to NMFS GARFO with sufficient time for review, comment, and approval.	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS
RPM 6	C, O&M, D	On-site Observation and Inspection	On-site observation and inspection must be conducted to gather information on the effectiveness and implementation of measures to minimize and monitor incidental take during activities described in this Opinion, including its Incidental Take Statement.	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS
T&C 1	C	Pile Driving and UXO Detonation	To implement the requirements of RPM 1 and 2, the measures required by the final MMPA ITA must be incorporated into any project authorizations/approvals, and the relevant Federal agency must monitor Ocean Wind's compliance with these measures: a. BOEM must require, through an enforceable condition of their approval of Ocean Wind's Construction and Operations Plan, that Ocean Wind comply with any measures in the final MMPA ITA that are revised from, or in addition to, measures included in the proposed ITA, which already have been incorporated into the proposed action. b. NMFS OPR must ensure that all mitigation measures as prescribed in the final ITA are implemented by Ocean Wind. c. The USACE must require, through an enforceable condition of any permit issued to Ocean Wind, compliance with any measures in the final MMPA ITA that are revised from, or in addition to, measures included in the proposed ITA, which have been incorporated into the proposed action.	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS
T&C 2	C	UXO Detonation	To implement the requirements of RPM 2, the following measures must be implemented by Ocean Wind: a. Establish a clearance zone for sea turtles extending 500 m around any planned UXO detonation. Maintain the clearance zone for at least 60 minutes prior to any UXO detonation. This requirement expands the size of the clearance zone identified by BOEM as part of the proposed action. Ocean Wind must ensure that there is sufficient PSO coverage to reliably document sea turtle presence within the clearance zone. In the event that a PSO detects a sea turtle outside the 500 m clearance zone, detonation will be delayed until the sea turtle has not been observed for 30 minutes. b. Provide NMFS GARFO with notification of planned UXO detonation as soon as possible but at least 48 hours prior to the planned detonation, unless this 48-hour notification would create delays to the detonation that would result in imminent risk of human life or safety. This notification must include the coordinates of the planned detonation, the estimated charge size, and any other information available on the characteristics of the UXO. NMFS GARFO will provide alerts to NMFS sea turtle and marine mammal stranding network partners consistent with best practices. Notification must be provided via email to nmfs.gar.incidental-take@noaa.gov and by phone to the NMFS GARFO Protected Resources Division (978-281-9328).	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS
T&C 3	C, O&M, D	Vessel Operations	To implement the requirements of RPM 3, the following conditions must be implemented by vessels transiting to/from the Paulsboro Marine Terminal, consistent with the terms and conditions of the July 19, 2022 Paulsboro Biological Opinion and any subsequent Opinion or amended ITS: a. No later than March 1 of each year, report the number of vessel calls to the Paulsboro Marine Terminal in the previous year by month. This report must also include the type of vessel and its draft. Reports must be filed with the USACE Philadelphia District and NMFS GARFO (nmfs.gar.incidental-take@noaa.gov). (Reference: RPM 1, Term and Condition 1 of the 2022 Paulsboro Biological Opinion) b. Report any sturgeon observed with injuries or mortalities in the Paulsboro Marine Terminal Area to NMFS within 24 hours using the form available at: https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null. Submit forms to nmfs.gar.incidental-take@noaa.gov within 24 hours. (Reference: RPM 2, Term and Condition 2 of the 2022 Paulsboro Biological Opinion). c. Hold any dead sturgeon in cold storage until proper disposal procedures are discussed with NMFS GARFO. (Reference: RPM 3, Term and Condition 5 of the 2022 Paulsboro Biological Opinion).	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
			d. Complete procedures for genetic sampling of any dead Atlantic sturgeon that are over 75 cm. (Reference RPM 4, Term and Condition 6 of the 2022 Paulsboro Biological Opinion). More information on submitting genetic samples is included in Term and Condition 6a below; these instructions are consistent with the requirements of the 2022 Paulsboro Opinion. e. In the event that the 2022 Paulsboro Opinion is replaced as a result of reinitiation, or its ITS is amended, comply with the requirements of any new Incidental Take Statement relevant to vessels transiting to/from the Paulsboro Marine Terminal. NMFS GARFO will strive to provide a copy of any new Opinions or amended ITSs to BOEM, BSEE, other action agencies, and Ocean Wind within three business days of their availability.		
T&C 4	C, O&M, D	Vessel Operations	To implement the requirements of RPM 3, the following conditions must be implemented by vessels transiting to/from the New Jersey Wind Port, consistent with the terms and conditions of the February 25, 2022 New Jersey Wind Port Biological Opinion and any subsequent Opinion or amended ITS: a. No later than March 1 of each year, report the number of vessel calls to the New Jersey Wind Terminal in the previous year by month. This report must also include the type of vessel and its draft. Reports must be filed with the USACE Philadelphia District and NMFS GARFO (nmfs.gar.incidental-take@noaa.gov). (Reference: RPM 1, Term and Condition 2 of the 2022 NJWP Biological Opinion) b. Report any sturgeon observed with injuries or mortalities in the Paulsboro Marine Terminal Area to NMFS within 24 hours using the form available at: https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null. Submit forms to nmfs.gar.incidental-take@noaa.gov within 24 hours. (Reference: RPM 3, Term and Condition 4 of the 2022 NJWP Biological Opinion). c. Hold any dead sturgeon in cold storage until proper disposal procedures are discussed with NMFS GARFO. (Reference: RPM 4, Term and Condition 7 of the 2022 NJWP Biological Opinion). d. Complete procedures for genetic sampling of any Atlantic sturgeon over 75 cm. (Reference: RPM 3, Term and Condition 8 of the 2022 NJWP Biological Opinion). More information on submitting genetic samples is included in Term and Condition 6a below; these instructions are consistent with the requirements of the 2022 NJWP Opinion. e. In the event that the 2022 NJWP Opinion is replaced as a result of reinitiation or its ITS is amended, comply with the requirements of any new Incidental Take Statement relevant to vessels transiting to/from the NJWP. NMFS GARFO will strive to provide a copy of any new Opinions or amended ITSs to BOEM, BSEE, other action agencies, and Ocean Wind within three business days of their availability.	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS
T&C 5	C	Reporting Requirements	To implement the requirements of RPM 4, Ocean Wind must file a report with NMFS GARFO (nmfs.gar.incidental-take@noaa.gov) in the event that any ESA listed species is observed within the identified shutdown zone during active pile driving. This report must be filed within 48 hours of the incident and include the following: duration of pile driving prior to the detection of the animal, location of PSOs and any factors that impaired visibility or detection ability, time of detection of the animal, time the PSO called for shutdown, time the pile driving was stopped, and any measures implemented (e.g., reduced hammer energy) prior to shutdown. The report must also include the time that the animal was last detected and any PSO reports on the behavior of the animal. If shutdown was determined not to be feasible, the report must include an explanation for that determination and the measures that were implemented (e.g., reduced hammer energy).	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS
T&C 6	C	Reporting Requirements	To implement the requirements of RPM 4, BOEM, BSEE, USACE, and Ocean Wind must implement the following reporting requirements necessary to document the amount or extent of take that occurs during all phases of the proposed action: i. All observations or collections of injured or dead whales, sea turtles, or sturgeon must be reported within 48 hours to NMFS GARFO Protected Resources Division by email (nmfs.gar.incidental-take@noaa.gov). Take reports should reference the Ocean Wind project and include the Take Report Form available on NMFS webpage (https://media.fisheries.noaa.gov/2021-07/Take%20Report%20Form%2007162021.pdf?null). Reports of Atlantic sturgeon take must include a statement as to whether a fin clip sample for genetic sampling was taken. Fin clip samples are required in all cases with the only exception being when additional handling of the sturgeon would result in an imminent risk of injury to the fish or the PSO, we expect such incidents to be limited to capture and handling of sturgeon in extreme weather. Instructions for fin clips and associated metadata are available at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-take-reporting-programmatics-greater-atlantic, under the "Sturgeon Genetics Sampling" heading. ii. If a North Atlantic right whale is observed at any time by PSOs or personnel on any project vessels, during any project-related activity or during vessel transit, Ocean Wind or their contractors must immediately report sighting information to NMFS (866-755-6622), the U.S. Coast Guard via channel 16 and through the WhaleAlert app (http://www.whalealert.org/). iii. In the event of a suspected or confirmed vessel strike of a sea turtle or sturgeon by any project vessel in any location, including observation of any injured sea turtle/sturgeon or sea turtle/sturgeon parts, Ocean Wind or their contractors must report the incident to	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
			NMFS GARFO (nmfs.gar.incidental-take@noaa.gov; and NMFS New England/Mid-Atlantic Regional Stranding Hotline (866-755-6622)) as soon as feasible. The report must include the following information: (A) Time, date, and location (latitude/longitude) of the incident; (B) Species identification (if known) or description of the animal(s) involved; (C) Vessel's speed during and leading up to the incident; (D) Vessel's course/heading and what operations were being conducted (if applicable); (E) Status of all sound sources in use; (F) Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike; (G) Environmental conditions (e.g., wind speed and direction, Beaufort scale, cloud cover, visibility) immediately preceding the strike; (H) Estimated size and length of animal that was struck; (I) Description of the behavior of the animal immediately preceding and following the strike; (J) Estimated fate of the animal (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and (K) To the extent practicable, photographs or video footage of the animal(s). iv. In the event that an injured or dead marine mammal or sea turtle is sighted, Ocean Wind or their contractor must report the incident to NMFS GARFO (nmfs.gar.incidental-take@noaa.gov), NMFS New England/Mid-Atlantic Regional Stranding Hotline (866-755-6622), and BSEE (protectedspecies@bsee.gov) as soon as feasible, but no later than 24 hours from the sighting. The report must include the following information: (A) Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable); (B) Species identification (if known) or description of the animal(s) involved; (C) Condition of the animal(s) (including carcass condition if the animal is dead); (D) Observed behaviors of the animal(s), if alive; (E) If available, photographs or video footage of the animal(s); and (F) General circumstances under which the animal was discovered. Staff responding to the hotline call will provide any instructions for handling or disposing of any injured or dead animals, which may include coordination of transport to shore, particularly for injured sea turtles. v. Ocean Wind must compile and submit weekly reports during pile driving that document the start and stop of all pile driving daily, the start and stop of associated observation periods by the PSOs, details on the deployment of PSOs, and a record of all observations of marine mammals and sea turtles. These weekly reports must be submitted to NMFS GARFO (nmfs.gar.incidental-take@noaa.gov), BOEM, and BSEE directly from the PSO providers and can consist of raw data. Weekly reports are due on Wednesday for the previous week (Sunday – Saturday). vi. Ocean Wind must compile and submit reports following any UXO detonation that provide details on the UXO that was detonated (e.g., charge size), location of the detonation, the start and stop of associated observation periods by the PSOs, details on the deployment of PSOs, and a record of all observations of marine mammals and sea turtles. This must include any observations of dead or injured fish or other marine life in the post detonation monitoring period. These reports must be submitted to NMFS GARFO (nmfs.gar.incidental-take@noaa.gov) and BOEM directly from the PSO providers and can consist of raw data. Reports must be submitted within one week of the detonation, with reports of dead or injured ESA listed species required to be submitted immediately, but no later than 24 hours following the observation. vii. Ocean Wind must compile and submit monthly reports that include a summary of all project activities carried out in the previous month, including trawl surveys, vessel transits (number, type of vessel, and route), and piles installed, and all observations of ESA listed whales, sea turtles, and sturgeon. These reports must be submitted to NMFS GARFO (nmfs.gar.incidental-take@Noaa.gov) and are due on the 15th of the month for the previous month.		
T&C 7	O&M	BOEM/NMFS meeting requirements for sea turtle take documentation	To implement the requirements of RPM 4 and to facilitate monitoring of the incidental take exemption for sea turtles, BOEM, BSEE, USACE, and NMFS must meet twice annually to review sea turtle observation records. These meetings/conference calls will be held in September (to review observations through August of that year) and December (to review observations from September to November) and will use the best available information on sea turtle presence, distribution, and abundance, project vessel activity, and observations to estimate the total number of sea turtle vessel strikes in the action area that are attributable to project operations.	Sea Turtles	BOEM, BSEE, and NMFS
T&C 8	C	Review of Plans	To implement RPM 5, within 10 business days of BSEE issuing a no objection to the complete Facility Design Report (FDR)/Fabrication and Installation Report (FIR) (but at least 30 calendar days prior to the initiation of pile driving) or the soonest time the relevant information is available, BOEM and/or BSEE must provide NMFS GARFO with the following information: number and size of foundations to be installed to support wind turbine generators and offshore substations, installation method for each of the seven planned cofferdams (i.e., gravity cell or sheet pile), the proposed construction schedule (i.e., months when pile driving is planned), and information that has become available on the ports identified for foundation fabrication and load out, WTG preassembly and load out, and cable staging. If at that time the amount or extent of incidental take is likely to exceed the maximum amount for each source and type of take considered in this ITS, consultation may need to be reinitiated. NMFS and BOEM will each endeavor to notify the other of the need to reinitiate consultation within 30 calendar days of BOEM's submission to NMFS, and NMFS' receipt, of the requested information.	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
T&C 9	C	Review of Plans	To implement RPM 5, BOEM, BSEE and/or Ocean Wind must submit the PSO Training Plan for Trawl Surveys as soon as possible after issuance of this Opinion but no later than 7 calendar days prior to the start of trawl surveys. BOEM, BSEE, and Ocean Wind must obtain NMFS GARFO's concurrence with this plan prior to the start of any trawl surveys. As described in Table 3.1.1, at least one of the survey staff onboard the trawl survey vessels must have completed NMFS Northeast Fisheries Observer Program training within the last 5 years or other training in protected species identification and safe handling (inclusive of taking genetic samples from Atlantic sturgeon). If Ocean Wind will deploy non-NEFOP trained observers, BOEM, BSEE, and/or Ocean Wind must submit a plan to NMFS describing the training that will be provided to the survey observers.	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS
T&C 10	C	Review of Plans	To implement RPM 5, the plans identified below must be submitted to NMFS GARFO by BOEM, BSEE and/or Ocean Wind at nmfs.gar.incidental-take@noaa.gov. For each plan, within 45 calendar days of receipt of the plan, NMFS GARFO will provide comments to BOEM, BSEE, and Ocean Wind, including a determination as to whether the plan is consistent with the requirements outlined in this ITS and/or in Table 3.3.1 of this Opinion. If the plan is determined to be inconsistent with these requirements, BOEM, BSEE and/or Ocean Wind must resubmit a modified plan that addresses the identified issues at least 15 calendar days before the start of the associated activity; at that time, BOEM, BSEE and NMFS will discuss a timeline for review and approval of the modified plan. BOEM, BSEE and Ocean Wind must receive NMFS GARFO's concurrence with these plans before the identified activity is carried out: a. Passive Acoustic Monitoring Plan. BOEM, BSEE and/or Ocean Wind must submit this Plan to NMFS GARFO at least 180 calendar days before impact pile driving is planned. BOEM, BSEE, and Ocean Wind must obtain NMFS GARFO's concurrence with this plan prior to the start of any pile driving. The Plan must include a description of all proposed PAM equipment, address how the proposed passive acoustic monitoring will follow standardized measurement, processing methods, reporting metrics, and metadata standards for offshore wind (Van Parijs et al., 2021). The plan must describe all proposed PAM equipment, procedures, and protocols including information to support that it will be able to detect vocalizing right whales within the clearance and shutdown zones. The plan must also incorporate the following requirements: If a North Atlantic right whale (NARW) is detected via real-time PAM, data shall be submitted by BOEM, BSEE and/or Ocean Wind to nmfs.pacmdata@noaa.gov using the NMFS Passive Acoustic Reporting System Metadata and Detection data spreadsheets (https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reportingsystem-templates as soon as feasible but no longer than 24 hours after the detection. BOEM, BSEE, and/or Ocean Wind must submit the completed data templates to nmfs.pacmdata@noaa.gov; the full acoustic species Detection data, Metadata and GPS data records, from real-time data, must be submitted within 90 calendar days via the ISO standard metadata forms available on the NMFS Passive Acoustic Reporting System website (https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reportingsystem-templates). BOEM, BSEE, and/or Ocean Wind must submit the completed data templates to nmfs.pacmdata@noaa.gov; the full acoustic recordings from real-time systems must be sent to NCEI for archiving within 90 calendar days after pile-driving has ended and instruments have been pulled from the water. b. Marine Mammal and Sea Turtle Monitoring Plan – Pile Driving and UXO Detonation. BOEM, BSEE, and/or Ocean Wind must submit this Plan to NMFS GARFO at least 90 calendar days before impact or vibratory pile driving or UXO detonation is planned. BOEM, BSEE, and/or Ocean Wind must obtain NMFS GARFO's concurrence with this plan prior to the start of any pile driving or carrying out any UXO detonation. The plan must include a description of all monitoring equipment and PSO protocols (including number and location of PSOs) for all pile driving and UXO detonations. The plan must detail all plans and procedures for sound attenuation as well as for monitoring ESA-listed whales and sea turtles during all impact and vibratory pile driving and UXO detonation. The plan would also describe how BOEM, BSEE, and Ocean Wind would determine the number of whales exposed to noise above the Level B harassment threshold during pile driving with the vibratory hammer to install cofferdams. c. Cofferdam Installation and Removal Monitoring Plan. BOEM, BSEE, and/or Ocean Wind must submit this Plan to NMFS GARFO at least 90 calendar days before vibratory pile driving is planned to begin. BOEM, BSEE, and Ocean Wind must obtain NMFS GARFO's concurrence with this plan prior to the start of any pile driving or the start of any cofferdam installation or removal with a vibratory hammer. This plan must include a description of how BOEM, BSEE, and Ocean Wind would determine the number of whales exposed to noise above the Level B harassment threshold during pile installation and removal with the vibratory hammer. This plan may be stand-alone or a component of the Pile Driving and Marine Mammal and Sea Turtle Monitoring Plan. d. Alternative Monitoring Plan/Night Time Pile Driving Monitoring Plan. BOEM, BSEE, and/or Ocean Wind must submit this Plan to NMFS GARFO at least 90 calendar days before impact pile driving is planned to begin. BOEM, BSEE, and Ocean Wind must obtain NMFS GARFO's concurrence with this plan prior to the start of pile driving. This plan must contain a thorough description of how Ocean Wind plans to monitor pile driving activities at night including proof of the efficacy of their night vision devices (e.g., mounted thermal/IR camera systems, hand-held or wearable night vision devices (NVDs), infrared (IR) spotlights) in detecting ESA listed marine mammals and sea turtles over the full extent of the required clearance and shutdown zones, including demonstration that the full extent of the minimum visibility zones (1,650 m May-November, 2,500 m December) can be effectively and reliably monitored. The	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
			Plan must identify the efficacy of the technology at detecting marine mammals and sea turtles in the clearance and shutdowns under all the various conditions anticipated during construction, including varying weather conditions, sea states, and in consideration of the use of artificial lighting. If the plan does not include a full description of the proposed technology, monitoring methodology, and data demonstrating to NMFS GARFO's satisfaction that marine mammals and sea turtles can reliably and effectively be detected within the clearance and shutdown zones for monopiles and pin piles before and during impact pile driving, nighttime pile driving (unless a pile was initiated 1.5 hours prior to civil sunset) may not occur. e. Sound Field Verification Plan. BOEM, BSEE, and/or Ocean Wind must submit to NMFS GARFO at least 180 calendar days before impact pile driving or UXO detonation is planned to begin. BOEM, BSEE, and Ocean Wind must obtain NMFS GARFO's concurrence with this plan prior to the start of pile driving or UXO detonation activities. The plan must describe how Ocean Wind would ensure that the first three monopile and pin pile installation sites and each UXO/MEC detonation site selected for SFV are representative of the rest of the monopile and pin pile installation and UXO/MEC sites. In the case that these sites are not determined to be representative of all other monopile and pin pile installation sites and UXO/MEC detonation locations, Ocean Wind must include information on how additional sites would be selected for SFV. The plan must also include methodology for collecting, analyzing, and preparing SFV data for submission to NMFS GARFO. The plan must describe how the effectiveness of the sound attenuation methodology would be evaluated based on the results. Ocean Wind must also provide, as soon as they are available but no later than 48 hours after each installation, the initial results of the SFV measurements to NMFS GARFO in an interim report after each monopile for the first 3 piles and pin pile installation for the first full jacket foundation (16 pin piles). f. North Atlantic Right Whale Vessel Strike Avoidance Plan. BOEM, BSEE, and/or Ocean Wind must submit to NMFS GARFO at least 90 calendar days prior to commencement of vessel use, with the exception of vessels deployed for the fisheries surveys. The plan must provide details on the vessel-based observer protocols on transiting vessels. If Ocean Wind plans to implement the Alternative Plan for vessel strike avoidance (i.e., implement PAM in the Atlantic City to lease area transit lane to allow vessel transit above 10 knots from May 1 – October 31) the plan must describe how PAM, in combination with visual observations, will be conducted to ensure the transit corridor is clear of North Atlantic right whales. Consistent with the requirements of the proposed MMPA ITA, unless and until the Plan is approved by NMFS (OPR and GARFO), all vessels transiting between the O&M facility and the lease area, year round, must comply with the 10-knot speed restriction.		
T&C 11	C, O&M, D	On-site Observation and Inspection	To implement the requirements of RPM 6, BOEM and BSEE must exercise their authorities to assess the implementation of measures to minimize and monitor incidental take of ESA-listed species during activities described in this Opinion. If any term and condition(s) is/are not being complied with, BOEM and/or BSEE, as appropriate, must immediately take effective action to ensure prompt implementation.	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS
T&C 12	C, O&M, D	On-site Observation and Inspection	To implement the requirements of RPM 6, Ocean Wind must consent to on-site observation and inspections by Federal agency personnel (including NOAA personnel) during activities described in the Biological Opinion, for the purposes of evaluating the effectiveness and implementation of measures designed to minimize or monitor incidental take.	ESA-listed fish, marine mammals, sea turtles	BOEM, BSEE, and NMFS
Conservation Measures and Reasonable and Prudent Measures and Terms and Conditions from the USFWS Biological Opinion Issued May 12, 2023					
Conservation Measures					
1	Project design, O&M	Turbine Configuration	Turbine Configuration: a. The WTG design provides a wind turbine air gap (minimum blade tip elevation to the sea surface) to minimize collision risk to marine birds (e.g., roseate terns) that may fly close to the ocean surface (BA Table 2-2, Measure BIRD-06). b. To minimize attracting birds (e.g., roseate terns) to operating turbines, Ocean Wind must install bird perching-deterrent devices where such devices can be safely deployed on WTGs and OSSs (BA Table 2-3, Measure 3a). Ocean Wind must submit for BOEM and Service approval a plan to deter perching on offshore infrastructure by roseate terns and other marine birds. The plan must include the type(s) and locations of bird perching-deterrent devices, include a maintenance plan for the life of the project, allow for modifications and updates as new information and technology become available, and track the efficacy of the deterrents. The plan will be based on best available science regarding the effectiveness of perching deterrent devices on minimizing collision risk. The location of bird-deterrent devices must be proposed by Ocean Wind based on best management practices applicable to the appropriate operation and safe installation of the devices. Ocean Wind must confirm the locations of bird perching-deterrent devices as part of the documentation it must submit with the Facility Design Report. (BA Table 2-3, Measure 3a).	Birds	BOEM, BSEE, and USFWS
2	O&M	Offshore Lighting	To aid safe navigation, Ocean Wind must comply with all Federal Aviation Administration (FAA), U.S. Coast Guard (USCG), and BOEM lighting, marking and signage requirements. Ocean Wind will comply with all applicable requirements while minimizing impacts through appropriate application, including directional aviation lights, that minimize visibility from shore. (BA Table 2-2, Measure GEN-07).	Birds	BOEM, BSEE, and USFWS

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
			a. Ocean Wind will use lighting technology that minimizes impacts on avian species to the extent practicable (BA Table 2-2, Measure BIRD-04). b. Ocean Wind will implement an aircraft detection lighting system (ADLS) on WTGs (BA Table 2-2, Measure GEN-07). Ocean Wind must use an FAA-approved vendor for the ADLS, which will activate the FAA hazard lighting only when an aircraft is in the vicinity of the wind facility to reduce visual impacts at night. Ocean Wind must confirm the use of an FAA-approved vendor for ADLS on WTGs and OSSs in the Fabrication and Installation Report. (BA Table 2-3, Measure 3b). c. Ocean Wind is required to light each WTG and OSS in a manner that is visible by mariners in a 360-degree arc around the structure. To minimize the potential of attracting migratory birds, the top of each USCG-required marine navigation light will be shielded to minimize upward illumination (conditional on USCG approval). (BA Table 2-3, Measure 3c). Coordination with USCG regarding maritime navigation lighting occurs post-COP approval, generally at least 120 calendar days prior to installation. The Service will be afforded an opportunity to review a copy of Ocean Wind's application to USCG to establish Private Aids to Navigation (PATON), which includes a lighting, marking, and signaling plan. The PATON application will include design specifications for maritime navigation lighting. Following approval of the PATON by the USCG, BOEM and the Service will work together to evaluate the USCG-approved navigation lighting system, in order to characterize the color, intensity, and duration of any light from maritime lanterns that is likely to reach the typical flight heights of listed birds, and will assess the degree to which the light is likely to attract or disorient listed birds. This information will be considered, as appropriate, in future estimates of project collision levels (see Conservation Measure 4, below), in any future updates to the incidental take statement accompanying this BO, and in future iterations of the Compensatory Mitigation Plan (see Conservation Measure 7, below).		
3	O&M	Collision Risk Model Support	BOEM has funded the development of a Stochastic Collision Risk Assessment for Movement (SCRAM), which builds on and improves earlier collision risk modeling frameworks. The Service fully supports SCRAM as a scientifically sound method for integrating best available information to assess collision risk for the three listed bird species. The first generation of SCRAM was released in early 2023 and still reflects a number of consequential data gaps and uncertainties. BOEM has already committed to funding Phase 2 of the development of SCRAM. We expect that the current limitations of SCRAM will decrease substantially over time as more and more tracking data get incorporated into the model (e.g., from more individual birds tagged in more geographic areas, improved bird tracking capabilities, and emerging tracking technologies), and as modeling methods and computing power continue to improve. Via this Conservation Measure, BOEM commits to continue funding the refinement and advancement of SCRAM, or its successor, with the goal of continually improving the accuracy and robustness of collision mortality estimates. This commitment is subject to the allocation of sufficient funds to BOEM from Congress. This commitment will remain in effect until one of the following occurs: i. the OW1 turbines cease operation; ii. the Service concurs that a robust weight of evidence has demonstrated that collision risks to all three listed birds from OW1 turbine operation are negligible (i.e., the risk of take from WTG operation is found to be discountable); or iii. the Service concurs that further development of SCRAM (or its successor) is unlikely to improve the accuracy or robustness of collision mortality estimates.	Birds	BOEM, BSEE, and USFWS
4	O&M	Collision Risk Model Utilization	BOEM will work cooperatively with the Service to re-run the SCRAM model (or its successor) for the OW1 project according to the following schedule: • At least annually for the first 3 years of WTG operation. • At least every other year for years 4 to 10 of WTG operation (i.e., years 4, 6, 8, and 10). • At least every 5 years between year 10 and the termination of WTG operation (i.e., years 15, 20, 25, and 30). Between these regularly scheduled model runs, BOEM will also re-run the SCRAM model (or its successor) within 90 days of each major model release or update, and at any time upon request by the Service or Ocean Wind, and at any time as desired by BOEM. Prior to each model run, BOEM and the Service will reach agreement on model inputs based on best available science, and the agencies may opt for multiple model runs using a range of inputs to reflect uncertainties in the inputs. The above schedule may be altered upon the mutual agreement of BOEM and the Service. The schedule is subject to sufficient allocation of funds to BOEM from Congress. This commitment will remain in effect until one of the following occurs: i. the OW1 turbines cease operation; ii. the Service concurs that a robust weight of evidence has demonstrated that collision risks to all three listed birds from OW1 turbine operation are negligible (i.e., the risk of take from WTG operation is found to be discountable); or iii. the Service concurs that further model runs are unlikely to improve the accuracy or robustness of collision mortality estimates.	Birds	BOEM, BSEE, and USFWS

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
			BOEM is currently undertaking a programmatic analysis of proposed offshore wind activities in the New York Bight, including activity on leases contiguous with Ocean Wind's Lease OCS-A 0498. To account for potential additive and synergistic effects of offshore wind infrastructure buildout across this section of the coast, BOEM will consider collision mortality estimates for OW1 in its assessment of overall collision risk for the New York Bight. The periodic updating of collision mortality estimates for OW1, according to the above schedule, may eventually be integrated into a regional or coastwide adaptive monitoring and impact minimization framework.		
5	C, O&M, D	Monitoring and Data Collection	An avian species monitoring plan for ESA-listed species and/or other priority species or groups will be developed and coordinated with the New Jersey Department of Environmental Protection (NJDEP) and the Service and implemented as required (BA Table 2-2, Measure BIRD-02 and Appendix B). BOEM will require that Ocean Wind develops and implements an Avian and Bat Post-Construction Monitoring Plan based on the Avian and Bat Post-Construction Monitoring Framework (COP Appendix AB) in coordination with the Service, NJDEP, and other relevant regulatory agencies. Annual monitoring reports will be used to determine the need for adjustments to monitoring approaches, consideration of new monitoring technologies, and/or additional periods of monitoring. (BA Table 2-3, Measure 5) Prior to or concurrent with offshore construction activities, Ocean Wind must submit an Avian and Bat Post-Construction Monitoring Plan for BOEM and Service review. BOEM and the Service will review the Avian and Bat Post-Construction Monitoring Plan and provide any comments on the plan within 30 calendar days of its submittal. Ocean Wind must resolve all comments on the Avian and Bat Post-Construction Monitoring Plan to the satisfaction of BOEM and the Service before implementing the plan (BA Table 2-3, Measure 5) and prior to the start of WTG operations. The objectives of the monitoring plan will be: (1) to advance understanding of how the target species utilize the offshore airspace and do (or do not) interact with the wind farm; (2) to improve the collision estimates from SCRAM (or its successor) for the three listed bird species; and (3) to inform any efforts aimed at minimizing collisions (see Conservation Measure 7, below) or other project effects on target species. a. Monitoring. Ocean Wind must conduct monitoring as outlined in the Avian and Bat Post-Construction Monitoring Framework (COP Appendix AB), which will include . . . use of radio-tags to monitor movement of ESA-listed birds in the vicinity of the project (BA Table 2-3, Measure 5). The Avian and Bat Post-Construction Monitoring Plan will allow for changing methods over time (see Conservation Measure 5.d, below) in order to regularly update and refine collision estimates for listed birds. The plan will include an initial monitoring phase involving deployment of Motus Wildlife Tracking System (Motus) radio tags on listed birds in conjunction with installation and operation of Motus receiving stations on turbines in the Lease Area following offshore Motus recommendations. The initial phase may also include deployment of satellite-based tracking technologies (e.g., GPS or Argos tags). b. Annual Monitoring Reports. Ocean Wind must submit to BOEM (at renewable_reporting@boem.gov), the Service, and the Bureau of Safety and Environmental Enforcement (BSEE) (at OSWSubmittals@bsee.gov) a comprehensive report after each full year of monitoring (pre- and post-construction) within 12 months of completion of the last avian survey. The report must include all data, analyses, and summaries regarding ESA-listed and non-ESA-listed birds and bats. BOEM, the Service, and BSEE will use the annual monitoring reports to assess the need for reasonable revisions (based on subject matter expert analysis) to the Avian and Bat Post-Construction Monitoring Plan. BOEM, BSEE, and the Service reserve the right to require reasonable revisions to the Avian and Bat Post-Construction Monitoring Plan and may require new technologies as they become available for use in offshore environments. (BA Table 2-3, Measure 5) (see Conservation Measure 5.d, below). c. Post-Construction Quarterly Progress Reports. Ocean Wind must submit quarterly progress reports during the implementation of the Avian and Bat Post-Construction Monitoring Plan to BOEM (at renewable_reporting@boem.gov) and the Service by the 15th day of the month following the end of each quarter during the first full year that the Project is operational. The progress reports must include a summary of all work performed, an explanation of overall progress, and any technical problems encountered. (BA Table 2-3, Measure 5). d. Monitoring Plan Revisions. Within 30 calendar days of submitting the annual monitoring report (pursuant to Conservation Measure 5.b, above), Ocean Wind must meet with BOEM, BSEE, the Service, and NJDEP to discuss the following: the monitoring results; the potential need for revisions to the Avian and Bat Post-Construction Monitoring Plan, including technical refinements or additional monitoring; and the potential need for any additional efforts to reduce impacts. If, based on this annual review meeting, BOEM and the Service jointly determine that revisions to the Avian and Bat Post-Construction Monitoring Plan are necessary, BOEM will require Ocean Wind to modify the Avian and Bat Post-Construction Monitoring Plan. If the projected collision levels, as informed by monitoring results, deviate substantially from the effects analysis included in this BO, Ocean Wind must transmit to BOEM recommendations for new mitigation measures and/or monitoring methods. (BA Table 2-3, Measure 5). The frequency, duration, and methods for various monitoring efforts in future revisions of the Avian and Bat Post-Construction Monitoring Plan will be determined adaptively based on current technology and the evolving weight of evidence regarding the likely levels of collision mortality for each	Birds	BOEM, BSEE, and USFWS

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
			listed bird species. The effectiveness and cost of various technologies/methods will be key considerations when revising the plan. Grounds for revising the Avian and Bat Post-Construction Monitoring Plan include, but are not limited to: (i) greater than expected levels of collision of listed birds; (ii) evolving data input needs (as determined by BOEM and the Service) for SCRAM (or its successor); (iii) changing technologies for tracking or otherwise monitoring listed birds in the offshore environment that are relevant to assessing collision risk; (iv) new information or understanding of how listed birds utilize the offshore environment and/or interact with wind farms; and (v) a need (as determined by BOEM and the Service) for enhanced coordination and alignment of tracking, monitoring, and other data collection efforts for listed birds across multiple wind farms/leases on the OCS. BOEM will require Ocean Wind to continue implementation of appropriate monitoring activities for listed birds (under the current and future versions of the Avian and Bat Post-Construction Monitoring Plan) until one of the following occurs: (i) the OW1 turbines cease operation; (ii) the Service concurs that a robust weight of evidence has demonstrated that collision risks to all three listed birds from OW1 turbine operation are negligible (i.e., the risk of take from WTG operation is found to be discountable); or (iii) the Service concurs that further data collection is unlikely to improve the accuracy or robustness of collision mortality estimates and is unlikely to improve the ability of BOEM and Ocean Wind to reduce or offset collision mortality (see Conservation Measure 7, below). e. Operational Reporting (Operations). Ocean Wind must submit to BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWSubmittals@bsee.gov) an annual report summarizing monthly operational data calculated from 10-minute supervisory control and data acquisition (SCADA) data for all turbines together in tabular format: the proportion of time the turbines were actually spinning each month, the average rotor speed (monthly revolutions per minute [rpm]) of spinning turbines plus 1 standard deviation, and the average pitch angle of blades (degrees relative to rotor plane) plus 1 standard deviation. BOEM and BSEE will use this information as inputs for avian collision risk models to assess whether the results deviate substantially from the effects analysis included in this BO. (BA Table 2-3, Measure 5). f. Raw Data. Ocean Wind must store the raw data from all avian and bat surveys and monitoring activities according to accepted archiving practices. Such data must remain accessible to BOEM, BSEE and the Service, upon request for the duration of the lease. Ocean Wind must work with BOEM to ensure the data are publicly available. (BA Table 2-3, Measure 5). All avian tracking data (i.e., from radio and satellite transmitters) will be stored, managed, and made available to BOEM and the Service following the protocols and procedures outlined in the agency document entitled *Guidance for Coordination of Data from Avian Tracking Studies*, or its successor.		
6	C, O&M, D	Incidental Mortality Reporting	Ocean Wind must provide an annual report to BOEM and the Service documenting any dead (or injured) birds or bats found on vessels and structures or in the ocean during construction, operations, and decommissioning. The report must contain the following information: the name of species (if possible), date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with federal or research bands must be reported to the United States Geological Survey's (USGS) Bird Banding Laboratory (BBL). Any occurrence of a dead ESA-listed bird or bat must be reported to BOEM, BSEE, and the Service as soon as practicable (taking into account crew and vessel safety), but no later than 24 hours after the sighting, and, if practicable, the dead specimen will be carefully collected and preserved in the best possible state, contingent on the acquisition of any necessary wildlife permits and compliance with Ocean Wind 1 health and safety standards. (BA Table 2-3, Measure 6).	Birds	BOEM, BSEE, and USFWS
7	Pre-O&M and O&M	Compensatory Mitigation	To minimize population-level effects on listed birds, BOEM will require Ocean Wind to provide appropriate compensatory mitigation as needed to offset projected levels of take of listed birds from WTG collision. Compensatory mitigation will be consistent with the conservation needs of listed species as identified in Service documents including, but not limited to, listing documents, Species Status Assessments, Recovery Plans, Recovery Implementation Strategies (RISs), and 5-Year Reviews. Compensatory mitigation will preferentially address priority actions, activities, or tasks identified in a Recovery Plan, RIS, or 5-Year Review, for each of the listed bird species; however, research, monitoring, outreach, and other recovery efforts that do not materially offset birds lost to collision mortality will not be considered compensatory mitigation. Compensatory mitigation may include, but is not limited to: restoration or management of lands, waters, sediment, vegetation, or prey species to improve habitat quality or quantity for listed birds; efforts to facilitate habitat migration or otherwise adapt to sea level rise; predator management; management of human activities to reduce disturbance to listed birds; and efforts to curtail other sources of direct human-caused bird mortality such as from vehicles, collision with other structures (e.g., power lines, terrestrial wind turbines), hunting, oil spills, and harmful algal blooms. Geographic considerations may include, but are not limited to: (a) any listed species recovery unit(s) or other management unit(s) determined to be disproportionally affected by or vulnerable to collision mortality; and/or (b) those portions of a species' range where compensatory mitigation is most likely to be effective in offsetting collision mortality. Compensatory mitigation for OW1 may be combined with mitigation associated with other offshore wind projects, but in no case will compensatory mitigation be double counted as applying to more than one offshore wind project. BOEM will require Ocean Wind to prepare a Compensatory Mitigation Plan prior to the start of WTG operation. At a minimum, the Plan will provide compensatory mitigation actions to offset projected levels of take of listed birds for the first 5 years of WTG operation at a ratio	Birds	BOEM, BSEE, and USFWS

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
			of 1:1. At its discretion, Ocean Wind may include actions to offset projected take over a longer time period and/or at a higher ratio. The Plan will include: a) detailed description of one or more specific mitigation actions; b) the specific location for each action; c) a timeline for completion; d) itemized costs; e) a list of necessary permits, approvals, and permissions; f) details of the mitigation mechanism (e.g., mitigation agreement, applicant-proposed mitigation); g) best available science linking the compensatory mitigation action(s) to the projected level of collision mortality as described in this BO; h) a schedule for completion; and i) monitoring to ensure the effectiveness of the action(s) in offsetting the target level of take. Plan development and implementation will occur according to the following schedule: • At least 180 days before the start of WTG operation Ocean Wind will distribute a draft Plan to BOEM, the Service, the NJDEP, and other identified stakeholders or interested parties for a 60-day review period. • At least 90 days before the start of WTG operation, Ocean Wind will transmit a revised Plan for approval by BOEM and the Service, along with a record of comments received on the draft. Ocean Wind will rectify any outstanding agency comments or concerns before final approval by BOEM and the Service. • Before or concurrent with the start of WTG operation, Ocean Wind will provide documentation to BOEM and the Service showing financial, legal, or other binding commitment(s) to Plan implementation. BOEM will require Ocean Wind to prepare and implement a new Plan every 5 years for the life of the project, according to a schedule developed by BOEM and approved by the Service. Compensatory mitigation actions included in each new Plan will reflect: a) the level and effectiveness of mitigation previously provided by Ocean Wind, to date; b) the level of take over the next 5 years as projected by SCRAM (or its successor) (see Conservation Measure 4); c) current information regarding any effects of offshore lighting (see Conservation Measure 2); and d) the effectiveness of any minimization measures that have been implemented as required by the reasonable and prudent measures included in this BO.		
Reasonable and Prudent Measures and Terms and Conditions					
1	Pre-O&M and O&M	Collision Minimization Report	Periodically review current technologies and methods for minimizing collision risk of listed birds. a) Prior to the start of WTG operations at OW1, BOEM must extract from existing project documentation (e.g., the BA, other consultation documents, the final Environmental Impact Statement, the COP) a stand-alone summary of technologies and methods that were evaluated by BOEM to reduce or minimize bird collisions at the OW1 WTGs. b) Within 5 years of the start of WTG operation, and then every 5 years for the life of the project, BOEM must prepare a Collision Minimization Report, reviewing best available scientific and commercial data on technologies and methods that have been implemented, or are being studied, to reduce or minimize bird collisions at WTGs. The review must be global in scope and include both offshore and onshore WTGs. c) BOEM must distribute a draft Collision Minimization Report to the Service, Ocean Wind, NJDEP, and NJBPU for a 60-day review period. BOEM must address all comments received during the review period, and issue the final report within 60 days of the close of the review period. d) Within 60 days of issuing the final Collision Minimization Report, BOEM must convene a meeting with the Service and Ocean Wind. Meeting participants will discuss the report and seek consensus on whether implementation of any technologies/methods are reasonable and prudent. However, if consensus cannot be reached, the Service will make the final determination of whether any minimization measures are reasonable and prudent (i.e., necessary or appropriate to minimize the amount or extent of incidental take), after considering input from BOEM, Ocean Wind, the NJDEP, and the NJBPU.	Birds	BOEM, BSEE, and USFWS

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-2. Description of Mitigation and Monitoring Measures Resulting from Consultations	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[2]
2	O&M	Implementation of Collision Minimization Technologies/Methods	Implement those technologies and methods deemed reasonable and prudent. a) BOEM will require Ocean Wind to adopt and deploy such minimization technologies/methods as deemed reasonable and prudent. BOEM will specify the Service-approved timeframe in which any required minimization measure(s) must be implemented, as well as any requirements to monitor, maintain, or adapt the measure(s) over time. b) BOEM will require Ocean Wind to provide periodic reporting on the implementation of any minimization measure(s) according to a schedule developed by BOEM and approved by the Service.	Birds	BOEM, BSEE, and USFWS

Table H-3 Additional Mitigation and Monitoring Measures

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-3. Description of Additional Mitigation and Monitoring Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[4]
Radar Systems Mitigations Resulting from NOAA IOOS Reviews					
2	O&M	Mitigation for oceanographic high frequency radars	BOEM will require that Ocean Wind coordinates with the radar operators and the Surface Currents Program of NOAA Integrated Ocean Observing System (IOOS) Office to assess if the Project causes radar interference to the degree that radar performance is no longer within the specified radar system's operation parameters or fails to meet mission objectives. If either is the case, the lessee must notify BOEM, make publicly available via NOAA IOOS the near real-time accurate numerical telemetry of surface current velocity, wave height, wave period, wave direction, and other oceanographic data measured at Project locations selected by the Lessee in coordination with the affected radar operators and the NOAA IOOS Surface Currents Program; and, if requested by the affected radar operators or the NOAA IOOS Surface Currents Program, share with them accurate numerical time-series data of blade rotation rates, nacelle bearing angles, and other information about the operational state of each turbine in the wind development area to aid interference mitigation.	Other Uses – Radar	BOEM and BSEE
NMFS-proposed Measures					
1	C, O&M	Vessel speed restriction	All vessels, regardless of size, would comply with a 10-knot speed restriction in any SMA, DMA, or Slow Zone.	Marine Mammals, Sea Turtles	BOEM and BSEE
2	C, O&M	Recreational fishing	The lessee shall develop a construction schedule that minimizes overlap with recreational fishing tournaments and other important seasonal recreational fishing events.	Recreation and Tourism	BOEM, BSEE, USACE, and NJDEP
3	C	Anadromous fish time of year restriction	Avoid construction activities during anadromous fish migration and spawning activity from March 1 through June 30 of each year within Barnegat Bay.	Finfish	USACE and NJDEP
NPS-proposed Measures					
1	C, O&M	Adopt sustainable lighting practices	Adopt NPS-recommended sustainable lighting practices for outdoor lighting at onshore facilities (e.g., onshore substation and O&M facility). Sustainable outdoor lighting specifications include use of LEDs in warm colors, recessed and fully shielded lights, fixtures that include timers, motion detectors, hue adaptors, and dimmers, reducing light intensity, and proper installation of lights (see https://www.nps.gov/subjects/nightskies/sustainable-outdoor-lighting.htm).	Scenic and Visual	BOEM, BSEE, and NJDEP
NJDEP-proposed Measures					
1	C	Revegetation	Areas of temporary disturbance on Island Beach State Park should be re-seeded or replanted with species native to New Jersey barrier islands, efforts to reduce soil erosion and sediment control should not include application of fertilizer or lime, and only native vegetation should be allowed to become re-established in other disturbed areas.	Coastal Habitat and Fauna	NJDEP
2	C	Vibration monitoring/structure monitoring	Vibration monitoring/structure monitoring be implemented for the onshore construction activities including but not limited to infrastructure, bridges, businesses, homes, and drainage structure.	Land Use and Coastal Infrastructure	NJDEP
NYSDOS-proposed Measures					
1	C	Cable protection	Avoid the use of concrete mattresses as cable protection (in all areas, but most critically within sand ridge/trough habitat features and the NJ to NY Connector Fairway) to the extent possible.	Benthic Resources	BOEM, BSEE, USACE, and NJDEP
2	C	Navigation safety plan	BOEM and BSEE would ensure that Ocean Wind coordinates with the U.S. Coast Guard in advance of export cable installation to develop a navigation safety plan, which may include: establishing a safety zone around the cable laying vessel(s); monitoring plan; mitigation plan; schedule; private aids to navigation; and, local notice to mariners.	Navigation and Vessel Traffic	BOEM and BSEE
3	O&M	Cable maintenance plan	BOEM and BSEE would ensure that Ocean Wind develops a cable maintenance and monitoring plan that outlines a process for identifying when cable burial depths reach unacceptable risks, requires prompt remediation of exposed and shallow-buried cable segments, and includes review to address repeat exposures. The cable maintenance and monitoring plan would also describe methods for providing an accessible graphic/geo-referenced repository of locations where target burial depths were not achieved and/or cable protection was installed, and mariner notification for monitoring and remedial burial activities.	Navigation and Vessel Traffic	BOEM and BSEE
4	Pre-C, C, O&M	Mariner Communication and Outreach Plan	Develop and implement a Mariner Communication and Outreach Plan that covers all project phases from pre-construction to decommissioning. There is a proposed fisheries outreach plan (See ID CFHFISH-02), and this should be expanded to include	Navigation and Vessel Traffic	BOEM and BSEE

[4] Enforcement by BOEM and BSEE will be conducted in accordance with Reorganization of Title 30 – Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf final rule, 88 *Federal Register* 6376.

#	Proposed Project Phase	Mitigation & Monitoring Measures	Table H-3. Description of Additional Mitigation and Monitoring Measures	Resource Area Mitigated	BOEM's Identification of the Anticipated Enforcing Agency[4]
			coordination with other mariners, including the commercial shipping industry and other recreational users who would also benefit from this coordination and may not be captured in the currently proposed fisheries plan.		
BOEM-proposed Measure					
1	Pre-C, C, O&M, D	Coordination with federally recognized tribal nations	No later than 90 calendar days after COP approval, the Lessee would contact the federally recognized tribal nations in government-to-government consultations with BOEM for the Project in order to solicit their interest in participating as active monitors on board vessels during construction and/or maintenance activities, participate in postmortem examinations of mortality events as a result of these activities, or have open access to the following: reports generated as a result of the Fisheries Monitoring Plan; reports of NARW sightings; injured or dead protected species reporting (sea turtles and NARW); NARW PAM monitoring; PSO reports (e.g., pile-driving reports); pile driving schedules and changes to them. At a minimum, the Lessee must offer access to the following federally recognized tribal nations: Delaware Nation; Delaware Tribe of Indians; Stockbridge-Munsee Community Band of Mohican Indians; and Wampanoag Tribe of Gay Head (Aquinnah). The Lessee must provide, in a manner suitable to the tribal nations, access to non-proprietary, non-confidential business information to any federally recognized tribal nation no later than 30 days after the information becomes available.	Cultural Resources	BOEM and BSEE
2	C, O&M, D	Brigantine Wilderness Area Air Quality Related Values (AQRV) Mitigation Framework	BOEM, BSEE, USFWS, and Ocean Wind would develop a framework for the mitigation of AQRV impacts at Brigantine Wilderness Area. The framework would include a description of existing conditions and monitoring objectives; description of preventative and compensatory mitigation measures; identification of the avoidance or offset value for each measure; cost estimates for each measure; schedule for USFWS implementation of each measure; the mechanism for the transfer of funding from Ocean Wind to USFWS; and, reporting to demonstrate completion of implementation.	Air Quality	BOEM and BSEE
3	C, O&M, D	SF6 leak rate monitoring and detection	Leak detection and monitoring requirements of less than 1% would be required, in line with IEC and USEPA guidance.	Air Quality	BOEM and BSEE
4	C, O&M	Shoreside seafood business analysis	In addition to the Direct Compensation Fund proposed by the Lessee, BOEM would require the Lessee to ensure that the Direct Compensation Fund includes losses to shoreside businesses. The Lessee shall analyze the impacts to shoreside seafood businesses adjacent to ports listed in Table 3.9-10. The shoreside seafood business analysis would be used to further supplement funds available for settling claims of lost (unrecovered) economic activity as a result of the Ocean Wind 1 project. The Lessee must submit to BOEM a report that includes (1) a description of the structure of the Fund and its consistency with BOEM's draft Guidance and (2) an analysis of the impacts of the Project on shoreside businesses for review and comment. The Lessee must then submit to BOEM evidence of the implementation of the Fund, including: • A description of any implementation details not covered in the report to BOEM regarding the mechanism established to compensate for losses to commercial and for-hire recreational fishermen and related shoreside businesses resulting from all phases of the project development on the Lease Area (pre-construction, construction, operation, and decommissioning); • The Fund charter, including the governance structure, audit and public reporting procedures, and standards for paying compensatory mitigation for impacts to fishers and related shoreside businesses from lease area development; and • Documentation regarding the funding account, including the dollar amount, establishment date, financial institution, and owner of the account.	Commercial and For-Hire Recreational Fisheries	BOEM and BSEE
5	C, O&M	Sand Wave Leveling, Boulder Clearance and Relocation	Sand wave leveling and boulder clearance and relocation should be limited and micrositing should be used to avoid these areas to the extent practicable. The Lessee must develop and implement a boulder relocation plan to ensure potential impacts to essential fish habitat and commercial and recreational fisheries are adequately minimized.	Commercial and For-Hire Recreational Fisheries	BOEM and BSEE
6	C, O&M	Mobile Gear–Friendly Cable Protection Measures	Cable protection measures should reflect the pre-existing conditions at the site. This mitigation measure chiefly ensures that seafloor cable protection does not introduce new hangs for mobile fishing gear. Thus, the cable protection measures should be trawl-friendly with tapered/sloped edges. If cable protection is necessary in "non-trawlable" habitat, such as rocky habitat, then the lessee should consider using materials that mirror the benthic environment.	Commercial and For-Hire Recreational Fisheries	BOEM and BSEE
USCG-proposed Measure					
1	C, O&M	Safety zones	Establishing safety zones should not be used as the key mitigating factor when considering risks and impacts. Commander, USCG Fifth District, may consider safety zones in the lease area, but safety zones will not be granted for the sole purpose of keeping project construction on track.	Navigation and Vessel Traffic	USCG

Table H-4 Lessee Authorization and Permit Conditions

#	Table H-4. Description of Lessee Authorization and Permit Conditions
NJDEP Federal Consistency Conditions Issued April 27, 2023[5]	
1	Ocean Wind LLC and the State of NJ shall execute a Memorandum of Understanding (MOU) to provide appropriate compensation measures for fisheries resources and fishing industry uses impacted by the authorized project.
2	Ocean Wind LLC shall implement all protective and mitigative measures as outlined in BOEM's Final EIS and Record of Decision for protection of fisheries, aquatic and benthic resources.
3	Prior to commencement of project construction, an Ocean Wind Offshore Wind Project Memorandum of Agreement shall be executed among the Section 106 consulting parties for the avoidance, minimization, and mitigation of project adverse effects on historic properties, pursuant to Section 106 of the National Historic Preservation Act.
4	Ocean Wind LLC shall develop a Project Mitigation Plan that is informed by public engagement, consultation with the appropriate state, federal (National Oceanic and Atmospheric Administration (NOAA Fisheries)), and regional, non-government organizations (i.e. the Regional Wildlife Science Collaborative for Offshore Wind and the Responsible Offshore Science Alliance). The Plan shall summarize the expected impacts; describe and provide technical details for each mitigation measure (including the type of impact to which it relates and the conditions under which it is required); identify policies and standards to be used and complied with; and, be responsive to impacts detected in project monitoring and other monitoring and research studies and initiatives, including Ocean Wind Fisheries Monitoring Plan, Ocean Wind Benthic Monitoring Plan, and the New Jersey Research and Monitoring Initiative for Offshore Wind.
5	If avoidance and minimization to Prime Fishing Areas identified on NOAA and NJDEP's publicly available GIS layer depicting previously identified Prime Fishing Areas (see https://gisdata-njdep.opendata.arcgis.com/) is not feasible, then Ocean Wind LLC shall provide the Division of Land Resource Protection with information that clearly shows any permanent changes to the bathymetry, including but not limited to flattening sand waves, filling, and relocation of boulders, post-construction. This shall include the location and extent of modification of the pre-existing bathymetry (figures and GIS shapefiles with locations and dimensions of these features within the project area should be provided), which structures were installed within these areas, and the avoidance and minimization measures which were implemented to reduce the area permanently modified.
6	For Wind Turbine Generators (WTGs) and Off Shore Substations (OSSs) – including most WTGs of Rows 1 through 8 and OSSs 1 and 2 – with the potential to impact artificial reefs and species using those reefs within the Atlantic City Reef and Great Egg Harbor artificial reef sites, additional noise dampening devices that result in greater noise dampening shall be utilized to avoid and minimize impacts to habitats and species. Devices may include, but are not limited to isolation casings, isolation casings with bubble curtains inside, and double-walled isolation casings.
7	If any military munitions and explosives of concern (MECs) or unexploded ordinances (UXOs) are encountered during project construction, Ocean Wind LLC shall immediately notify the United States Coast Guard (USCG) of the munition and its location.
NJDEP Permits Issued April 27, 2023[7]	
1	**Coastal Permit Conditions** 1. This permit is issued subject to compliance with N.J.A.C 7:7-27.2, Conditions that apply to all coastal permits. 2. The permittee shall obtain all applicable Federal, State, and local approvals prior to commencement of regulated activities authorized under a permit. Approvals include, but are not limited to, authorization from the US Army Corps of Engineers to conduct work below the high tide line and a Section 408 approval. 3. Additional development or other related construction will require either a modification to this permit #0000-21-0008.2 LUP220001 & LUP230001 or, a new permit depending on the size and scope of the proposed development as well as the activity status of the existing permit. 4. Prior to any construction or site preparation, the permittee must receive new Tidelands licenses for the electric transmission cables and installation of the cables below the mean high water line authorized by this permit. The applications for new Tidelands licenses are pending under file# 0000-21-0008.2 TDI220001, TDI220002, TDI220003 & TDI220004. Failure to comply with this condition will result in fines up to $1000 plus $100 per day, a higher fee for the conveyance and possible prosecution by the Attorney General's office to remove unauthorized structures and to pay use and occupancy charge. 5. No activities authorized in Barnegat Bay under this permit may commence until a monetary contribution has been made to the Department's account for Shellfish Habitat Mitigation. This contribution is based upon the area of shellfish habitat impacted by the electric transmission cable installations, the documented shellfish density, and the commercial value of the shellfish resource. The formula for assessing the monetary contribution is as follows: [see Permit for formula]. The impacted area of shellfish habitat is 29.077 acres (1,266,594.12 square feet). Using the above formula, a monetary contribution of $7,504.570.16 is required. This contribution must be made to the Department's account for Shellfish Habitat Mitigation within 90 days of the issuance date of this permit. An invoice will be forwarded to the permittee in the amount of $7,504,570.16. This contribution is based upon the impact acreage provided by the Applicant utilizing worst case scenario impacts. The Division reserves the right to modify the contribution amount if information is provided by the Applicant which demonstrates a reduction of the specified 29.077 acres of impact to shellfish habitat and the Division concurs the impacts have been reduced. 6. Prior to any construction activities in Barnegat Bay authorized by this permit, the permittee shall perform a submerged aquatic vegetation ("SAV") habitat pre-construction survey of the work area no more than six (6) months prior to construction and submit the survey results to the Department for review. The pre-construction survey methodology must be included in any SAV mitigation plan and be approved by the Department prior to execution. The pre-construction survey must be performed within the growing season window of mid-April through early November, but avoiding July, August, and early September may be necessary to avoid macroalgae blooms that can adversely affect survey results. Upon completion of the pre-construction survey, the permittee shall coordinate with the Department to develop a mitigation plan for the impacts to SAV. The Department must be provided with a mitigation plan at least 30 days prior to a planned start date for the pre-construction survey. Implementation of the required mitigation for impacts to SAV habitat shall be defined in the Department approved mitigation plan. 7. Prior to the commencement of site preparation, inclusive of site clearing, project staging, onsite storage of materials, pre-construction earth movement, other site disturbance, and all authorized activities, and within 90 days of the issuance of this permit authorization, the Permittee shall complete mitigation for the direct loss of Critical Wildlife Habitat: a. To the NJDEP Watershed and Land Management Program, Endangered & Threatened Species Unit, the Permittee shall first submit a proposal of mitigation for direct impacts to 16.119 acres of stopover habitat for migratory birds. After the mitigation proposal is accepted by the Division in writing, the Permittee shall then proceed with the placement of a conservation restriction over the approved mitigation site. The Permittee shall record the conservation restriction on the deed, and shall file the restriction with the appropriate County Clerk's Office (the Registrar of Deeds and Mortgages). The conservation restriction shall run with the land and be binding upon all successive owners. A copy of the recorded conservation restriction shall be forwarded to and received by the Division. No project site preparation and authorized activities may commence until the required conservation

[5] NJDEP Federal Consistency Certification and NJDEP State Permits are available on NJDEP's website: https://dep.nj.gov/offshorewind/projects/

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	restriction has been recorded and a signed copy has been received by the Division of Land Resource Protection. Any activities undertaken on the site before a copy of the recorded restriction is received by the Division will be considered a violation of the Coastal Area Facility Review Act. b. Within 90 days of the issuance of this permit authorization, the Permittee shall develop and submit a proposed “Barn Owl Breeding Habitat Mitigation Proposal” (“proposal”) designed to address disturbance of barn owl breeding habitat in the vicinity of the authorized limit of disturbance on the B.L. England Generating Station property. An approvable proposal will include the installation and stewardship of two barn owl nest boxes on the B.L. England Generating Station property and will demonstrate that nest box structure, design, and locations have been vetted by the NJDEP Division of Fish & Wildlife. No component of the required barn owl breeding habitat mitigation effort may take place until the required proposal has been approved in writing by the Division of Watershed Protection and Restoration Endangered and Threatened Species Unit, indicating that the Permittee is authorized to commence with the installation of the nest box structures. No component of project site preparation, clearing, grading, or disturbance associated with the authorized activity(-ies) may take place until after the Permittee has demonstrated to the Department that the barn owl breeding habitat mitigation effort has been completed. Any regulated activities, including site preparation, undertaken on the site before proof of mitigation completion has been received by the Department will be considered a violation of the Coastal Area Facility Review Act. 8. Prior to any construction or site preparation, the permittee shall provide to the Department for review and approval a final, formal proposal outlining in detail the proposed offsite public access improvements which will be designed, permitted, and constructed by the permittee. The Department-approved public access improvements must be constructed prior to or concurrent with construction of the project authorized under this permit. 9. Concurrent with the construction of the offsite public access improvements, the permittee in conjunction with the property owner shall file a conservation restriction dedicating the improvements for public access. The permittee shall include the conservation restriction on the deed and shall file the restriction with the Ocean County and Cape May County Clerk’s Office (the Registrar of Deeds and Mortgages). Said restriction shall run with the land and be binding upon all successive owners. The conservation restriction shall conform, verbatim, to the format and content of the model Declaration of Restriction for Public Access to the Waterfront on the Division's website at www.nj.gov/dep/landuse/forms.html. A copy of the recorded conservation restriction shall be emailed to the Division’s Project Manager, Lindsey Davis, at Lindsey.Davis@dep.nj.gov within 30 days of filing of the conservation restriction. 10. To avoid impacts to Northern Long-eared Bat, Tricolored Bat (proposed federal listing), and nesting migratory bird species, the Permittee shall adhere to a seasonal restriction on the clearing of all woody vegetation from April 1 through September 30 of each calendar year. 11. To protect sensitive habitat for the State-listed Osprey, the permittee shall adhere to a seasonal restriction on the use of heavy construction equipment/machinery within 300 meters (1000 feet) of all active osprey nests along the project limit of disturbance from April 1 through August 31 of each calendar year. The initiation and implementation of work which generates disturbance (e.g., sound levels, visual interruption) that is out of character with what currently exists at or surrounding the anticipated work area during the restricted time period recommended above may result in the permittee being in violation of the “take” clause within State of New Jersey Endangered and Nongame Species Conservation Act (N.J.S.A. 23:2A-1). Please note that adherence to this seasonal restriction shall also be applied if nest building and nest occupancy is observed at any given osprey nest location during the months of March and April of the given calendar year of work. 12. No sediment generating activities (e.g. pile-driving, sheet driving, dredging, etc.) shall occur within State waters, including the Atlantic Ocean inlets and/or any tidal waterway, between March 1st and June 30th of each calendar year to protect anadromous fish and spawning activities during migration for diadromous fish. 13. The Permittee shall adhere to the provisions of the City of Ocean City Beach Management Plan For the Protection of Federally & State-Listed Species (dated January 2016 unless superseded by the most current edition) adopted by the Borough and created in coordination with the United States Department of the Interior Fish & Wildlife Service New Jersey Field Office and the New Jersey Department of Environmental Protection Division of Fish and Wildlife Endangered and Nongame Species Program. Particular attention must be given to provisions within “Protected” and “Precautionary” Zones outlined within the Beach Management Plan. 14. If activity of rare beach-nesting shorebird species (i.e. State- or federally listed threatened or endangered species, or migratory shorebird species of special concern), or a State-/Federally listed endangered beach plant population, is discovered at or near the permitted limit of disturbance, work and recreational use of the area shall cease until the Permittee has coordinated with, and guidance on habitat management practices can be issued by, the New Jersey Department of Environmental Protection and, potentially, the US Fish & Wildlife Service. Please note that this coordination may result in the need for the Permittee’s adherence to provisions as necessary to protect this sensitive habitat (e.g., seasonal restriction on regulated activities). The Department reserves the right to suspend all regulated activities onsite should it be determined that the Permittee has not taken proper precautions to ensure continuous compliance with these conditions. 15. Prior to commencement of project construction, there shall be an executed Ocean Wind Offshore Project Memorandum of Agreement among the Section 106 consulting parties, which includes the permitttee, for the avoidance, minimization, and mitigation of project adverse effects on historic properties, pursuant to Section 106 of the National Historic Preservation Act. 16. The permittee shall notify the Department’s Bureau of Marine Water Monitoring 30 days prior to the start of construction and/or site preparation for the work within Barnegat Bay and Peck Bay/Crook Horn Creek. Notification shall be made via email to the following addresses: lisa.dielmo@dep.nj.gov, debbie.watkins@dep.nj.gov, sarah.gentile@dep.nj.gov, and robert.schuster@dep.nj.gov. The permittee shall abide by any restrictions put in place by the Bureau of Marine Water Monitoring during construction and/or site preparation. 17. If any military munitions and explosives of concern (MECs) or unexploded ordinances (UXOs) are encountered during project construction, the permittee shall immediately notify the United States Coast Guard (USCG) of the munition and its location. 18. Any necessary remediation activities shall be conducted in accordance with all applicable regulations and under the supervision of a Licensed Site Remediation Professional. 19. Any work within the limits of the Great Egg Harbor Inlet and Pecks Beach or Great Egg Harbor Inlet to Townsends Inlet beach nourishment projects inshore of the 2,500-foot limit as measured from project baseline and/or at or below -35 feet NAVD88 within the US Army Corps of Engineers beach and dune design template (including slopes) is subservient to the to the construction, operation, maintenance, repair, rehabilitation and replacement of the Federal beachfill project and is subject to removal prior to future project-related construction. 20. The permittee shall conduct and provide to the Department pre-construction topographic and bathymetric surveys that capture the entire profile of the existing conditions between the HDD pit located at 35th Street in Ocean City and the offshore HDD pit before commencing construction. 21. The permittee shall conduct and provide to the Department post-construction topographic and bathymetric surveys that capture the entire profile of the existing conditions between the HDD pit located at 35th Street in Ocean City and the offshore HDD pit within 30 days of the completion of construction of the entry and exit HDD pits. 22. No excavation or grading of a beach or dune is authorized by this permit. 23. No disturbance to dune vegetation or dune fencing is authorized by this permit.

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	24. No disturbance to dune crossovers, including but not limited to split rail fencing, subsurface geotextile base matting, compacted I-5 surface, etc., within the City of Ocean City is authorized by this permit. 25. Beach berm elevations and widths shall not be lowered or lessened during temporary occupation within the limits of the Federal beach template during construction. 26. All occupations within the limits of the Federal beach template shall maintain and not alter any public access without the pre-approval of all local, State and Federal agencies including the USACE, the NJDEP's OCE, and NJDEP's Division of Land Resource Protection. 27. The permittee shall provide to the NJDEP's OCE as-built surveys for the entire length of the cable installed from the HDD pits in the Atlantic Ocean to the State's 3 nautical mile (nm) jurisdictional limit. 28. Prior to electric transmission cable installation, the permittee shall establish a hotline with contact information, including an email and a phone number. Protocols regarding unintended interaction with the cables and proposed nearby construction activities should be included with the hotline information. Coordination of the development of these protocols shall occur with NJDEP's OCE, the USACE, and the US Coast Guard. 29. Barges and other vessel hauls shall not rest on the bay bottom to the maximum extent practicable to eliminate the potential for scour. 30. Any landscaping of the properties shall be done with native plants to maximum extent practicable. The use of plastic or other impervious material under newly landscaped or gravel areas is prohibited. All sub-surface liners must be made of filter cloth or other permeable material. 31. Vegetation within a riparian zone shall only be disturbed in the areas specifically shown on the approved drawing(s). No other vegetation within a riparian zone shall be disturbed for any reason. 32. Upon completion of the project, all temporarily disturbed areas within a riparian zone shall be restored to original topography and replanted with indigenous, non-invasive vegetation in accordance with N.J.A.C. 7:13-11.2(z). 33. All excavated material must be lawfully disposed of outside any flood plain, open water, freshwater wetlands or transition area. 34. All debris generated from the construction is to be disposed of at an approved disposal site. Oyster Creek Federal Channel Maintenance Dredging Condition 1. Prior to dredging the Oyster Creek federal navigation channel, the permittee shall apply for a modification to this permit and submit: 1. Sediment sampling results obtained in accordance with a sampling plan approved by the Office of Dredging and Sediment Technology, 2. Current hydrographic survey including a calculation of the quantity of sediment to be dredged, and, 3. Written consent from the proposed dredged material management site to accept the specified quantity of dredged material. Cable Installation Conditions – West Coast of IBSP in Barnegat Bay (Prior Channel) 1. Prior to trenching and open-cut activities in the Prior Channel, the permittee shall apply for a modification to this permit and submit: 1. Sediment sampling results obtained in accordance with a sampling plan approved by the Office of Dredging and Sediment Technology, 2. Current hydrographic survey including a calculation of the quantity of sediment to be dredged, and, 3. Written consent from the proposed dredged material management site to accept the specified quantity of dredged material. 2. Prior to in-water construction activities in the Prior Channel within Barnegat Bay, the permittee shall submit a Sediment Containment Plan for review and approval. Said plan shall detail the specific turbidity control methods and measures that will be utilized during construction to demonstrate that turbidity associated with cable installation will be minimized. Questions regarding the requirements of the Sediment Containment Plan should be directed to katherine.todoroff@dep.nj.gov. 3. Prior to the installation of the sheet pile for construction of open-cut areas, the area must be enclosed with a full-depth turbidity curtain and anchored. This sediment control measure shall be maintained for the duration of sheet pile installation and removal. In the instance where a turbidity curtain cannot be installed in shallow water, the applicant shall propose another measure of turbidity control and provide details in the sediment containment plan, specified in Prior Channel Condition No. 2 above. 4. The sheet pile cofferdam proposed for open-cut areas must extend 100' waterward of sediment core DS007. The open-end of the sheet pile enclosure must be enclosed with a full-depth turbidity curtain and anchored. This sediment control measure shall be maintained for the duration of sheet pile installation and removal. 5. Prior to jetting operations, an anchored, full-depth turbidity curtain must be installed in parallel along the entire length of the Prior Channel within Barnegat Bay. This sediment control measure shall be maintained for the duration of jetting operations. 6. Prior to trenching operations, the work area must be enclosed by a full-depth turbidity curtain and anchored. This sediment control measure shall be maintained for the duration of trenching within that specific area. 7. Open-cut areas supported by trenches are limited to thirty feet (30') in length, five feet (5') in width, and six and one-half feet (6.5') in depth below the mudline. 8. Sediment removal in open-cut areas shall be limited to approximately seventy-two cubic yards (72 yds3). 9. Trenching shall be restricted to the limits as depicted on the authorized plans. The depth of trenching shall be limited to a maximum depth of eleven and one-half feet below mean lower low water (-11.5' MLLW). 10. Sediment removal in proposed trench areas shall be limited to approximately fifty-two thousand six hundred seventy-five cubic yards (52,675 CY). Cable Installation Conditions - Holtec Landfall in Barnegat Bay 1. Prior to trenching or open-cut activities for the Holtec Landfall, the permittee shall apply for a modification to the permit and submit: 1. Sediment sampling results obtained in accordance with a sampling plan approved by the Office of Dredging and Sediment Technology, 2. Current hydrographic survey including a calculation of the quantity of sediment to be dredged, and, 3. Written consent from the proposed dredged material management site to accept the specified quantity of dredged material. 2. Prior to in-water construction activities associated with the Holtec Landfall, the permittee shall submit a Sediment Containment Plan for review and approval. Said plan shall detail the specific turbidity control methods and measures that will be utilized during construction to demonstrate that turbidity associated with cable installation will be minimized. Questions regarding the requirements of the Sediment Containment Plan should be directed to H-55atherine.todoroff@dep.nj.gov. 3. Prior to the installation of the sheet pile for construction of open-cut areas, the area must be enclosed with a full-depth turbidity curtain and anchored. This sediment control measure shall be maintained for the duration of sheet pile installation and removal. In the instance where a turbidity curtain cannot be installed in shallow water, the applicant shall propose another measure of turbidity control and provide details in the sediment containment plan, specified in condition Holtec Property Landing No. 2 above.

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	4. Prior to jetting operations, an anchored, full-depth turbidity curtain must be installed in parallel along the entire length of the Holtec route. This sediment control measure shall be maintained for the duration of jetting operations. 5. Prior to trenching operations, the work area must be enclosed by a full-depth turbidity curtain and anchored. This sediment control measure shall be maintained for the duration of trenching within that specific area. 6. Open-cut areas supported by trenches are limited to fifty feet (50') in length, five feet (5') in width, and six and one-half feet (6.5') in depth below the mudline. 7. Sediment removal in open-cut areas shall be limited to approximately one hundred and twenty cubic yards (120 yds^3). 8. Trenching shall be restricted to the limits as depicted on the authorized plans. The depth of trenching shall be limited to a maximum of depth of twelve and one-half feet below mean lower low water (- 12.5' MLLW). 9. Sediment removal in proposed trench areas shall be limited to approximately twenty-eight thousand five hundred sixty-eight cubic yards (28,568 CY). Cable Installation Conditions – Ocean City, 35th Street HDD Landfall 1. The single HDD pit in the Atlantic Ocean is limited to two hundred forty-three feet (243') in length, one hundred thirty- four feet (134') in width, and ten feet (10') in depth below the mudline. 2. Sediment removal in the HDD pit in the Atlantic Ocean shall be limited to approximately two thousand cubic yards (2000 yds^3). Cable Installation Conditions: IBSP Oceanfront HDD Landfall 1. The two HDD pits in the Atlantic Ocean are limited to two hundred fifty feet (250') in length, one hundred fifty feet (150') in width, and thirteen feet (13') in depth below the mudline. 2. Sediment removal in the HDD pits in the Atlantic Ocean shall be limited to approximately three thousand six hundred yards per pit for an approximate total of seven thousand two hundred yards (7200 yds^3). In-Water Cable Installation & Maintenance Dredging Conditions – Sediment Removal 1. Side casting of dredge material is prohibited. 2. Use and/or location of all vessels, barges, equipment, etc. utilized for cable installations and maintenance dredging shall be properly coordinated with the U.S. Coast Guard. 3. Jetting shall be restricted to the limits as depicted on the authorized plans. The depth of cable burial installed by jetting technology shall be at least 4 feet (4') minimum below the seabed. 4. The applicant shall exercise caution and employ all reasonable controls to minimize the release of sedimentation into the adjacent waters during the dredging and deposition process. 5. All sediments from this project shall be removed using a closed clamshell environment bucket. 6. The dredge shall be operated to control the rate of descent of the bucket so as to maximize the vertical cut of the clamshell bucket while not penetrating the sediment beyond the vertical dimension of the open bucket (i.e. overfilling the bucket). This will reduce the amount of free water in the dredged material, will avoid overfilling the bucket, and minimize the number of dredge bucket cycles needed to complete the dredging contract. The dredging contractor shall use appropriate software and sensors on the dredging equipment to ensure consistent compliance with this condition during the entire dredging operation. The independent dredging inspector shall monitor the operation of the software and sensors during the inspections as specified in the below conditions. Any malfunction of the software and sensors on the dredge at any time shall be immediately reported to the independent dredging inspector and the permittee by the dredging contractor and shall be immediately repaired to working order. 7. The closed clamshell environmental bucket shall be equipped with sensors to ensure complete closure of the bucket before lifting the bucket. Said sensors shall be operational during the entire dredging operation. 8. The closed clamshell environmental bucket shall be lifted slowly through the water, at a rate of 2 feet per second or less. 9. Dredged material shall be placed deliberately in the barge in order to prevent spillage of material overboard. 10. The discharge (i.e. "overflow") of water from the barge/scow into which dredged material is placed is prohibited. 11. All barges or scows used to transport sediment shall be of solid hull construction or be sealed with concrete. 12. The gunwales of the dredge scows shall not be rinsed or hosed during dredging except to the extent necessary to ensure the safety of workers maneuvering on the dredge scow. 13. All decant water holding scows shall be water tight and of solid hull construction. 14. Decant water from this project may only be discharged within the area of Barnegat Bay from where the sediments originated, in close proximity to the dredging contract area. Discharge to another receiving waterbody requires prior approval from the Department and may require a New Jersey Discharge Pollutant Elimination System/Discharge to Surface Water (NJDPES/DSW) permit. 15. All decant water shall be held in the decant holding scow a minimum of 24 hours after the last addition of water to the decant holding scow. Said water contained in the decant holding scow may only be discharge after this mandatory 24-hour retention time. 16. During pumping of the decant water from the holding scow, great care shall be taken to avoid re-suspending or pumping sediment which has settled in the decant holding scow. 17. Dewatering on land must be completed within a secured watertight container. 18. REPORTING REQUIREMENTS: At the completion of the project, the permittee shall submit the following information to the Department. This information shall be submitted within three months of completion of dredging. 1. Start and finish date of work order(s). 2. Post-dredge hydrographic survey. 3. Completed "Notice of Completion of Dredging" attached for each work order(s)/completion of project. Barnegat Bay In-Water Backfill Conditions 1. All backfill must be sourced from clean material and/or over 90% sand. 2. Trenches must be backfilled with a clamshell bucket. The bucket shall remain closed until it reaches the bottom of the trench.
2	Freshwater Wetland Conditions 1. This permit is issued subject to compliance with N.J.A.C 7:7A-9.3, Conditions applicable to an individual permit.

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	2. Prior to the commencement of site clearing, grading, or construction onsite, the permittee shall install a sediment barrier at the limits of disturbance authorized herein, which is sufficient to prevent the sedimentation of the remaining freshwater wetlands and transition areas and shall serve as a physical barrier protecting these areas from encroachment by construction vehicles or other soil-disturbing activities. All sediment barriers and soil erosion control measures shall be kept in place and maintained throughout the duration of construction, until such time that the site is stabilized. 3. The permittee shall ensure that the authorized activities do not interfere with the natural hydraulic characteristics of any wetlands, transition area, or State open water. 4. Access through wetlands and transition areas shall be only as depicted on the above-referenced plans. 5. This authorization for a Freshwater wetland Individual Permit (FWIP) is valid for a term not to exceed five (5) years from the date of this letter. If the permittee wishes to continue an activity covered by the permit after the expiration date of the permit, the permittee must apply for and obtain a permit extension or a new permit, prior to the permit's expiration. 6. The total amount of disturbance associated with this authorization shall not exceed a combined total of 7.118 acres to state open waters, wetlands and transition areas. The wetlands affected by this permit authorization are of exceptional intermediate, and ordinary resource value. The standard transition area required adjacent to exceptional wetlands is 150ft. The standard transition area required adjacent to intermediate wetlands is 50ft. There is no transition area associated with ordinary resource value wetlands. Any additional disturbance of freshwater wetlands, State open waters and/or transition areas besides that shown on the approved plans shall be considered a violation of the Freshwater Wetlands Protection Act rules unless the activity is exempt or a permit is obtained from the Department prior to the start of the proposed disturbance.
3	Engineering Conditions 1. This permit is issued subject to compliance with N.J.A.C 7:13-5.6, Conditions that apply to an issued or reissued verification and N.J.A.C. 7:13-10.3 Conditions applicable to an individual permit. 2. Recording of Permit: This permit shall be recorded in its entirety in the office of the County Clerk or the Registrar of Deeds and Mortgages for each county where this project is located. Verified notice of this action shall be forwarded to the Division immediately thereafter. NOTE: The following information is to be submitted to the clerk for all Flood Hazard Area Verifications: a. The Department file number for the verification; b. The approval and expiration dates of the verification; c. A metes and bounds description of any flood hazard area limit and/or floodway limit approved under the verification; d. The flood hazard area design flood elevation, or range of elevations if variable, approved under the verification; and e. The width and location of any riparian zone approved under the verification; and f. The following statement: "The State of New Jersey has determined that all or a portion of this lot lies in a flood hazard area. Certain activities in flood hazard areas are regulated by the New Jersey Department of Environmental Protection and some activities may be prohibited on this site or may first require a permit. Contact the Division of Land Use Regulation at (609) 777-0454 for more information prior to any construction onsite." 3. The Department has approved this permit because the project satisfies the requirements of the Flood Hazard Area Control Act Rules and Coastal Rules. The Department has not reviewed the proposed structure/s to determine compliance with the International Building Code or any other local construction codes or flood ordinances. The proposed building/s may therefore not fully comply with any such requirements. Please contact your municipal construction official for further information. 4. All foundations, slabs, footings and walls of the proposed structure/s shall be designed to resist uplift, flotation, collapse and displacement due to hydrostatic and hydrodynamic forces resulting from flooding up to an elevation of one foot above the flood hazard area design flood elevation as shown on the approved plan sheets. Furthermore, all structural components shall be designed to resist the same forces. 5. The floor elevation labeled "12.0'" on the approved drawing(s) is the elevation of the lowest finished floor of the proposed building(s) at the B.L. England Substation project site. The construction of any habitable area below this elevation, such as a basement, is prohibited. 6. The Department has determined that this project meets the requirements of the Stormwater Management rules at N.J.A.C. 7:8. Any future expansion or alteration of the approved stormwater management system, which would affect water quality, increase the rate or volume of stormwater leaving the site, affect the infiltration capacity on the site, or alter the approved low impact site design, shall be reviewed and approved by the Department prior to construction. This includes any proposed changes to the discharge characteristics of any basin, the construction of new inlets or pipes that tie into the storm sewer network and/or the replacement of existing inlets or pipes with structures of different capacity. 7. The applicant shall make specific arrangements to ensure the continuous maintenance and efficient operation of all proposed stormwater management measures onsite. This includes the inspection (and cleaning where necessary) of any and all constructed swales, basins, inlets, and mechanical treatment devices at least four times per year and after every major storm totaling 1 inch of rainfall or more, the use of appropriate soil conservation practices onsite, and any other reasonable effort required to maintain the stormwater management system in good working order. 8. Prior to the start of any construction onsite, the applicant/owner shall record a deed notice for all stormwater management measures authorized under this permit which shall be recorded in the Office of the County Clerk or the registrar of deeds and mortgages of the county in which the development, project, project site, or mitigation area containing the stormwater management measure is located. A form of deed notice shall be submitted to the Watershed and Land Management Program (Program) for approval prior to filing. The deed notice shall contain a description of the stormwater management measure(s) used to meet the green infrastructure, groundwater recharge, stormwater runoff quality, and stormwater runoff quantity standards at N.J.A.C. 7:8-5.3, 5.4, 5.5, and 5.6 and shall identify the location of the stormwater management measure(s) in NAD 1983 State Plane New Jersey FIPS 2900 US Feet or Latitude and Longitude in decimal degrees. The deed notice shall also reference the maintenance plan required to be recorded upon the deed pursuant to N.J.A.C. 7:8- 5.8(d). Prior to the commencement of construction, proof that the above required deed notice has been filed shall be submitted to the Program. Proof that the required information has been recorded on the deed shall be in the form of either a copy of the complete recorded document or a receipt from the clerk or other proof of recordation provided by the recording office. However, if the initial proof provided to the Program is not a copy of the complete recorded document, a copy of the complete recorded document shall be provided to the Program within 180 calendar days of the authorization granted by the Program. 9. In accordance with N.J.A.C. 7:13-12.6(f), the deed for each lot on which the private roadway or parking area is constructed, as well as any lot served by the private roadway or parking area, and each lease or rental agreement for a unit within the multi-residence building served by a private roadway or parking area that lies below the flood hazard area design flood elevation shall be modified to: i. Explain that the private roadway or parking area is likely to be inundated by floodwaters, which may result in damage and/or inconvenience; and ii. Disclose the depth of flooding that the private roadway or parking area would experience during the FEMA 100-year flood, if available, and the flood hazard area design flood; and iii. The modified deeds are recorded in the Office of the County Clerk or the registrar of deeds and mortgages of the county in which the building is located, and proof that the modified deed has been recorded is provided to the Department prior to the sooner of either: 1) The start of any site disturbance (including pre-construction earth movement, removal of vegetation or structures, or construction of the project); or 2) The date that is 90 calendar days after the issuance of the permit. 10. Construction may only occur while the stream area is dry or in a de-watered condition. No work may be performed where the stream channel is wet.

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	11. De-watering of cofferdams must include properly sized temporary sediment basins or other filtering methods to reduce turbidity. The stream area to receive return water discharged from cofferdams must be encompassed by a turbidity barrier. The turbidity barrier must be located parallel to the stream banks and anchored to the shoreline to maintain freeflow of the stream center. In order to avoid obstruction of stream flows or fish passage, turbidity barriers must not be placed across the entire stream channel.
4	Mitigation Conditions Wetlands Permanent Impact Mitigation Conditions 1. The permittee shall mitigate for the permanent loss of 0.302 acres of forested and 1.519 acres of emergent wetlands with the purchase of 1.821 credits from a mitigation bank serving the appropriate watershed management area. 2. At this time, the following bank(s) are approved to serve the project area; additional banks may be approved at any time, so please contact the Mitigation unit for the most up to date service area information if you would like additional options. Within 60 days and prior to initiation of regulated activities, the permittee shall submit proof of purchase for the amount of mitigation credits listed above to the attention of the Mitigation Unit Supervisor, NJDEP, Division of Watershed Protection and Restoration at Mail Code 501-02A, P.O. Box 420, Trenton, NJ 08625-0420. Great Bay Wetland Mitigation Bank - Contact Mark Renna of Evergreen Environmental, LLC at (201)644-7302 (office) or 973-356-7164 or at mrenna@evergreenenv.com 3. If mitigation credits are no longer available from the above referenced mitigation bank, the permittee shall contact the Division of Watershed Protection and Restoration, Mitigation Unit to arrange for an alternative mitigation option prior to the initiation of regulated activities. Wetlands Temporary Impact Mitigation Conditions 1. The permittee shall mitigate for the temporary disturbance to 5.436 acres of emergent wetlands and 0.07 acres of open waters through an on-site restoration project. (N.J.A.C. 7:7A-11 et seq/N.J.A.C. 7:7-17.1) 2. Within 30 days of receipt of the permit, or at least 90 calendar days prior to the commencement of regulated activities authorized by the permit, the applicant shall submit to the Department for review a temporary restoration plan providing details regarding the number, type, size and location of restoration plantings and the contents of any seed mix, if applicable. 3. Regulated activities shall not commence until the temporary restoration plan has been reviewed and approved by the Department. (N.J.A.C. 7:7A-11.6(a)). 4. All mitigation shall be conducted immediately following completion of the activity that caused the disturbance and shall be continued to completion within six months after the end of the activity that caused the disturbance. 5. If the permittee fails to perform mitigation within the applicable time-period the activity shall be considered permanent and mitigation shall be required to replace the affected resource. (N.J.A.C. 7:7A-11.3(c)). 6. If the permittee is conducting a temporary restoration project, the following conditions shall apply: a. Prior to the initiation of regulated activities authorized by this permit the permittee shall submit a final design of the mitigation project for approval and include all of the items listed on the checklist entitled Checklist for Completeness: Creation, Restoration or Enhancement for a Coastal Wetland Mitigation Proposal located at http://www.nj.gov/dep/landuse/forms/index.html. b. The permittee shall obtain a secured bond or other financial surety acceptable to the Division from a firm licensed to provide such services in New Jersey. (N.J.A.C. 7:7-17.17) c. The permittee shall notify the Mitigation Unit at the Division of Watershed Protection and Restoration in writing at least 30 days prior to the start of construction of the wetland restoration project to arrange for an on-site pre-construction meeting among the permittee, the contractor, the consultant and the Division. d. To ensure the intent of the mitigation design and its predicted wetland hydrology is realized in the landscape, the mitigation designer shall be present on-site during all critical stages of mitigation construction and during the restoration of any temporarily impacted areas. Critical stages of construction include but are not limited to herbicide applications, earthmoving activities, planting, and inspections. e. The permittee shall be responsible for ensuring that best management practices are used throughout construction to control the spread and colonization of highly invasive plants. Specifically, all equipment, especially tracks and tires, must be thoroughly cleaned every time equipment or vehicles move from an area containing invasive plants or from off-site to the mitigation area. In addition, soil containing root fragments and above-ground vegetative material from invasive plants shall be carefully managed during earthmoving activities and disposed of at a suitable offsite location rather than mulched and reused or stockpiled elsewhere on the site. For information on the specific species that are considered to be invasive, please refer to the Invasive Plant Atlas at http://www.invasiveplantatlas.org/index.html. f. If changes to the mitigation design are necessary to ensure success of the project as a result of on-site conditions, the mitigation designer shall immediately notify the Division in writing and submit an alternative plan which achieves the proposed wetland conditions. Any modifications to the plan that are reviewed and approved by the Division must be shown on a signed and sealed revised plan. The As-Built plans required as a part of the Construction Completion Report may serve as the signed and sealed revised plan required to be submitted as part of the construction modification process described above if time constraints warrant such action and have been approved by the Division in writing. g. Within 30 days of final grading of the mitigation site and prior to planting, the permittee shall notify the Mitigation Unit at the Division of Watershed Protection and Restoration in writing to arrange a post-grading construction meeting among the permittee, contractor, consultant and the Division. h. Within 60 days following the completion of the mitigation project, the permittee shall submit a Construction Completion Report to the Division detailing as-built conditions (N.J.A.C. 7:7-17.11(h)). The Construction Completion Report shall contain, at a minimum, the following information: 1) A completed Wetland Mitigation Project Completion of Construction Form that certifies the mitigation project has been constructed as designed and that the proposed area of wetland restoration has been accomplished. This form is located at on the Division's website at: www.nj.gov/dep/landuse in the Mitigation tab of Forms & Checklists. 2) An as-built plan of the completed mitigation area showing grading and any structures included in the approved mitigation proposal; 3) Photographs, both pre- and post-construction, of the intertidal and subtidal shallows mitigation project including a photo location map as well as the GPS waypoints in NJ state plane coordinates NAD 1983; and 4) Any changes to the approved mitigation plan that were made during construction and an explanation for the deviation(s). i. Within 30 days following final planting of the mitigation project, the permittee shall post the mitigation area with permanent signs which identify the site as a wetland mitigation project and that all-terrain vehicle use, motorbike use, mowing, dumping, draining, cutting and/or removal of plant materials is prohibited and that violators shall be prosecuted and fined to the fullest extent under the law. The signs must also state the name of the permittee, a contact name and phone number, and the Department's permit number. j. The permittee shall monitor the mitigation for 5 full growing seasons beginning the year after the mitigation project has been completed. The permittee shall submit monitoring reports to the Division of Watershed Protection and Restoration no later than December 31st of each full monitoring year (N.J.A.C. 7:7-17.13(e)). All monitoring reports must include the standard items identified in the checklists entitled Wetland Mitigation Monitoring Project

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	Checklist and Tidal Wetland Mitigation Monitoring Checklist. The Wetland Mitigation Monitoring Project Checklist and Tidal Wetland Mitigation Monitoring Checklist are located at http://www.nj.gov/dep/landuse/forms/index.html. Please note: The monitoring period may be reduced if the restoration is successful more quickly. k. Once the required monitoring period has expired and the permittee has submitted the final monitoring report, the Division will make the finding that the mitigation project is either a success or a failure. In accordance with N.J.A.C. 7:7-17.11(k), the mitigation project will be considered successful if the permittee demonstrates all of the following: 1) A completed Wetland Mitigation Project Completion of Construction Form that certifies the mitigation project has been constructed as designed and that the proposed area of wetland creation, restoration or enhancement has been accomplished. This form is located at on the Division's website at: www.nj.gov/dep/landuse in the Mitigation tab of Forms & Checklists. 2) An as-built plan of the completed mitigation area showing grading and any structures included in the approved mitigation proposal; 3) Photographs, both pre and post-construction, of the tidal wetland mitigation project including a photo location map as well as the GPS waypoints in NJ state plane coordinates NAD 1983; 4) The site has an 85 percent survival and 85 percent area coverage of the mitigation plantings or target hydrophytes, which are species native to the area and similar to ones identified on the mitigation planting plan. All plant species in the mitigation area must be healthy and thriving; and 5) The site has less than 10 percent coverage by invasive or noxious species. Please note: If the site is originally comprised of invasive species, the percent coverage and composition of invasive plants on the site shall be document in advance of the conduct of the activity. During restoration, the applicant shall make a good faith effort to avoid restoration with invasives, but the Department will consider the pre-construction site composition when determining whether this criteria has been satisfied. 7. The permittee is responsible for assuming all liability for any corrective work necessary to meet the success criteria established above (N.J.A.C. 7:7-17.13(h)). The Division will notify the permittee in writing if the mitigation project is considered to be a failure. Within 30 days of notification, the permittee shall submit a revised mitigation plan to meet the success criteria identified above for Division review and approval. The financial surety, if required, will not be released by the Division until such time that the permittee satisfies the success criteria as stipulated above.
5	Standard Conditions 1. The issuance of a permit shall in no way expose the State of New Jersey or the Department to liability for the sufficiency or correctness of the design of any construction or structure(s). Neither the State nor the Department shall, in any way, be liable for any loss of life or property that may occur by virtue of the activity or project conducted as authorized under a permit. 2. The issuance of a permit does not convey any property rights or any exclusive privilege. 3. The permittee shall obtain all applicable Federal, State, and local approvals prior to commencement of regulated activities authorized under a permit. 4. A permittee conducting an activity involving soil disturbance, the creation of drainage structures, or changes in natural contours shall obtain any required approvals from the Soil Conservation District or designee having jurisdiction over the site. 5. The permittee shall take all reasonable steps to prevent, minimize, or correct any adverse impact on the environment resulting from activities conducted pursuant to the permit, or from noncompliance with the permit. 6. The permittee shall immediately inform the Department of any unanticipated adverse effects on the environment not described in the application or in the conditions of the permit. The Department may, upon discovery of such unanticipated adverse effects, and upon the failure of the permittee to submit a report thereon, notify the permittee of its intent to suspend the permit. 7. The permittee shall immediately inform the Department by telephone at (877) 927-6337 (WARN DEP hotline) of any noncompliance that may endanger public health, safety, and welfare, or the environment. The permittee shall inform the Watershed & Land Management by telephone at (609) 777-0454 of any other noncompliance within two working days of the time the permittee becomes aware of the noncompliance, and in writing within five working days of the time the permittee becomes aware of the noncompliance. Such notice shall not, however, serve as a defense to enforcement action if the project is found to be in violation of this chapter. The written notice shall include: i. A description of the noncompliance and its cause; ii. The period of noncompliance, including exact dates and times; iii. If the noncompliance has not been corrected, the anticipated length of time it is expected to continue; and iv. The steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance. 8. Any noncompliance with a permit constitutes a violation of this chapter and is grounds for enforcement action, as well as, in the appropriate case, suspension and/or termination of the permit. 9. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the authorized activity in order to maintain compliance with the conditions of the permit. 10. The permittee shall employ appropriate measures to minimize noise where necessary during construction, as specified in N.J.S.A. 13:1G-1 et seq. and N.J.A.C. 7:29. 11. The issuance of a permit does not relinquish the State's tidelands ownership or claim to any portion of the subject property or adjacent properties. 12. The issuance of a permit does not relinquish public rights to access and use tidal waterways and their shores. 13. The permittee shall allow an authorized representative of the Department, upon the presentation of credentials, to: i. Enter upon the permittee's premises where a regulated activity, project, or development is located or conducted, or where records must be kept under the conditions of the permit; ii. Have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit; iii. Inspect, at reasonable times, any facilities, equipment, practices, or operations regulated or required under the permit. Failure to allow reasonable access under this paragraph shall be considered a violation of this chapter and subject the permittee to enforcement action; and iv. Sample or monitor at reasonable times, for the purposes of assuring compliance or as otherwise authorized by the Federal Act, by the Freshwater Wetlands Protection Act, or by any rule or order issued pursuant thereto, any substances or parameters at any location. 14. The permittee shall not cause or allow any unreasonable interference with the free flow of a regulated water by placing or dumping any materials, equipment, debris or structures within or adjacent to the channel while the regulated activity, project, or development is being undertaken. Upon completion of the regulated activity, project, or development, the permittee shall remove and dispose of in a lawful manner all excess materials, debris, equipment, and silt fences and other temporary soil erosion and sediment control devices from all regulated areas. 15. The permittee and its contractors and subcontractors shall comply with all conditions, site plans, and supporting documents approved by the permit. 16. All conditions, site plans, and supporting documents approved by a permit shall remain in full force and effect, so long as the regulated activity, project, or development, or any portion thereof, is in existence, unless the permit is modified pursuant to the rules governing the herein approved permits. 17. The permittee shall perform any mitigation required under the permit in accordance with the rules governing the herein approved permits. 18. If any condition or permit is determined to be legally unenforceable, modifications and additional conditions may be imposed by the Department as necessary to protect public health, safety, and welfare, or the environment.

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	19. Any permit condition that does not establish a specific timeframe within which the condition must be satisfied (for example, prior to commencement of construction) shall be satisfied within six months of the effective date of the permit. 20. A copy of the permit and all approved site plans and supporting documents shall be maintained at the site at all times and made available to Department representatives or their designated agents immediately upon request. 21. The permittee shall provide monitoring results to the Department at the intervals specified in the permit. 22. A permit shall be transferred to another person only in accordance with the rules governing the herein approved permits. 23. A permit can be modified, suspended, or terminated by the Department for cause. 24. The submittal of a request to modify a permit by the permittee, or a notification of planned changes or anticipated noncompliance, does not stay any condition of a permit. 25. Where the permittee becomes aware that it failed to submit any relevant facts in an application, or submitted incorrect information in an application or in any report to the Department, it shall promptly submit such facts or information. 26. The permittee shall submit email notification to the Bureau of Coastal & Land Use Compliance & Enforcement at CLU_tomsriver@dep.nj.gov at least 3 days prior to commencement of site preparation and/or regulated activities, whichever comes first. The notification shall include proof of completion of all pre-construction conditions, including proof of recording of permits, approved plans and/or conservation easements, if required. The permittee shall allow an authorized Bureau representative on the site to inspect to ensure compliance with this permit. Additionally, the permittee shall notify the Department in writing (at the address listed on page one of this permit) within five working days prior to commencement of operation of a CAFRA individual permit. At this time, the permittee shall certify that all conditions of the permit that must be met prior to operation of the development have been met. 27. The permittee shall record the permit, including all conditions listed therein, with the Office of the County Clerk (the Registrar of Deeds and Mortgages, if applicable) of each county in which the site is located. The permit shall be recorded within 30 calendar days of receipt by the permittee, unless the permit authorizes activities within two or more counties, in which case the permit shall be recorded within 90 calendar days of receipt. Upon completion of all recording, a copy of the recorded permit shall be forwarded to Watershed & Land Management at the address listed on page one of this permit.
NMFS Proposed Incidental Take Regulations and Associated 5-year Letter of Authorization Issued October 26, 2022[6]	
1	**Training and Coordination** Prior to the onset of any in-water activities involving vessel use, pile driving, UXO/MEC detonation, and HRG surveys, and when new personnel join the work, Ocean Wind would conduct briefings for construction supervisors and crews, marine mammal observer and acoustic monitoring teams, and all Ocean Wind staff prior to the start of all pile driving, UXO/MEC detonation, and HRG survey activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, and marine mammal mitigation, monitoring, and reporting requirements. More information on vessel crew training requirements can be found in the Vessel Strike Avoidance Measures section below. **North Atlantic Right Whale Awareness Monitoring** Ocean Wind must use available sources of information on North Atlantic right whale presence, including daily monitoring of the Right Whale Sightings Advisory System, monitoring of Coast Guard VHF Channel 16 throughout each day to receive notifications of any sightings, and information associated with any regulatory management actions (*e.g.,* establishment of a zone identifying the need to reduce vessel speeds). Maintaining daily awareness and coordination affords increased protection of North Atlantic right whales by understanding North Atlantic right whale presence in the area through ongoing visual and passive acoustic monitoring efforts and opportunities (outside of Ocean Wind's efforts), and allows for planning of construction activities, when practicable, to minimize potential impacts on North Atlantic right whales. **Protected Species Observers and PAM Operator Training** Ocean Wind would only employ NMFS-approved PSOs and PAM operators. The PSO field team and PAM team will have a lead member (designated as the "Lead PSO" or "PAM Lead") who will have prior experience observing mysticetes, odontocetes and pinnipeds in the Northwestern Atlantic Ocean on other offshore projects requiring PSOs. Any remaining PSOs and PAM operators must have previous experience observing marine mammals during projects and must have the ability to work with all required and relevant software and equipment. New and/or inexperienced PSOs would be paired with an experienced PSO to ensure that the quality of marine mammal observations and data recording is kept consistent. All PSOs and PAM operators would be required to complete a Permits and Environmental Compliance Plan (PECP) training, as well as a two-day training and refresher session. These trainings will be held with the PSO provider and Project compliance representatives and will occur before the start of project activities related to the construction and development of the Ocean Wind 1 Offshore Wind Energy Facility. PSOs would be required during all foundation installation, cofferdam installation/removal, UXO/MEC detonation, and HRG surveys. More information on requirements during each activity can be found in the Proposed Monitoring and Reporting section.
2	**Vessel Strike Avoidance Measures** This proposed rule contains numerous vessel strike avoidance measures. Ocean Wind will be required to comply with these measures except under circumstances when doing so would create an imminent and serious threat to a person or vessel, or to the extent that a vessel is unable to maneuver and, because of the inability to maneuver, the vessel cannot comply (*e.g.,* due to towing, *etc.*). Vessel operators and crews will receive protected species identification training. This training will cover sightings of marine mammals and other protected species known to occur or which have the potential to occur in the project area. It will include training on making observations in both good weather conditions (*i.e.,* clear visibility, low wind, and low sea state) and bad weather conditions (*i.e.,* fog, high winds and high sea states, in glare). Training will not only include identification skills, but will also include information and resources available regarding applicable Federal laws and regulations for protected species. Ocean Wind will abide by the following vessel strike avoidance measures: • All vessel operators and crews must maintain a vigilant watch for all marine mammals and slow down, stop their vessel, or alter course (as appropriate) and regardless of vessel size, to avoid striking any marine mammal. • During any vessel transits within or to/from the Ocean Wind project area, such as for crew transfers), an observer would be stationed at the best vantage point of the vessel(s) to ensure that the vessel(s) are maintaining the appropriate separation distance from marine mammals.

[6] NMFS Proposed Incidental Take Regulations and Associated 5-year Letter of Authorization are available on NMFS's website: https://www.fisheries.noaa.gov/action/incidental-take-authorization-ocean-wind-lcc-construction-ocean-wind-1-wind-energy-facility

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	• Year-round, all vessel operators will monitor, the project's Situational Awareness System, WhaleAlert, US Coast Guard VHF Channel 16, and the Right Whale Sighting Advisory System (RWSAS) for the presence of North Atlantic right whales once every 4-hour shift during project-related activities. The PSO and PAM operator monitoring teams for all activities will also monitor these systems no less than every 12 hours. If a vessel operator is alerted to a North Atlantic right whale detection within the project area, they will immediately convey this information to the PSO and PAM teams. For any UXO/MEC detonation, these systems will be monitored for 24 hours prior to blasting. • Any observations of any large whale by any Ocean Wind staff or contractor, including vessel crew, must be communicated immediately to PSOs and all vessel captains to increase situational awareness. • All vessels would comply with existing NMFS regulations and speed restrictions and state regulations as applicable for North Atlantic right whales. • Between November 1st and April 30th, all vessels, regardless of size, would operate port to port (specifically from ports in New Jersey, New York, Maryland, Delaware, and Virginia) at 10 knots or less. • All vessels, regardless of size, would immediately reduce speed to 10 kts or less when any large whale, mother/calf pairs, or large assemblages of non-delphinid cetaceans are observed near (within 500 m) an underway vessel. • All vessels, regardless of size, would immediately reduce speed to 10 kts or less when a North Atlantic right whale is sighted, at any distance, by an observer or anyone else on the vessel. • If a vessel is traveling at greater than 10 kts, in addition to the required dedicated visual observer, real-time PAM of transit corridors must be conducted prior to and during transits. If a North Atlantic right whale is detected via visual observation or PAM within or approaching the transit corridor, all crew transfer vessels must travel at 10 kts or less for the following 12 hours. Each subsequent detection will trigger a 12-hour reset. A slowdown in the transit corridor expires when there has been no further visual or acoustic detection in the transit corridor in the past 12 hours. • All underway vessels (*e.g.,* transiting, surveying) must have a dedicated visual observer on duty at all times to monitor for marine mammals within a 180° direction of the forward path of the vessel (90° port to 90° starboard). Visual observers must be equipped with alternative monitoring technology for periods of low visibility (*e.g.,* darkness, rain, fog, *etc.*). The dedicated visual observer must receive prior training on protected species detection and identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements in this proposed action. Visual observers may be third-party observers (*i.e.,* NMFS-approved PSOs) or crew members and must not have any other duties other than observing for marine mammals. Observer training related to these vessel strike avoidance measures must be conducted for all vessel operators and crew prior to the start of in-water construction activities to distinguish marine mammals from other phenomena and broadly to identify a marine mammal as a North Atlantic right whale, other whale (defined in this context as sperm whales or baleen whales other than North Atlantic right whales), or other marine mammals. Confirmation of the observers' training and understanding of the ITA requirements must be documented on a training course log sheet and reported to NMFS. • All vessel operators and crews, regardless of their vessel's size, must maintain a vigilant watch for all marine mammals and slow down, stop their vessel, or alter course, as appropriate, to avoid striking any marine mammal. • All vessels must maintain a minimum separation distance of 500 m from North Atlantic right whales. If a whale is observed but cannot be confirmed as a species other than a North Atlantic right whale, the vessel operator must assume that it is a North Atlantic right whale and take appropriate action. • If underway, all vessels must steer a course away from any sighted North Atlantic right whale at 10 kts or less such that the 500-m minimum separation distance requirement is not violated. If a North Atlantic right whale, or a large whale that cannot be confirmed to species, is sighted within 500 m of an underway vessel, that vessel must shift the engine to neutral. Engines will not be engaged until the whale has moved outside of the vessel's path and beyond 500 m. • All vessels must maintain a minimum separation distance of 100 m from sperm whales and non-North Atlantic right whale baleen whales. If one of these species is sighted within 100 m of an underway vessel, that vessel must shift the engine to neutral. Engines will not be engaged until the whale has moved outside of the vessel's path and beyond 100 m. • All vessels must, to the maximum extent practicable, attempt to maintain a minimum separation distance of 50 m from all delphinoid cetaceans and pinnipeds, with an exception made for those that approach the vessel (*e.g.,* bow-riding dolphins). If a delphinoid cetacean or pinniped is sighted within 50 m of an underway vessel, that vessel must shift the engine to neutral, with an exception made for those that approach the vessel (*e.g.,* bow-riding dolphins). Engines will not be engaged until the animal(s) has moved outside of the vessel's path and beyond 50 m. • When a marine mammal(s) is sighted while a vessel is underway, the vessel must take action as necessary to avoid violating the relevant separation distances (*e.g.,* attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area. If a marine mammal(s) is sighted within the relevant separation distance, the vessel must reduce speed and shift the engine to neutral, not engaging the engine(s) until the animal(s) is clear of the area. This does not apply to any vessel towing gear or any situation where respecting the relevant separation distance would be unsafe (*i.e.,* any situation where the vessel is navigationally constrained. • All vessels underway must not divert or alter course in order to approach any marine mammal. Any vessel underway must avoid excessive speed or abrupt changes in direction. • For in-water construction heavy machinery activities other than impact or vibratory pile driving, if a marine mammal in on a path towards or comes within 10 m of equipment, Ocean Wind must cease operations until the marine mammal has moved more than 10 m on a path away from the activity to avoid direct interaction with equipment. • Individuals implementing the monitoring protocol will assess its effectiveness using an adaptive approach. All PSOs will use their best professional judgment throughout implementation and seek improvements to these methods when deemed appropriate. Any modifications to the protocol will be coordinated between NMFS and Ocean Wind. With the measures described herein, NMFS has prescribed the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.
3	**Fisheries Monitoring Surveys** **Training** All crew undertaking the fishery survey activities would be required to receive protected species identification training prior to activities occurring. **During Vessel Use** During all fishery monitoring activities that require the use of a vessel as a platform, Ocean Wind would follow the *Vessel Strike Avoidance Measures,* described in the section above. • Vessels would also undertaking the following measures: • Specifically for trawl surveys, marine mammal monitoring will occur prior to, during, and after haul-back, and gear will not be deployed if a marine mammal is observed in the area;

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	• Trawl operations will only start after 15 minutes of no marine mammal sightings within 1 nm of the sampling station; and, • During daytime sampling for the research trawl surveys, Ocean Wind will maintain visual monitoring efforts during the entire period of time that trawl gear is in the water from deployment to retrieval. If a marine mammal is sighted before the gear is removed from the water, the vessel will slow its speed and steer away from the observed animal(s). **Gear-Specific Best Management Practices (BMPs)** Ocean Wind would be required to undertake BMPs to reduce risks to marine mammals during several types of activities. These include: • BRUV sampling and chevron trap usage, for example, would utilize specific mitigation measures to reduce impacts to marine mammals. These specifically include the breaking strength of all lines being less than 1,700 pounds (771 kg), limited soak durations of 90 minutes or less, no gear being left without a vessel nearby, and a delayed deployment of gear if a marine mammal is sighted nearby; • The permit number will be written clearly on buoy and any lines that go missing will be reported to NOAA Fisheries' Greater Atlantic Regional Fisheries Office (GARFO) Protected Resources Division as soon as possible; • If marine mammals are sighed near the proposed sampling location, chevron traps and/or BRUVs will not be deployed; • If a marine mammal is determined to be at risk of interaction with the deployed gear, all gear will be immediately removed; • Marine mammal monitoring would occur during daylight hours and begin prior to the deployment of any gear (*e.g.,* trawls, longlines) and continue until all gear has been retrieved; • If marine mammals are sighted in the vicinity within 15 minutes prior to gear deployment and it is determined the risks of interaction are present regarding the research gear, the sampling station will either move to another location or suspend activities until there are no marine mammal sightings for 15 minutes within 1 nm.
4	**WTG and OSS Foundation Installation** **Seasonal and Daily Restrictions** No foundation impact pile driving activities would occur January 1 through April 30. This seasonal restriction would minimize the potential for North Atlantic right whales to be exposed to pile driving noise. Based on the best available information (Roberts *et al.,* 2022), the highest densities of North Atlantic right whales in the project area are expected during the months of January through April. NMFS is requiring this seasonal restriction to minimize the potential for North Atlantic right whales to be exposed to noise incidental to impact pile driving of monopiles, which is expected to greatly reduce the number of takes of North Atlantic right whales. No more than two foundation monopiles would be installed per day. Monopiles would be no larger than 11-m in diameter, representing the larger end of the tapered 8/11-m monopile design. If jacket foundations are used for OSSs, pin piles would be no larger than 2.44-m in diameter. For all monopiles and pin piles, the minimum amount of hammer energy necessary to effectively and safely install and maintain the integrity of the piles must be used. Hammer energies must not exceed 4,000 kJ. Ocean Wind has requested authorization to initiate pile driving during nighttime when detection of marine mammals is visually challenging. To date, Ocean Wind has not submitted a plan containing the information necessary, including evidence, that their proposed systems are capable of detecting marine mammals, particularly large whales, at distances necessary to ensure mitigation measures are effective and, in general, the scientific literature on these technologies demonstrate there is a high degree of uncertainty in reliably detecting marine mammals at distances necessary for this project. Therefore, NMFS is not proposing, at this time, to allow Ocean Wind to initiate pile driving later than 1.5 hours after civil sunset or 1 hour before civil sunrise. We are, however, proposing to encourage and allow Ocean Wind the opportunity to further investigate and test advanced technology detection systems to support their request. NMFS is proposing to condition the LOA such that nighttime pile driving would only be allowed if Ocean Wind submits an Alternative Monitoring Plan to NMFS for approval that proves the efficacy of their night vision devices (*e.g.,* mounted thermal/IR camera systems, hand-held or wearable night vision devices (NVDs), infrared (IR) spotlights) in detecting protected marine mammals. If the plan does not include a full description of the proposed technology, monitoring methodology, and data supporting that marine mammals can reliably and effectively be detected within the clearance and shutdown zones for monopiles before and during impact pile driving, nighttime pile driving (unless a pile was initiated 1.5 hours prior to civil sunset) will not be allowed. The Plan should identify the efficacy of the technology at detecting marine mammals in the clearance and shutdowns under all the various conditions anticipated during construction, including varying weather conditions, sea states, and in consideration of the use of artificial lighting. **Noise Abatement Systems** Ocean Wind would employ noise abatement systems, also known as noise mitigation systems (NMS), during all impact pile driving (monopiles and pin piles) to reduce the sound pressure levels that are transmitted through the water in an effort to reduce ranges to acoustic thresholds and minimize any acoustic impacts resulting from pile driving. Ocean Wind would be required to employ a big double bubble curtain or a combination of two or more NMS during these activities, as well as the adjustment of operational protocols to minimize noise levels. Two categories of NMS exist: primary and secondary. A primary NMS would be used to reduce the level of noise produced by the pile driving activities at the source, typically through adjustments on to the equipment (*e.g.,* hammer strike parameters). Primary NMS' are still evolving and will be considered for use during mitigation efforts when the NMS has been demonstrated as effective in commercial projects. However, as primary NMS are not fully effective at eliminating, a secondary NMS would be employed. The secondary NMS is a device or group of devices that would reduce noise as it was transmitted through the water away from the pile, typically through a physical barrier that would reflect or absorb sound waves and, therefore reducing the distance the higher energy sound propagates through the water column. Together, these systems must reduce noise levels to the lowest level practicable with the goal of not exceeding measured ranges to Level A harassment and Level B harassment isopleths corresponding to those modeled assuming 10-dB sound attenuation, pending results of SFV (see the *Acoustic Monitoring for Sound Field and Harassment Isopleth Verification* section). Noise abatement systems, such as bubble curtains, are sometimes used to decrease the sound levels radiated from a source. Bubbles create a local impedance change that acts as a barrier to sound transmission. The size of the bubbles determines their effective frequency band, with larger bubbles needed for lower frequencies. There are a variety of bubble curtain systems, confined or unconfined bubbles, and some with encapsulated bubbles or panels. Attenuation levels also vary by type of system, frequency band, and location. Small bubble curtains have been measured to reduce sound levels but effective attenuation is highly dependent on depth of water, current, and configuration and operation of the curtain (Austin *et al.,* 2016; Koschinski and Lüdemann, 2013). Bubble curtains vary in terms of the sizes of the bubbles and those with larger bubbles tend to perform a bit better and more reliably, particularly when deployed with two separate rings (Bellmann, 2014; Koschinski and Lüdemann, 2013; Nehls *et al.,* 2016). Encapsulated bubble systems (*e.g.,* Hydro Sound Dampers (HSDs)), can be effective within their targeted frequency ranges, *e.g.,* 100-800 Hz, and when used in conjunction with a bubble curtain appear to create the greatest attenuation. The literature presents a wide array of observed attenuation results for bubble curtains. The variability in attenuation levels is the result of variation in design, as well as differences in site conditions and difficulty in properly installing and operating in-water attenuation devices. Secondary NMS that must be used by Ocean Wind include a big bubble curtain (BBC), a hydro-sound damper (HSD), or an AdBm Helmholz resonator (Elzinga *et al.,* 2019). See Section 2.8 of the ITA application (Appendix B, Protected Species Mitigation and Monitoring Plan (PSMMP)) for more information on these (Ocean Wind, 2022b). If a single system is used, it must be a double big bubble curtain (DBBC). Other systems (*e.g.,* noise mitigation screens) are not considered feasible for the Ocean Wind 1 project as they are

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	in their early stages of development and field tests to evaluate performance and effectiveness have not been completed. Should the research and development phase of these newer systems demonstrate effectiveness, as part of adaptive management, Ocean Wind may submit data on the effectiveness of these systems and request approval from NMFS to use them during pile driving. If a bubble curtain is used (single or double), Orsted would be required to maintain the following operational parameters: The bubble curtain(s) must distribute air bubbles using a target air flow rate of at least 0.5 m^3 /(min*m), and must distribute bubbles around 100 percent of the piling perimeter for the full depth of the water column. The lowest bubble ring must be in contact with the seafloor for the full circumference of the ring, and the weights attached to the bottom ring must ensure 100-percent seafloor contact; no parts of the ring or other objects should prevent full seafloor contact. Ocean Wind must require that construction contractors train personnel in the proper balancing of airflow to the bubble ring, and must require that construction contractors submit an inspection/performance report for approval by Ocean Wind within 72 hours following the performance test. Corrections to the attenuation device to meet the performance standards must occur prior to impact driving of monopiles. If Ocean Wind uses a noise mitigation device in addition to a BBC, similar quality control measures will be required. The literature presents a wide array of observed attenuation results for bubble curtains. The variability in attenuation levels is the result of variation in design, as well as differences in site conditions and difficulty in properly installing and operating in-water attenuation devices. Dähne *et al.* (2017) found that single bubble curtains that reduce sound levels by 7 to 10 dB reduced the overall sound level by approximately 12 dB when combined as a double bubble curtain for 6 m steel monopiles in the North Sea. Bellmann *et al.* (2020) provide a review of the efficacy of using bubble curtains (both single and double) as noise abatement systems in the German Exclusive Economic Zone (EEZ) of the North and Baltic Seas. For 8 m diameter monopiles, single bubble curtains achieved an average of 11 dB broadband noise reduction (Bellmann *et al.,* 2020). Ocean Wind would use a combination of two devices during impact pile driving. As previously discussed, the modeling of the sound fields for Ocean Wind's proposed activities demonstrated modeling assuming broadband attenuation levels of 0 dB, 6 dB, 10 dB, 15 dB, and 20 dB to gauge the effects on the ranges to threshold, given these various levels of sound attenuation. Ocean Wind anticipates, and NMFS agrees, that the use of a noise mitigation system will produce field measurements of the isopleth distances to the Level A harassment and Level B harassment thresholds that accord with those modeled assuming 10 dB of attenuation for both impact pile driving of monopiles and pin piles (refer back to the Estimated Take, Proposed Mitigation, and Proposed Monitoring and Reporting sections). **Use of PSOs and PAM Operators** As described above, Ocean Wind would be required to use PSOs and acoustic PSOs (*i.e.,* PAM operator) during all foundation installation activities. At minimum, four PSOs would be actively observing marine mammals before, during, and after pile driving. At least two PSOs would be stationed on the pile driving vessel and at least two PSOS would be stationed on a secondary, PSO-dedicated vessel. The dedicated PSO vessel would be located at the outer edge of the 2 km (in the summer; 2.5 km in the winter) large whale clearance zone (unless modified by NMFS based on SFV). These PSOs would be required to maintain watch at all times when impact pile driving of monopiles and/or pin piles is underway. Concurrently, at least one PAM operator would be actively monitoring for marine mammals before, during and after pile driving. More details on PSO and PAM operator requirements can be found in the Proposed Monitoring and Reporting section. Furthermore, all crew and personnel working on the Ocean Wind 1 project would be required to maintain situational awareness of marine mammal presence (discussed further above) and would be required to report any sightings to the PSOs. **Clearance and Shutdown Zones** NMFS is proposing to require the establishment of both clearance and shutdown zones during all impact pile driving of WTG and OSS foundation piles. Ocean Wind must use visual PSOs and PAM operators to monitor the area around each foundation pile before, during and after pile driving. Prior to the start of impact pile driving activities, Ocean Wind would clear the area of marine mammals, per Table 37, to minimize the potential for and degree of harassment. The purpose of “clearance” of a particular zone is to prevent potential instances of auditory injury, and more severe behavioral disturbance or, in the case of North Atlantic right whales, avoid and minimize behavioral disturbance to the maximum extent practicable (for North Atlantic right whales, the clearance and shutdown zones are set to any distance; see Table 37). By delaying the commencement of impact pile driving if marine mammals are detected within certain pre-defined distances from the pile being installed. PSOs would visually monitor for marine mammals for a minimum of 60 minutes while PAM operators would review data from at least 24 hours prior to pile driving and actively monitor hydrophones for 60 minutes prior to pile driving. Prior to initiating soft-start procedures, all clearance zones must be visually confirmed to be free of marine mammals for 30 minutes immediately prior to starting a soft-start of pile driving. If a marine mammal is observed entering or within the relevant clearance zone prior to the initiation of impact pile driving activities, pile driving must be delayed and will not begin until either the marine mammal(s) has voluntarily left the specific clearance zones and have been visually or acoustically confirmed beyond that clearance zone, or, when specific time periods have elapsed with no further sightings or acoustic detections have occurred (*i.e.,* 15 minutes for small odontocetes and 30 minutes for all other marine mammal species). All distances to the perimeter of clearance zones are the radii from the center of the pile. Mitigation zones related to impact pile driving activities were created around two different seasonal periods to account for the different seasonal sound speed profiles that were used in JASCO's underwater sound propagation modeling, including summer (May through November) and winter (December) (Table 37). Ocean Wind would be required to implement these zones during foundation installation. While clearance and shutdowns would be monitored both visually and acoustically, NMFS is proposing to establish a minimum visibility zone close to the piles to ensure that marine mammals are detected prior to commencement of pile driving as visual and acoustic methods provide the most effective means of detection when combined (*e.g.,* VanParijs *et al.,* 2021). The minimum visibility zone would extend 1,650 m from the pile during summer months and 2,500 m during December (Table 37). These values correspond to the maximum LFC distance to Level A harassment thresholds assuming two monopiles are driven in a day. The entire minimum visibility zone must be visible (*i.e.,* not obscured by dark, rain, fog, *etc.*) for a full 30 minutes immediately prior to commencing impact pile driving. For North Atlantic right whales, there is an additional requirement that the clearance zone may only be declared clear if no confirmed North Atlantic right whale acoustic detections (in addition to visual) have occurred during the 60-minute monitoring period. Any large whale sighted by a PSO or acoustically detected by a PAM operator that cannot be identified as a non-North Atlantic right whale must be treated as if it were a North Atlantic right whale. The purpose of a shutdown is to prevent a specific acute impact, such as auditory injury or severe behavioral disturbance of sensitive species, by halting the activity. If a marine mammal is observed entering or within the respective shutdown zone (Table 37) after impact pile driving has begun, the PSO will request a temporary cessation of impact pile driving. In situations when shutdown is called for but Ocean Wind determines shutdown is not practicable due to imminent risk of injury or loss of life to an individual, or risk of damage to a vessel that creates risk of injury or loss of life for individuals, reduced hammer energy must be implemented when the lead engineer determines it is practicable. Specifically, pile refusal or pile instability could result in not being able to shut down pile driving immediately. Pile refusal occurs when the pile driving sensors indicate the pile is approaching refusal, and a shut-down would lead to a stuck pile which then poses an imminent risk of injury or loss of life to an individual, or risk of damage to a vessel that creates risk for individuals. Pile instability occurs when the pile is unstable and unable to stay standing if

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	the piling vessel were to "let go." During these periods of instability, the lead engineer may determine a shut-down is not feasible because the shut-down combined with impending weather conditions may require the piling vessel to "let go" which then poses an imminent risk of injury or loss of life to an individual, or risk of damage to a vessel that creates risk for individuals. After shutdown, impact pile driving may be reinitiated once all clearance zones are clear of marine mammals for the minimum species-specific periods, or, if required to maintain pile stability, at which time the lowest hammer energy must be used to maintain stability. If pile driving has been shut down due to the presence of a North Atlantic right whale, pile driving may not restart until the North Atlantic right whale is no longer observed or 30 minutes has elapsed since the last detection. Upon re-starting pile driving, soft start protocols must be followed. The clearance and shutdown zone sizes vary by species and are shown in Table 37. Ocean Wind would be allowed to request modification to these zone sizes pending results of sound field verification (see Proposed Monitoring and Reporting section). Any changes to zone size would be part of adaptive management and would require NMFS' approval.

Table 37 -- Clearance and Shutdown Zones During Impact Pile Driving In Summer And Winter

Monitoring details	Zone Sizes for Impact Piling [a]				
	North Atlantic right whales	Large whales	Delphinids	Harbor porpoises	Seals
Minimum Visibility Zone	1,650 m (2,500 m)				
Clearance Zone	any distance	2,000 m (2,500 m)	100 m	1,100 m (1,450 m)	100 m
PAM Clearance Zone	3,500 m (3,800 m)	n/a	n/a	n/a	n/a
Shutdown Zone	any distance	1,800 m (2,500 m)	100 m	1,000 m (1,450 m)	100 m
PAM Shutdown Zone	1,650 m (2,500 m)	n/a	n/a	n/a	n/a

a - Winter (i.e., December) distances are presented in parentheses.

Soft-Start

The use of a soft start procedure is believed to provide additional protection to marine mammals by warning them, or providing them with a chance to leave the area prior to the hammer operating at full capacity. Soft start typically involves initiating hammer operation at a reduced energy level (relative to full operating capacity) followed by a waiting period. Ocean Wind must utilize a soft start protocol for impact pile driving of monopiles by performing 4-6 strikes per minute at 10 to 20 percent of the maximum hammer energy, for a minimum of 20 minutes. NMFS notes that it is difficult to specify a reduction in energy for any given hammer because of variation across drivers. For impact hammers, the actual number of strikes at reduced energy will vary because operating the hammer at less than full power results in "bouncing" of the hammer as it strikes the pile, resulting in multiple "strikes"; however, as mentioned previously, Ocean Wind will target less than 20 percent of the total hammer energy for the initial hammer strikes during soft start. Soft start will be required at the beginning of each day's monopile installation, and at any time following a cessation of impact pile driving of 30 minutes or longer. If a marine mammal is detected within or about to enter the applicable clearance zones, prior to the beginning of soft-start procedures, impact pile driving would be delayed until the animal has been visually observed exiting the clearance zone or until a specific time period has elapsed with no further sightings (*i.e.,* 15 minutes for small odontocetes and 30 minutes for all other species).

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5	**Cofferdam Installation and Removal** **Seasonal and Daily Restrictions** Ocean Wind has proposed to construct the cofferdams from October to May within the first year of the effective period of the regulations and LOA, with some potential removal being necessary in April or May. However, NMFS is not requiring any seasonal restrictions in this proposed rule due to the relatively short duration of work (*i.e.,* low associated impacts) and although North Atlantic right whales do migrate in coastal waters, they do not typically migrate very close to shore off of New Jersey and/or within New Jersey bays where work would be occurring. Given the distance to the Level B harassment isopleth is conservatively modeled at approximately 10 km, any exposure to vibratory pile driving during cofferdam installation would be at levels closer to the 120 dB Level B harassment threshold and not at louder source levels. Ocean Wind would be required; however, to conduct vibratory pile driving associated with cofferdam installation during daylight hours only. **Noise Abatement Systems** Ocean Wind would install the cofferdams using vibratory pile driving. Given this and the short duration of work, NMFS is not proposing to require noise abatement systems during this activity. **Passive Acoustic Monitoring** PAM would not be required during the installation or removal of temporary cofferdams.

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	Clearance and Shutdown Zones Ocean Wind would establish clearance and shutdown zones for vibratory pile driving activities associated with cofferdam installation (Table 38). Prior to the start of vibratory pile driving activities, at least two PSOs will monitor the clearance zone for 30 minutes, continue monitoring during pile driving and for 30 minutes post pile driving. If a marine mammal is observed entering or is observed within the respective zones, piling will not commence or will be delayed until the animal has exited the zone or a specific amount of time has elapsed since the last sighting (*i.e.,* 30 minutes for large whales and 15 minutes for dolphins, porpoises, and pinnipeds). If a marine mammal is observed entering or within the respective shutdown zone after vibratory pile driving has begun, the PSO will call for a temporary cessation of vibratory pile driving. Ocean Wind must immediately cease pile driving upon orders of the PSO unless shutdown is not practicable due to imminent risk of injury or loss of life to an individual, pile refusal, or pile instability. Pile driving must not restart until either the marine mammal(s) has voluntarily left the specific clearance zones and have been visually or acoustically confirmed beyond that clearance zone, or, when specific time periods have elapsed with no further sightings or acoustic detections have occurred (*i.e.,* 15 minutes for small odontocetes and 30 minutes for all other marine mammal species). Because a vibratory hammer can grip a pile without operating, pile instability should not be a concern and no caveat for re-starting pile driving due to pile instability is proposed.

Table 38 -- Distances to Harassment Thresholds and Mitigation Zones[1] During Vibratory Sheet Pile Driving

Marine Mammal Species	Level A harassment (SEL_{cum}) (m)	Level B harassment (m)	Clearance Zone[2] (m)	Shutdown Zone[3] (m)
Low-frequency cetaceans				
Fin whale*	86.7	10,000	150	100
Minke whale	86.7	10,000	150	100
Sei whale*	86.7	10,000	150	100
Humpback whale	86.7	10,000	150	100
North Atlantic right whale*	86.7	10,000	150	100
Blue whale*	86.7	10,000	150	100

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	(table continued below)

Mid-frequency cetaceans				
Sperm whale*	7.7	10,000	150	100
Atlantic white-sided dolphin	7.7	10,000	150	50
Atlantic spotted dolphin	7.7	10,000	150	50
Common dolphin	7.7	10,000	150	50
Risso's dolphin	7.7	10,000	150	50
Bottlenose dolphin (offshore stock)	7.7	10,000	150	50
Bottlenose dolphin (coastal stock)	7.7	10,000	150	50
Long-finned pilot whale	7.7	10,000	150	50
Short-finned pilot whale	7.7	10,000	150	50
High-frequency cetaceans				
Harbor porpoise	128.2	10,000	150	150
Phocid Pinnipeds (in water)				
Gray seal	52.7	10,000	150	60
Harbor seal	52.7	10,000	150	60

* = denotes species listed under the Endangered Species Act.
Note: SEL_{cum} = cumulative sound exposure level; SPL_{pk} = peak sound pressure level.
1 - Zone sizes are based upon a practical spreading loss model and a source level of 165.0 dB re 1 µPa (JASCO, 2021).
2 - The clearance zones for large whales, porpoises, and seals are based upon the maximum Level A harassment zone (128.2 m) and rounded up for PSO clarity.
3 - The shutdown zones for large whales (including North Atlantic right whale) and porpoises are based upon the maximum Level A harassment zone for each group and rounded up for PSO clarity. Shutdown zones for other dolphins and pilot whales were set using precautionary distances.

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6	**UXO/MEC Detonations** While there would be no more than 10 detonations of UXOs/MECs, and these detonations are of very short duration (approximately 1 second), UXO/MEC detonations have a higher potential to cause mortality and injury than other activities proposed by Ocean Wind, and therefore have specific mitigation measures designed to minimize the likelihood of mortality and/or injury of marine mammals, including: (1) time of year/seasonal restrictions; (2) time of day

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	restrictions; (3) use of PSOs to visually observe for North Atlantic right whales; (4) use of PAM to acoustically detect North Atlantic right whales; (5) implementation of clearance zones; (6) use of noise mitigation technology; and, (7) post-detonation monitoring visual and acoustic monitoring by PSOs and PAM operators. **As Low as Reasonably Practicable (ALARP) Approach** For any UXOs/MECs that require removal, Ocean Wind would be required to implement the As Low as Reasonably Practicable (ALARP) process. This process would require Ocean Wind to undertake “life-and-shift”, *i.e.,* physical removal and then lead up to in situ disposal, which would include low-order (deflagration) to high-order (detonation) methods of removal. Other approaches involve the cutting of the UXO/MEC to extract any explosive components. Implementing the ALARP approach would minimize potential impacts to marine mammals as UXOs/MECs would only be detonated as a last resort. **Seasonal and Daily Restrictions** There is no specific time of year that UXOs/MECs would be detonated as detonation would be considered on a case-by-case basis. However, Ocean Wind would be limited to detonating UXOs/MECs only between May 1st through October 31st to reduce impacts to North Atlantic right whales during peak migratory periods. Furthermore, UXO/MEC detonation would be limited to daylight hours only to reduce impacts on migrating species (such as North Atlantic right whales) and to ensure that visual PSOs can confirm appropriate clearance of the site prior to detonation events occurring. **Noise Abatement Systems** Ocean Wind would be required to use a dual noise abatement system during all UXO/MEC detonation events, as detonations are determined to be necessary during the construction. Although the exact level of noise attenuation that can be achieved by noise abatement systems is unknown, available data from Bellmann *et al.* (2020) and Bellmann and Betke (2021) provide a reasonable expectation that the noise abatement systems will be able to achieve at least 10 dB attenuation. SFV would be required for all detonation events to verify the modeled distances, assuming 10 dB attenuation, are representative of the sound fields generated during detonations. This level of noise reduction is substantial in reducing impact zones for low-frequency cetaceans such as the North Atlantic right whale. For example, assuming the largest UXO/MEC charge weight (454 kg; E12) at a depth of 45 m, a 10 dB reduces the Level A harassment isopleth from 229 km^2 to approximately 41 km^2 (Table 6-4 in the ITA application). The Level B harassment zone, given the same parameters, would decrease from 1,134 km^2 to 437 km^2 (Table 6-5 in the ITA application). However, and as previously stated in this document, Ocean Wind does not expect that all ten of the potential UXOs/MECs would constitute the largest charge weight; however, this weight was used as a conservative option in estimating exposures and take of marine mammals. **Use of PSOs and PAM Operators** Clearing the zone would require use of at least six visual PSOs and one PAM operator on at least two dedicated PSO vessels. An aerial survey must also be performed prior to detonation and immediately after detonation to monitor for marine mammals. This zone must be fully visible for at least 60 minutes and all marine mammal(s) must be confirmed to be outside of the clearance zone for at least 30 minutes prior to detonation. PAM must also be conducted for at least 60 minutes and the zone must be acoustically cleared during this time. **Clearance Zones** Prior to any detonation activities, Ocean Wind proposed to clear a zone encompassing a radius of 3.78 km around the detonation site using both visual and acoustic monitoring methods. This distance represents the modeled Level A (PTS) harassment threshold for low-frequency cetaceans (*i.e.,* large whales) rounded up to the nearest km assuming a 454 kg charge weight and use of a bubble curtain (Table 39). However, NMFS is proposing to require more protective zone sizes in order to ensure the least practicable adverse impact which includes minimizing the potential for TTS. It is currently not known how easily Ocean Wind will be able to identify UXO/MEC size in the field. For this reason, NMFS proposes to require Ocean Wind to clear a zone extending 10 km for large whales, 2 km for dolphins, 10 km for harbor porpoises, and 5 km for seals (Table 39). These zones are based on (but not equal to) the greatest TTS threshold distances from 454 kg charge at any site modeled. We note that harbor porpoise and seals are difficult to detect at great distances, but due to the UXO/MEC detonation time of year restrictions, their presence/abundance is likely to be relatively low. These zone sizes may be adjusted based on SFV and confirmation of UXO/donor charge sizes. Moreover, if Ocean Wind indicates to NMFS they will be able to easily identify charge weights in the field, NMFS would develop clearance zones in the final rule for each charge weight analyzed. The zones would be based on Table 39 below. If a marine mammal is observed entering or within the clearance zone prior to denotation, the activity would be delayed. Only when the marine mammals have been confirmed to have voluntarily left the clearance zones and been visually confirmed to be beyond the clearance zone, or when 60 minutes have elapsed without any redetections for whales (including the North Atlantic right whale) or 15 minutes have elapsed without any redetections of delphinids, harbor porpoises, or seals may detonation continue.

#	Table H-4. Description of Lessee Authorization and Permit Conditions
	Table 39 -- Largest Modeled Clearance and Harassment Zones during UXO/MEC Detonation of E12 (454 kg) Charges Assuming 10 dB Noise Abatement

Marine Mammal Species		Distances to Zones for E12 (454 kg) UXO/MEC Charge Weight[1]		
		Level A Harassment Clearance zone (m)	Level B Harassment Zone (m)	Clearance Zones
Low-frequency cetaceans				
Fin whale*		3,780	11,900	10,000
Minke whale				
Sei whale*				
Humpback whale				
North Atlantic right whale*				
Blue whale*				
Mid-frequency cetaceans				
Sperm whale*		461	2,550	2,000
Atlantic white-sided dolphin				
Atlantic spotted dolphin				
Common dolphin (short-beaked)				
Risso's dolphin				
Bottlenose dolphin	Coastal			
	Offshore			
Long-finned pilot whale				
Short-finned pilot whale				
High-frequency cetaceans				

#	Table H-4. Description of Lessee Authorization and Permit Conditions
	(table continued below)

Harbor porpoise	6,200	14,100	10,000
Pinnipeds (in water)			
Gray seal	1,600	7,020	5,000
Harbor seal			

* = denotes species listed under the Endangered Species Act; kg = kilograms; m = meters; PK = peak pressure level; SEL = sound exposure level.
1 - At time of preparing this proposed rule, Ocean Wind has not provided NMFS evidence they will be able to reliably determine the charge weight of any UXO/MEC that must be detonated; therefore, NMFS assumes all UXO/MECs could be of the largest size modeled. If Ocean Wind provides information they can detect charge weights in the field prior to issuance of the final rule, if issued, NMFS may modify the clearance zone to ones based on charge weights distances to PTS and TTS. Distances to PTS and TTS thresholds have been identified by Ocean Wind in Appendix C of their application.

7

HRG Surveys

Ocean Wind would be required to implement several mitigation measures during all HRG survey activities using boomers, sparkers, and CHIRPs. The measures include shutdown, clearance, ramp-up, the use of PSOs, and vessel strike avoidance. There are no mitigation measures prescribed for sound sources greater than 180 kHz as these would be expected to fall outside of marine mammal hearing ranges and not result in harassment; however, all HRG survey vessels would be subject to the aforementioned vessel strike avoidance measures described earlier in this section. Furthermore, due to the frequency range and characteristics of some of the sound sources, shutdown, clearance, and ramp-up procedures are not proposed to be conducted during HRG surveys utilizing only non-impulsive sources (*e.g.,* Ultra-Short BaseLine and other parametric sub-bottom profilers), with exception to usage of CHIRPS and other non-parametric sub-bottom profilers.

Seasonal and Daily Restrictions

Given the potential impacts to marine mammals from exposure to HRG survey noise sources are relatively minor (*e.g.,* limited to Level B harassment) and that the distances to the Level B harassment isopleth is very small (maximum distance is 141 m), NMFS is not proposing to implement any seasonal or time-of-day restrictions for HRG surveys.

Although no temporal restrictions are proposed, NMFS would require Ocean Wind to deactivate acoustic sources during periods where no data is being collected, except as determined necessary for testing. Any unnecessary use of the acoustic source would be avoided.

Use of PSOs

Ocean Wind would be required to employ qualified, NMFS-approved PSOs during site characterization surveys related to the Ocean Wind 1 project. One PSO would be required to monitor during daylight hours and two would be required to monitor during nighttime hours, per vessel. Any PSO would have the authority to call for a delay or shutdown of survey activities. PSOs would begin visually monitoring 30 minutes prior to the initiation of the specified acoustic source (*i.e.,* ramp-up, if applicable) through 30 minutes after the use of the specified acoustic source has ceased. PSOs would be required to establish and monitor the appropriate clearance and shutdown zones. These zones would be based around the radial distance from the acoustic source and not from the vessel.

Ocean Wind would be required to instruct all vessel personnel regarding the authority of the marine mammal monitoring team(s). For example, the vessel operator(s) would be required to immediately comply with any call for a shutdown by the Lead PSO. Any disagreement between the Lead PSO and the vessel operator would only be discussed after shutdown has occurred. All relevant vessel personnel and the marine mammal monitoring team would be required to participate in joint, onboard briefings that would be led by the vessel operator and the Lead PSO, prior to the beginning of survey activities. This would serve to ensure that all relevant responsibilities, communication procedures, marine mammal monitoring protocols, safety, operational procedures, and ITA requirements are clearly understood by all involved parties. The briefing would be repeated whenever new relevant personnel (*e.g.,* new PSOs, acoustic source operators, relevant crew) join the survey operation before work commences.

Passive Acoustic Monitoring

PAM would not be required during HRG surveys. While NMFS agrees that PAM can be an important tool for augmenting detection capabilities in certain circumstances, its utility in further reducing impacts during HRG survey activities is limited. We have provided a thorough description of our reasoning for not requiring PAM during HRG surveys in several Federal Register notices (*e.g.,*87 FR 40796, July 8, 2022; 87 FR 52913, August 3, 2022; 87 FR 51356, August 22, 2022) which we adopt and those reasons continue to apply for this proposed action.

Clearance, Shutdown, and Vessel Separation Zones

Ocean Wind would be required to implement a 30-minute clearance period of the clearance zones (Table 40) immediately prior to the commencing of the survey or when there is more than a 30 minute break in survey activities and PSOs are not actively monitoring. The clearance zones would be monitored by PSOs, using the appropriate visual technology. If a marine mammal is observed within a clearance zone during the clearance period, ramp-up (as described further on) would not be allowed to begin until the animal(s) has been observed voluntarily exiting its respective clearance zone or until an additional time period has elapsed with no further sighting (*i.e.,* 15 minutes for small odontocetes and seals, and 30 minutes for all other species). In any case when the clearance process has begun in conditions with good visibility, including via the use of night vision equipment (IR/thermal camera), and the Lead PSO has determined that the clearance zones are clear of marine mammals, survey operations would be allowed to commence (*i.e.,* no delay is required) despite periods of inclement weather and/or loss of daylight.

Once the survey has commenced, Ocean Wind would be required to shut down boomers, sparkers, and CHIRPs if a marine mammal enters a respective shutdown zone (Table 40). In cases when the shutdown zones become obscured for brief periods due to inclement weather, survey operations would be allowed to continue (*i.e.,* no shutdown is required) so long as no marine mammals have been detected. The use of boomers, and sparkers, and CHIRPS would not be allowed to commence or resume until the animal(s) has been confirmed to have left the Level B harassment zone or until a full 15 minutes (for small odontocetes and seals) or 30 minutes (for all other marine

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	mammals) have elapsed with no further sighting. Any large whale sighted by a PSO within 1,000 m of the boomers, sparkers, and CHIRPs that cannot be identified as a non-North Atlantic right whale would be treated as if it were a North Atlantic right whale. **Ocea**n Wind would be required to immediately shut down any boomer, sparker, or CHIRP sources if a marine mammal(s) is sighted entering or within its respective shutdown zone: • A 500 m zone for the North Atlantic right whale; and, • A 100 m zone for all other marine mammal species (with exception of specific delphinid species). The shutdown requirement would be waived for small delphinids of the following genera: *Delphinus, Stenella, Lagenorhynchus,* and *Tursiops.* Specifically, if a delphinid from the specified genera is visually detected approaching the vessel (*i.e.,* to bow-ride) or towed equipment, shutdown would not be required. Furthermore, if there is uncertainty regarding identification of a marine mammal species (*i.e.,* whether the observed marine mammal(s) belongs to one of the delphinid genera for which shutdown is waived), the PSOs would use their best professional judgment in making the decision to call for a shutdown. Additionally, shutdown is required if a delphinid that belongs to a genus other than those specified is detected in the shutdown zone. If a boomer, sparker, or CHIRP is shut down for reasons other than mitigation (*e.g.,* mechanical difficulty) for less than 30 minutes, it would be allowed to be activated again without ramp-up only if: (1) PSOs have maintained constant observation and (2) no additional detections of any marine mammal occurred within the respective shutdown zones. If a boomer, sparker, or CHIRP was shut down for a period longer than 30 minutes, then all clearance and ramp-up procedures would be required to be initiated, as previously described.

Table 40 -- Harassment Threshold Ranges and Mitigation Zones During HRG Surveys

Marine Mammal Species	Level B Harassment Zone (m)		Clearance Zone (m)	Shutdown Zone (m)
	Boomer/Sparker use	CHIRPs		
Low-frequency cetaceans				
Fin whale*	141	48	100	100
Minke whale			100	100
Sei whale*			100	100
Humpback whale			100	100
North Atlantic right whale*			500	500
Blue whale*			100	100

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Mid-frequency cetaceans				
Sperm whale*	141	48	100	100
Atlantic white-sided dolphin			100	n/a
Atlantic spotted dolphin			100	n/a
Common dolphin			100	n/a
Risso's dolphin			100	100
Bottlenose dolphin (offshore stock)			100	n/a
Bottlenose dolphin (coastal stock)			100	n/a
Long-finned pilot whale			100	100
Short-finned pilot whale			100	100
High-frequency cetaceans				
Harbor porpoise	141	48	100	199
Phocid Pinnipeds (in water)				
Gray seal	141	48	100	100
Harbor seal				

Note: n/a = no shutdown zone mitigation will be applied
* = species is listed under the Endangered Species Act.

Ocean Wind to deactivate acoustic sources during periods where no data is being collected, except as determined necessary for testing. Any unnecessary use of the acoustic source would be avoided.

Ramp-Up

At the start or restart of the use of boomers, sparkers, and/or CHIRPs, a ramp-up procedure would be required unless the equipment operates on a binary on/off switch. A ramp-up procedure, involving a gradual increase in source level output, is required at all times as part of the activation of the acoustic source when technically feasible. Operators should ramp up sources to half power for 5 minutes and then proceed to full power. Prior to a ramp-up procedure starting, the operator would have to notify a PSO of the planned start of the ramp-up. This notification time would not be less than 60 minutes prior to the planned ramp-up activities as all relevant PSOs would need the appropriate 30 minute period to monitor prior to the initiation of ramp-up. Prior to ramp-up beginning, the operator must receive confirmation from the PSO that the clearance zone is clear of any marine mammals. All ramp-ups would be scheduled to

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	minimize the overall time spent with the source being activated. The ramp-up procedure must be used at the beginning of construction survey activities or after more than a 30-minute break in survey activities using the specified HRG equipment to provide additional protection to marine mammals in or near the survey area by allowing them to vacate the area prior to operation of survey equipment at full power. Ocean Wind would not initiate ramp-up until the clearance process has been completed (see Clearance and Shutdown Zones section above). Ramp-up activities would be delayed if a marine mammal(s) enters its respective shutdown zone. Ramp-up would only be reinitiated if the animal(s) has been observed exiting its respective shutdown zone or until additional time has elapsed with no further sighting (*i.e.,* 15 minutes for small odontocetes and seals, and 30 minutes for all other species). Based on our evaluation of the applicant's proposed measures, as well as other measures considered by NMFS, NMFS has preliminarily determined that the proposed mitigation measures would provide the means affecting the least practicable impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.
8	**Proposed Monitoring and Reporting** In order to promulgate a rulemaking for an activity, section 101(a)(5)(A) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring. Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following: • Occurrence of marine mammal species or stocks in the area in which take is anticipated (*e.g.,* presence, abundance, distribution, density). • Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) action or environment (*e.g.,* source characterization, propagation, ambient noise); (2) affected species (*e.g.,* life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.,* age, calving or feeding areas). • Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors. ○ How anticipated responses to stressors impact either: (1) long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks. • Effects on marine mammal habitat (*e.g.,* marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat). • Mitigation and monitoring effectiveness. Separately, monitoring is also regularly used to support mitigation implementation, which is referred to as mitigation monitoring, and monitoring plans typically include measures that both support mitigation implementation and increase our understanding of the impacts of the activity on marine mammals. During the construction activities related to Ocean Wind 1, visual monitoring by NMFS-approved PSOs would be conducted before, during, and after impact pile driving; vibratory pile driving; any UXO/MEC detonations, and during HRG surveys, and PAM will be conducted during all impact pile driving and UXO/MEC detonations. Observations by PSOs will support the mitigation measures described above. Also, to increase understanding of the impacts of the activity on marine mammals, observers will record all incidents of marine mammal occurrence at any distance from the piling location, UXO/MEC detonation site, and during active HRG acoustic sources, and monitors will document all behaviors, and behavioral changes, in concert with distance from an acoustic source. The required monitoring is described below, beginning with PSO measures that are applicable to all activities or monitoring, followed by activity-specific monitoring requirements. **Protected Species Observer Requirements** Ocean Wind would be required to collect sighting data and behavioral response data related to construction activities for marine mammal species observed in the region of the activity during the period in which an activity occurs using NMFS-approved visual and acoustic PSOs (see Proposed Mitigation section). All observers must be trained in marine mammal identification and behaviors and are required to have no other construction-related tasks while conducting monitoring. PSOs will monitor all clearance and shutdown zones prior to, during, and following impact pile driving; vibratory pile driving; UXO/MEC detonation; and during HRG surveys using boomers, sparkers, and CHIRPs (with monitoring durations specified further below). PSOs will also monitor the Level B harassment zones and will document any marine mammals observed within these zones, to the extent practicable (noting that some zones are too large to fully observe). Observers would be located at the best practicable vantage points on the pile driving vessel and, where required, dedicated PSO vessels or aerial platforms. Full details regarding all marine mammal monitoring must be included in relevant Plans (*e.g.,* Pile Driving and Marine Mammal Monitoring Plan) that, under this proposed action, Ocean Wind would be required to submit to NMFS for approval at least 90 days in advance of the commencement of any construction activities. The following measures apply to all visual monitoring efforts: 1. Monitoring must be conducted by qualified, trained PSOs who will be placed on the primary vessel relevant to the activity (*e.g.,* pile driving vessel, UXO/MEC vessel, HRG survey vessel) and dedicated PSO vessels (*e.g.,* additional UXO/MEC vessels) and must be in positions that allow for the best vantage point to monitor for marine mammals and implement the relevant shutdown procedures, when determine to be applicable; 2. PSO must be independent, dedicated, and qualified, meaning that they must be employed by a third-party observer provider and must have no other tasks beyond to conduct observational effort, collect data, and communicate with an instruct the relevant vessel crew with regard to the presence of protected species and mitigation requirements; 3. During all activities, PSOs would be located at the best vantage point(s) to provide adequate coverage of the entire visual shutdown and clearance zones, and as much of the Level B harassment zone as possible, while still maintaining a safe work environment; 4. PSOs may not exceed 4 consecutive watch hours, must have a minimum 2-hour break between watches, and may not exceed a combined watch schedule of more than 12 hours in a single 24-hour period; 5. During all observation periods related to pile driving (impact and vibratory), and UXO/MEC detonations, PSOs would be required to use high-magnification (25x), as well as standard handheld (7x), binoculars and the naked eyes to search continuously for marine mammals. During periods of low visibility (*e.g.,* darkness, rain, fog, poor weather conditions, *etc.*), PSOs would be required to use alternative technologies (*i.e.,* infrared or thermal cameras) to monitor the shutdown and clearance zones. At least one PSO located on the foundation pile driving vessel and UXO/MEC monitoring vessel would be equipped with “Big Eye” binoculars (*e.g.,* 25 × 150; 2.7 view angle; individual

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	ocular focus; height control) of appropriate quality. These would be mounted on a pedestal on the deck of the vessel at the most appropriate vantage point that would provide for the optimal sea surface observation, as well as safety of the PSO; 6. PSOs should have the following minimum qualifications: a. Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water's surface with the ability to estimate the target size and distance. The use of binoculars is permitted and may be necessary to correctly identify the target(s); b. Ability to conduct field observations and collect data according to the assigned protocols; c. Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations; d. Writing skills sufficient to document observations, including but not limited to: the number and species of marine mammals observed, the dates and times of when in-water construction activities were conducted, the dates and time when in-water construction activities were suspended to avoid potential incidental injury of marine mammals from construction noise within a defined shutdown zone, and marine mammal behavior; e. Ability to communicate orally, by radio, or in-person, with project personnel to provide real-time information on marine mammals observed in the area, as necessary. Observer teams employed by Ocean Wind, in satisfaction of the mitigation and monitoring requirements described herein, must meet the following additional requirements: 1. At least one observer must have prior experience working as an observer; 2. Other observers may substitute education (a degree in biological science or a related field) or training for experience; 3. One observer will be designated as lead observer or monitoring coordinator ("Lead PSO"). This Lead PSO would have prior experience working as an observer in an offshore environment; 4. At least two PSOs located on platforms (either vessel-based or aerial) would be required to have a minimum of 90 days of at-sea experience working in those roles in an offshore environment and would be required to have no more than eighteen months elapsed since the conclusion of their last at-sea experience; and, 5.All PSOs must be approved by NMFS. Ocean Wind would be required to submit the curriculum vitae (CV) of the initial set of PSOs necessary to commence the project to NMFS OPR (at *itp.potlock@noaa.gov*) for approval at least 60 days prior to the first day of construction activities. PSO resumes would need to include the dates of training and any prior NMFS approval, as well as the dates and description of their last PSO experience, and must be accompanied by information documenting their successful completion of an acceptable training course. NMFS would allow for 3 weeks to approve PSOs from the time that the necessary information is received by NMFS, after which any PSOs that meet the minimum requirements would automatically be considered approved. Some activities planned to be undertaken by Ocean Wind may require the use of PAM, which would necessitate the employment of at least one acoustic PSO (aka PAM operator on duty at any given time). PAM operators would be required to meet several of the specified requirements described above for PSOs, including: 2, 6b-e, 8, 10, and 11. Furthermore, PAM operators would be required to complete a specialized training for operating the PAM systems and must demonstrate familiarity with the PAM system on which they will be working. PSOs would be able to act as both acoustic and visual observers during the construction of Ocean Wind 1 if the individual(s) demonstrates that they have had the required level and appropriate training and experience to perform each task. However, a single individual would not be allowed to concurrently act in both roles. Ocean Wind would be required to conduct briefings between construction supervisors, construction crews, and the PSO/PAM team prior to the start of all construction activities. When new personnel join the work, briefings must be held to explain all responsibilities, communication procedures, marine mammal monitoring protocols, and operational procedures. An informal guide must be included with the Marine Mammal Monitoring Plan to aid in identifying species if they are observed in the vicinity of the project area. Ocean Wind's personnel and PSOs would also be required to use available sources of information on North Atlantic right whale presence to aid in monitoring efforts. This includes: 1. Monitoring daily of the Right Whale Sightings Advisory System; 2. Consulting of the WhaleAlert app; and, 3. Monitoring of the Coast Guard's VHF Channel 16 throughout the day to receive notifications of any sightings and information associated with any Dynamic Management Areas, to plan construction activities and vessel routes, if practicable, to minimize the potential for co-occurrence with North Atlantic right whales. Additionally, whenever multiple project-associated vessels (of any size; *e.g.,* construction survey, crew transfer) are operating concurrently, any visual observations of ESA-listed marine mammals must be communicated to PSOs and vessel captains associated with other vessels to increase situational awareness. The following are proposed monitoring and reporting measures that NMFS would require specific to each construction activity: **WTG and OSS Foundation Installation** Ocean Wind would be required to implement the following monitoring procedures during all impact pile driving activities of monopiles and/or pin piles related to WTG and OSS installation. Ocean Wind would be required to have a minimum of four PSOs actively observing marine mammals before, during, and after (specific times described below) the installation of foundation piles (monopiles and/or pin piles). At least four PSOs must be actively observing for marine mammals. At least two PSOs must be actively observing on the pile driving vessel while at least two PSOs are actively observing on a secondary, PSO-dedicated vessel. At least one active PSO on each platform must have a minimum of 90 days at-sea experience working in those roles in offshore environments with no more than 18 months elapsed since the conclusion of the at-sea experience. Concurrently, at least one acoustic PSO (*i.e.,* passive acoustic monitoring (PAM) operator) must be actively monitoring for marine mammals before, during and after impact pile driving. All PSOs would need to be located at the best vantage point(s) on the impact pile driving vessel and dedicated PSO vessels in order to ensure 360° visual coverage of the entire clearance and shutdown zones around the vessels, and as much of the Level B harassment zone as possible. During all observation periods associated with impact pile driving, PSOs would use high magnification (25x) binoculars, standard handheld (7x) binoculars, and the naked eye to search continuously for marine mammals. At least one PSO on the foundation pile driving vessel must be equipped with Big Eye binoculars (*e.g.,* 25 x 150; 2.7 view angle; individual ocular focus; height control) of appropriate quality. These must be pedestal mounted on the deck at the most appropriate vantage point that provides for optimal sea surface observation and PSO safety. As described in the Proposed Mitigation section, if the minimum visibility zone cannot be visually monitored at all times using this or alternative equipment, pile driving operations may not commence or, if active, must shutdown. To supplement visual observers within the applicable shutdown zones, Ocean Wind would utilize at least one PAM operator before, during, and after pile installation. This PAM operator would assist the PSOs in ensuring full coverage of the clearance and shutdown zones. All on-duty visual PSOs will remain in contact

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	with the PAM operator on-duty, who will monitor the PAM systems for acoustic detections of marine mammals in the area. The use of real-time PAM will require at least one PAM operator to monitor each system by viewing the data/data products that would be streamed in real-time or near real-time to a computer workstation and monitor. In some cases, the PAM operator may be located onshore with the workstation and monitor or they may be located on a vessel. In either situation, PAM operators will maintain constant and clear communications with visual PSOs on duty regarding animal detections that would be approaching or found within the applicable zones related to impact pile driving. Ocean Wind would utilize PAM to acoustically monitor the clearance and shutdown zones, and would record all detections of marine mammals and estimated distance (noting whether they are in the Level A harassment or Level B harassment zones). To effectively utilize PAM, Ocean Wind would implement the following protocols: • PAM operators would be stationed on at least one of the dedicated monitoring vessels in addition to the PSOs; or located remotely/onshore. • PAM operators would have completed specialized training for operating PAM systems prior to the start of monitoring activities. • All on-duty PSOs will be in contact with the PAM operator on-duty, who will monitor the PAM systems for acoustic detections of marine mammals that are vocalizing in the area. • For real-time PAM systems, at least one PAM operator will be designated to monitor each system by viewing data or data products that are streamed in real-time or near real-time to a computer workstation and monitor located on a Project vessel or onshore. • The PAM operator will inform the Lead PSO on duty of animal detections approaching or within applicable ranges of interest to the pile driving activity via the data collection software system (*i.e.,* Mysticetus or similar system) who will be responsible for requesting the designated crewmember to implement the necessary mitigation procedures. • Acoustic monitoring during nighttime and low visibility conditions during the day will complement visual monitoring (*e.g.,* PSOs and thermal cameras) and will cover an area of at least the Level B harassment zone around each foundation. All PSOs and PAM operators would be required to begin monitoring 60 minutes prior to any impact pile driving, during, and after for 30 minutes. As described in the Proposed Mitigation section, in addition to the clearance zones which can be both visually and acoustically cleared, PSOs would need to visually clear an area extending 1.65 km from the pile during summer months and 2.5 km during December prior to any impact pile driving activities occurring. During this period, marine mammals must be able to be visually detected within the entire minimum visibility zone for a full 30 minutes immediately prior to the start of impact pile driving. The impact pile driving of both monopiles and/or pin piles would only be able to commence when the minimum visibility zone is fully visible (*e.g.,* not obscured by darkness, rain, fog, *etc.*) and the clearance zones are clear of marine mammals for at least 30 minutes, as determined by the Lead PSO, immediately prior to the initiation of impact pile driving. For North Atlantic right whales, any visual or acoustic detection would trigger a delay to the commencement of pile driving. In the event that a large whale is sighted or acoustically detected that cannot be confirmed as a non-North Atlantic right whale species, it must be treated as if it were a North Atlantic right whale. Following a shutdown, monopile and/or pin pile installation may not recommence until the minimum visibility zone is fully visible and clear of marine mammals for 30 minutes. **Cofferdam Installation and Removal** Ocean Wind would be required to implement the following procedures during all vibratory pile driving activities on sheet piles associated with cofferdam installation and removal. Ocean Wind would be required to have a minimum of two PSOs on active duty during any installation and removal of the temporary cofferdams. These PSOs would always be located at the best vantage point(s) on the vibratory pile driving platform or secondary platform in the immediate vicinity of the vibratory pile driving platform, in order to ensure that appropriate visual coverage is available of the entire visual clearance zone and as much of the Level B harassment zone, as possible. NMFS would not require the use of PAM during vibratory pile driving activities related to the installation or removal of the temporary cofferdam. PSOs will monitor the clearance zone for the presence of marine mammals for 30 minutes before, throughout the installation of the sheet piles (and casing pipe, if installed), and for 30 minutes after all vibratory pile driving activities have ceased. Sheet pile or casing pipe installation may only commence when visual clearance zones are fully visible (*e.g.,* not obscured by darkness, rain, fog, *etc.*) and clear of marine mammals, as determined by the Lead PSO, for at least 30 minutes immediately prior to initiation of impact or vibratory pile driving. During all observation periods related to vibratory pile driving, PSOs must use high-magnification (25x), standard handheld (7x) binoculars, and the naked eye to search continuously for marine mammals. During periods of low visibility (*e.g.,* darkness, rain, fog, *etc.*), PSOs must use alternative technology (*i.e.,* IR/Thermal camera) to monitor clearance and shutdown zones. **UXO/MEC Detonations** Ocean Wind would be required to implement the following procedures during all UXO/MEC detonations. Ocean Wind would be required to use a minimum of six PSOs and one PAM operator located on at least two dedicated PSO vessels. All PSOs and PAM operators would be required to begin monitoring 60 minutes prior to the UXO/MEC detonation event, during the event, and after for 30 minutes. As UXO/MEC detonation would only occur during daylight hours, PSOs would only need to monitor during daylight hours (*i.e.,* period between civil twilight rise and set). Ocean Wind would be required to utilize a PAM operator at least 60 minutes prior to detonation events to monitor for marine mammals prior to and after detonation events. The PAM operator would be stationed on one of the dedicated monitoring vessels but may also be located remotely on-shore, but this is subject to approval by NMFS. When real-time PAM is used, at least one PAM operator would be designated to monitor each system by viewing the data or data products that would be streamed in real-time or near real-time to a computer workstation and monitor, which would be located either on an Ocean Wind vessel or onshore. The PAM operator would work in coordination with the visual PSOs to ensure no detections of marine mammals prior to detonation occurring. The PAM operator would inform the Lead PSO on-duty of any animal detections approaching or within the applicable ranges of interest to the detonation activity via the data collection software (*i.e.,* Mysticetus or a similar system), who would then be responsible for requesting the necessary mitigation procedures. The PAM operator would monitor to and past the clearance zone for large whales (10 km), as possible. Ocean Wind would also be required to perform aerial surveys, given the size of the UXO/MEC detonation zones, and at least two PSOs must also be located on the plane during aerial surveys that would occur before, during, and after UXO/detonation events. Aerial PSOs (which would be the same as the vessel-based PSOs) would continue to monitoring for marine mammals before, during, and after the detonation has occurred. PSOs will monitor the clearance zone for the presence of marine mammals for 60 minutes before, throughout the detonation event, and for 30 minutes after. Detonation may only commence when visual clearance zones are fully visible (*e.g.,* not obscured by darkness, rain, fog, *etc.*) and clear of marine mammals, as determined by the Lead PSO, for at least 60 minutes immediately prior to detonation occurring. For detonation zones (based on UXO/MEC charge weight) larger than 2 km, a secondary vessel would be used to monitor the detonation zone(s). In the event a secondary vessel is needed, two PSOs would be located at an appropriate vantage point on this vessel and would

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	maintain watch during the same time period as the PSOs on the primary monitoring vessel. Ocean Wind would be required to ensure that the clearance zones are fully (100 percent) monitored prior to, during, and after detonation events. During all observation periods related to UXO/MEC detonation, PSOs must use high-magnification (25x), standard handheld (7x) binoculars, and the naked eye to search continuously for marine mammals. PSOs located on the UXO/MEC monitoring vessel would also be equipped with "Big Eye" binoculars (*e.g.,* 25 x 150; 2.7 view angle; individual ocular focus; height control). These would be mounted on a pedestal on the deck of the vessel at the most appropriate vantage point that would provide for the optimal sea surface observation, as well as safety of the PSO. **HRG Surveys** Ocean Wind would be required to implement the following procedures during all HRG surveys. Between four and six PSOs would be present on every 24-hour survey vessel, and two to three PSOs would be present on every 12-hour survey vessel. Ocean Wind would be required to have at least one PSO on active duty during HRG surveys that are conducted during daylight hours (*i.e.,* from 30 minutes prior to sunrise through 30 minutes following sunset) and at least two during HRG surveys that are conducted during nighttime hours. During all observation periods, PSOs must use standard handheld (7x) binoculars and the naked eye to search continuously for marine mammals. During periods of low visibility (*e.g.,* darkness, rain, fog, *etc.*), PSOs must use alternative technology (*i.e.,* IR/Thermal camera) to monitor clearance and shutdown zones, as necessary. NMFS does not require the use of PAM during HRG survey activities. All PSOs would begin monitoring 30 minutes prior to the activation of boomers, sparkers, or CHIRPs; throughout boomer, sparker, or CHIRP use; and for 30 minutes after the use of the acoustic sources has ceased. Given that multiple HRG vessels may be operating concurrently, any observations of marine mammals would be required to be communicated to PSOs on all nearby survey vessels. Ramp-up of boomers, sparkers, and CHIRPs would only commence when visual clearance zones are fully visible (*e.g.,* not obscured by darkness, rain, fog, *etc.*) and clear of marine mammals, as determined by the Lead PSO, for at least 30 minutes immediately prior to initiation of survey activities utilizing the specified acoustic sources. During daylight hours when survey equipment is not operating, Ocean Wind would ensure that visual PSOs conduct, as rotation schedules allow, observations for comparison of sighting rates and behavior with and without use of the specified acoustic sources. Off-effort PSO monitoring must be reflected in the monthly PSO monitoring reports. **Marine Mammal Passive Acoustic Monitoring** Ocean Wind would be required to utilize a PAM system to supplement visual monitoring for all monopile and pin pile installations, as well as during all UXO/MEC detonations. The PAM system must be monitored by a minimum of one PAM operator beginning at least 60 minutes prior to soft start of impact pile driving of monopiles and pin piles and UXO/MEC detonation, at all times during monopile and pin pile installation and UXO/MEC detonation, and 30 minutes post-completion of impact pile installation and UXO/MEC detonation. PAM PSOs must immediately communicate all detections of marine mammals at any distance (*i.e.,* not limited to the Level B harassment zones) to visual PSOs, including any determination regarding species identification, distance, and bearing and the degree of confidence in the determination. PAM operators may be on watch for a maximum of 4 consecutive hours followed by a break of at least 2 hours between watches. PAM operators must be required to demonstrate that they have completed specialized training for operating PAM systems, including identification of species-specific mysticete vocalizations. PSOs can act as PAM operators or visual PSOs (but not simultaneously) as long as they demonstrate that their training and experience are sufficient to perform each task. Some PAM systems may be used for real-time mitigation monitoring. This can utilize a variety of sources, but the most likely options, as proposed in Ocean Wind's PSMMP, will be discussed here. Towed PAM systems may be utilized for the Ocean Wind 1 project. These would consist of cabled hydrophone arrays that would be deployed from a vessel and then typically monitored from a tow vessel. Notably, several challenges exist when using a towed PAM system (*i.e.,* the tow vessel may not be fit for the purpose as it may be towing other equipment, operating sound sources, or working in patterns not conducive to effective PAM). Furthermore, detection and localization capabilities for low-frequency cetacean calls (*i.e.,* mysticete species) can be difficult in a commercial deployment setting. Alternatively, these systems have many positive benefits, as they are often low cost to operate, have high mobility, and are fairly easy and reliable to operate. These types of systems also work well in conjunction with visual monitoring efforts. Another PAM system being considered by Ocean Wind are mobile and hybrid PAM systems that are often autonomous and may utilize Autonomous Surface Vehicle (ASV) and radio-linked autonomous acoustic recorders. Ocean Wind plans to deploy PAM arrays specific for mitigation and monitoring of marine mammals outside of the shutdown zone to optimize the PAM system's capabilities to monitor for the presence of animals potentially entering these zones. The exact configuration and number of PAM systems would depend on the size of the zone(s) being monitored, the amount of noise expected in the area, and the characteristics of the signals being monitored. More closely spaced hydrophones would allow for more directionality, and perhaps, range to the vocalizing marine mammals; although, this approach would add additional costs and greater levels of complexity to the project. As larger baleen cetacean species (*i.e.,* mysticetes), which would produce loud and lower-frequency vocalizations, may be able to be heard with fewer hydrophones spaced at greater distances. However, smaller cetaceans (such as mid-frequency delphinids; odontocetes) may necessitate more hydrophones and to be spaced closer together given the shorter range of the shorter, mid-frequency acoustic signals (*e.g.,* whistles and echolocation clicks). As there are no "perfect fit" single optimal array configurations, these set-ups would need to be considered on a case-by-case basis. A Passive Acoustic Monitoring Plan must be submitted to NMFS and BOEM for review and approval at least 180 days prior to the planned start of monopile and pin pile installations. PAM should follow standardized measurement, processing methods, reporting metrics, and metadata standards for offshore wind (Van Parijs *et al.,* 2021). The plan must describe all proposed PAM equipment, procedures, and protocols. However, NMFS considers PAM usage for every project on a case-by-case basis and would continue discussions with Ocean Wind for choosing the PAM system that is determined to be appropriate for this proposed project. **Acoustic Monitoring for Sound Field and Harassment Isopleth Verification (SFV)** During the installation of the first 3 monopile foundations, the installation of the first full jacket foundation (consisting of 16 total pin piles), and during all UXO/MEC detonations, Ocean Wind must empirically determine source levels, the ranges to the isopleths corresponding to the Level A harassment and Level B harassment thresholds and the transmission loss coefficient(s). Ocean Wind may also estimate ranges to the Level A harassment and Level B harassment isopleths by extrapolating from in situ measurements conducted at several distances from the monopile and pin piles being driven and all UXOs/MECs being detonated. Ocean Wind must measure received levels at a standard distance of 750 m from the monopiles and pin piles and at both the presumed modeled Level A harassment and Level B harassment threshold ranges, or an alternative distance as agreed to in the SFV Plan. If acoustic field measurements collected during installation of the first or subsequent monopile, pin pile, and UXOs/MEC being detonated indicate ranges to the isopleths corresponding to Level A harassment and Level B harassment thresholds are greater than the ranges predicted by modeling (assuming 10-dB attenuation), Ocean Wind must implement additional noise mitigation measures prior to installing the next monopile or pin pile, or detonating any additional UXOs/MECs. Initial additional measures may include improving the efficacy of the implemented noise mitigation technology (*e.g.,* BBC, DBBC) and/or modifying the piling schedule to reduce the sound source. Each sequential modification would be evaluated empirically by acoustic field measurements. In the event that field measurements indicate ranges to isopleths corresponding to Level A harassment and Level B harassment thresholds are

#	Table H-4. Description of Lessee Authorization and Permit Conditions
	greater than the ranges predicted by modeling (assuming 10 dB attenuation), NMFS may expand the relevant harassment, clearance, and shutdown zones and associated monitoring protocols. If harassment zones are expanded beyond an additional 1,500 m, additional PSOs would be deployed on additional platforms, with each observer responsible for maintaining watch in no more than 180° and of an area with a radius no greater than 1,500 m. If acoustic measurements indicate that ranges to isopleths corresponding to the Level A harassment and Level B harassment thresholds are less than the ranges predicted by modeling (assuming 10 dB attenuation), Ocean Wind may request a modification of the clearance and shutdown zones for impact pile driving of monopiles and pin piles and for detonation of all UXOs/MECs. For a modification request to be considered by NMFS, Ocean Wind would have had to conduct SFV on 3 or more monopiles and 1 entire jacket foundation (16 pin piles) and on all UXOs/MECs to verify that zone sizes are consistently smaller than predicted by modeling (assuming 10 dB attenuation). In addition, if a subsequent monopile and pin pile installation and location is selected that was not represented by previous three locations (*i.e.,* substrate composition, water depth), SFV would be conducted. Furthermore, if a subsequent UXO/MEC charge weight is encountered and/or detonation location is selected that was not representative of the previous locations (*i.e.,* substrate composition, water depth), SFV would also be required to be conducted. Upon receipt of an interim SFV report, NMFS may adjust zones (*i.e.,* Level A harassment, Level B harassment, clearance, and/or shutdown) to reflect SFV measurements. The shutdown and clearance zones for pile driving would be equivalent to the measured range to the Level A harassment isopleths plus 10 percent (shutdown zone) and 20 percent (clearance zone), rounded up to the nearest 100 m for PSO clarity. However, the minimum visibility zone would not be decreased to a radius smaller than 1.65 km in the summer (and 2.5 km in the winter) from the pile. The shutdown zone for sei, fin, blue, and sperm whales (*i.e.,* large whales) would not be reduced to a size less than 1.8 km in the summer and 2.5 km in the winter. The visual and PAM clearance and shutdown zones for North Atlantic right whales would not be decreased, regardless of acoustic field measurements. The Level B harassment zone would be equal to the largest measured range to the Level B harassment isopleth. Ocean Wind would be required to submit a SFV Plan at least 180 days prior to the planned start of impact pile driving or any detonation activities. The plan would describe how Ocean Wind would ensure that the first three monopile and pin pile installation sites and each UXO/MEC detonation site selected for SFV are representative of the rest of the monopile and pin pile installation and UXO/MEC sites. In the case that these sites are not determined to be representative of all other monopile and pin pile installation sites and UXO/MEC detonation locations, Ocean Wind would include information on how additional sites would be selected for SFV. The plan would also include methodology for collecting, analyzing, and preparing SFV data for submission to NMFS. The plan would describe how the effectiveness of the sound attenuation methodology would be evaluated based on the results. Ocean Wind must also provide, as soon as they are available but no later than 48 hours after each installation, the initial results of the SFV measurements to NMFS in an interim report after each monopile for the first 3 piles and pin pile installation for the first full jacket foundation (16 pin piles). **Reporting** Prior to any construction activities occurring, Ocean Wind would provide a report to NMFS (at *itp.potlock@noaa.gov* and *pr.itp.monitoringreports@noaa.gov*) that demonstrates that all required training for Ocean Wind personnel, which includes the vessel crews, vessel captains, PSOs, and PAM operators have completed all required trainings. NMFS would require standardized and frequent reporting from Ocean Wind during the life of the proposed regulations and LOA. All data collected relating to the Ocean Wind 1 project would be recorded using industry-standard software (*e.g.,* Mysticetus or a similar software) installed on field laptops and/or tablets. Ocean Wind would be required to submit weekly, monthly and annual reports as described below. During activities requiring PSOs, the following information would be collected and reported related to the activity being conducted: • Date and time that monitored activity begins or ends; • Construction activities occurring during each observation period; • Watch status (*i.e.,* sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform); • PSO who sighted the animal; • Time of sighting; • Weather parameters (*e.g.,* wind speed, percent cloud cover, visibility); • Water conditions (*e.g.,* sea state, tide state, water depth); • All marine mammal sightings, regardless of distance from the construction activity; • Species (or lowest possible taxonomic level possible); • Pace of the animal(s); • Estimated number of animals (minimum/maximum/high/low/best); • Estimated number of animals by cohort (*e.g.,* adults, yearlings, juveniles, calves, group composition, *etc.*); • Description (*i.e.,* as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics); • Description of any marine mammal behavioral observations (*e.g.,* observed behaviors such as feeding or traveling) and observed changes in behavior, including an assessment of behavioral responses thought to have resulted from the specific activity; • Animal's closest distance and bearing from the pile being driven, UXO/MEC, or specified HRG equipment and estimated time entered or spent within the Level A harassment and/or Level B harassment zones; • Construction activity at time of sighting (*e.g.,* vibratory installation/removal, impact pile driving, UXO/MEC detonation, construction survey), use of any noise attenuation device(s), and specific phase of activity (*e.g.,* ramp-up of HRG equipment, HRG acoustic source on/off, soft start for pile driving, active pile driving, post-UXO/MEC detonation, *etc.*); • Description of any mitigation-related action implemented, or mitigation-related actions called for but not implemented, in response to the sighting (*e.g.,* delay, shutdown, *etc.*) and time and location of the action; • Other human activity in the area. For all real-time acoustic detections of marine mammals, the following must be recorded and included in weekly, monthly, annual, and final reports: a. Location of hydrophone (latitude & longitude; in Decimal Degrees) and site name;

#	Table H-4. Description of Lessee Authorization and Permit Conditions
	b. Bottom depth and depth of recording unit (in meters); c. Recorder (model & manufacturer) and platform type (*i.e.,* bottom-mounted, electric glider, *etc.*), and instrument ID of the hydrophone and recording platform (if applicable); d. Time zone for sound files and recorded date/times in data and metadata (in relation to UTC. *i.e.* EST time zone is UTC-5); e. Duration of recordings (start/end dates and times; in ISO 8601 format, yyyy-mm-ddTHH:MM:SS.sssZ); f. Deployment/retrieval dates and times (in ISO 8601 format); g. Recording schedule (must be continuous); h. Hydrophone and recorder sensitivity (in dB *re. 1 μPa*); i. Calibration curve for each recorder; j. Bandwidth/sampling rate (in Hz); k. Sample bit-rate of recordings; and, l. Detection range of equipment for relevant frequency bands (in meters). For each detection the following information must be noted: a. Species identification (if possible); b. Call type and number of calls (if known); c. Temporal aspects of vocalization (date, time, duration, *etc.,* date times in ISO 8601 format); d. Confidence of detection (detected, or possibly detected); e. Comparison with any concurrent visual sightings; f. Location and/or directionality of call (if determined) relative to acoustic recorder or construction activities; g. Location of recorder and construction activities at time of call; h. Name and version of detection or sound analysis software used, with protocol reference; i. Minimum and maximum frequencies viewed/monitored/used in detection (in Hz); and, j. Name of PAM operator(s) on duty. If a North Atlantic right whale is observed at any time by PSOs or personnel on or in the vicinity of any impact or vibratory pile-driving vessel, dedicated PSO vessel, construction survey vessel, or during vessel transit, Ocean Wind must immediately report sighting information to the NMFS North Atlantic Right Whale Sighting Advisory System (866) 755-6622, to the U.S. Coast Guard via channel 16, and through the WhaleAlert app (*http://www.whalealert/org/*) as soon as feasible but no longer than 24 hours after the sighting. Information reported must include, at a minimum: time of sighting, location, and number of North Atlantic right whales observed. If a North Atlantic right whale is detected via Ocean Wind PAM, the date, time, location (*i.e.,* latitude and longitude of recorder) of the detection as well as the recording platform that had the detection must be reported to *nmfs.pacmdata@noaa.gov* as soon as feasible, but no longer than 24 hours after the detection. Full detection data and metadata must be submitted monthly on the 15th of every month for the previous month via the webform on the NMFS North Atlantic right whale Passive Acoustic Reporting System website (*https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reporting-system-templates*). Prior to initiation of project activities, Ocean Wind must demonstrate in a report submitted to NMFS (at *itp.potlock@noaa.gov* and *pr.itp.monitoringreports@noaa.gov*) that all required training for Ocean Wind personnel (including vessel crew and captains, and PSOs) has been completed. *Weekly Report* —Ocean Wind would be required to compile and submit weekly PSO and PAM reports to NMFS (at *itp.potlock@noaa.gov* and *PR.ITP.monitoringreports@noaa.gov*) that document the daily start and stop of all pile driving, HRG survey, or UXO/MEC detonation activities, the start and stop of associated observation periods by PSOs, details on the deployment of PSOs, a record of all detections of marine mammals, any mitigation actions (or if mitigation actions could not be taken, provide reasons why), and details on the noise attenuation system(s) used and its performance. Weekly reports would be due on Wednesday for the previous week (Sunday-Saturday). *Monthly Report* —Ocean Wind would be required to compile and submit monthly reports that include a summary of all information in the weekly reports, including project activities carried out in the previous month, vessel transits (number, type of vessel, and route), number of piles installed, and all observations of marine mammals. Monthly reports would be due on the 15th of the month for the previous month. The report should note the location and date of any turbines that become operational. *Annual Report* —Ocean Wind would be required to submit an annual summary report to NMFS no later than 90 days following the end of a given calendar year describing, in detail, the following: • Total number of marine mammals of each species/stock detected and how many were within designated Level A harassment and Level B harassment zones with comparison to authorized take of marine mammals for the associated activity type; • Marine mammal detections and behavioral observations before, during, and after each activity; • What mitigation measures were implemented (*i.e.,* number of shutdowns or clearance zone delays, *etc.*) or, if no mitigative action was taken, why not; • Operational details (*i.e.,* days of impact and vibratory pile driving, days/amount of HRG survey effort, total number and charge weights related to UXO/MEC detonations, *etc.*); • SFV/SSV results; • PAM systems used; • The results, effectiveness, and which noise abatement systems were used during relevant activities (*i.e.,* impact pile driving, UXO/MEC detonation);

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	• Summarized information related to Situational Reporting; and, • Any other important information relevant to the Ocean Wind 1 project, including additional information that may be identified through the adaptive management process. A final annual report would be prepared and submitted within 30 calendar days following receipt of any NMFS comments on the draft report. If no comments were received from NMFS within 60 calendar days of NMFS' receipt of the draft report, the report would be considered final. *Five-year Report* —By 90 days after the expiration of the rule, Ocean Wind would submit a final report that summarizes all of the data contained within the annual reports. A final five-year report would be prepared and submitted within 60 calendar days following receipt of any NMFS comments on the draft report. If no comments were received from NMFS within 60 calendar days of NMFS' receipt of the draft report, the report would be considered final. **Situational Reporting** Specific situations encountered during the development of Ocean Wind 1 would require immediate reporting to be undertaken. These situations and the relevant procedures include: • If a marine mammal observation occurs during vessel transit, the following information must be recorded: a. Time, date, and location; b. The vessel's activity, heading, and speed; c. Sea state, water depth, and visibility; d. Marine mammal identification to the best of the observer's ability (*e.g.,* North Atlantic right whale, whale, dolphin, seal); e. Initial distance and bearing to marine mammal from vessel and closest point of approach; and, f. Any avoidance measures taken in response to the marine mammal sighting. • If a sighting of a stranded, entangled, injured, or dead marine mammal occurs. In this situation, the sighting would be reported to OPR, the NMFS RWSAS hotline, and the NMFS Greater Atlantic Regional Fisheries Office (GARFO) Marine Mammal and Sea Turtle Stranding & Entanglement Hotline (866-755-6622), and the U.S. Coast Guard within 24 hours. The report must include the following information: a. Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable); b. Species identification (if known) or description of the animal(s) involved; Condition of the animal(s) (including carcass condition if the animal is dead); c. Observed behaviors of the animal(s), if alive; d. If available, photographs or video footage of the animal(s); and e. General circumstances under which the animal was discovered. • If a marine mammal is injured or killed as a result of Ocean Wind 1 project-related activities or vessels. In this case, the vessel captain or PSO on board shall immediately report the strike incident to the NMFS Office of Protected Resources and the GARFO within and no later than 24 hours. If activities related to the Ocean Wind 1 project caused the injury or death of the animal, Ocean Wind would supply a vessel to assist with any salvage efforts, if requested by NMFS. The notification of the strike would include: a. Time, date, and location (latitude/longitude) of the incident; b. Species identification (if known) or description of the animal(s) involved; c. Vessel's speed during and leading up to the incident; d. Vessel's course/heading and what operations were being conducted (if applicable); e. Status of all sound sources in use; f. Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike; g. Environmental conditions (*e.g.,* wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the strike; h. Estimated size and length of animal that was struck; i. Description of the behavior of the marine mammal immediately preceding and following the strike; j. If available, description of the presence and behavior of any other marine mammals immediately preceding the strike; k. Estimated fate of the animal (*e.g.,* dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and l. To the extent practicable, photographs or video footage of the animal(s). **Sound Monitoring Reporting** Ocean Wind will be required to provide the initial results of SFV (including measurements) to NMFS in interim reports after each monopile installation and pin pile installation or the first three piles as soon as they are available, but no later than 48 hours after each installation. Ocean Wind would also have to provide interim reports after every UXO/MEC detonation as soon as they are available, but no later than 48 hours after each detonation. If SFV is required for subsequent monopile and pin pile installations, the same reporting timeline and data requirements apply. In addition to in situ measured ranges to the Level A harassment and Level B harassment isopleths, the acoustic monitoring report must include: SPL_{peak}, SPL_{rms} that contains 90 percent of the acoustic energy, single strike sound exposure level, integration time for SPL_{rms}, SEL_{ss}, and 24-hour cumulative SEL extrapolated from measurements. All these levels must be reported in the form of median, mean, max, and minimum. The SEL and SPL power spectral density and one-third octave band levels (usually calculated as decidecade band levels) at the receiver locations should be

#	Table H-4. Description of Lessee Authorization and Permit Conditions
	reported. The acoustic monitoring report must also include a description of the hydrophones used, hydrophone and water depth, distance to the pile driven, and sediment type at the recording location. Final results of SFV must be submitted as soon as possible, but no later than within 90 days following completion of impact pile driving of monopiles and pin piles and detonations of up to 10 UXOs/MECs.

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Appendix I. Supplemental Information

I.1. Climate and Meteorology

The National Climatic Data Center defines distinct climatological divisions to represent geographic areas that are nearly climatically homogeneous. Locations within the same climatic division are considered to share the same overall climatic features and influences. New Jersey's north-south orientation, with the highest elevations in the northern portion and lower coastal plains in the south and along the bays and the ocean, contributes to climatic differences between the northern and southern portions of the state. Temperature differences between the northern and southern parts of the state are greatest in the winter and least in summer (Rutgers University 2020). New Jersey has four well-defined physiographic belts that parallel the Atlantic Coast—the Coastal Plain, Piedmont, Highlands, and the Valley and Ridge Province (New Jersey Geological Society 2003). The Proposed Action is within the New Jersey Coastal Plain climatic division (NOAA 2021).

I.1.1 Ambient Temperature

The Onshore Project area is characterized by mild seasons and storms that bring precipitation (rain and snow) to the region; the mild seasons are influenced by sea winds that reduce both the temperature range and mean temperature while providing humidity (NJDEP 2010). Air temperatures in the Project area are generally moderate. Air temperature data collected from the Office of the New Jersey State Climatologist, Rutgers University, which averaged the annual, seasonal, and monthly means in southern and coastal areas of New Jersey for 1985–2009, indicate that the annual mean air temperature was 53.2°F (11.8°C) (NJDEP 2010). The mean seasonal air temperature between 1985 and 2010 during the winter ranged from approximately 32–43°F (0–6°C) and in the spring from 54–64°F (12–18°C). The mean seasonal air temperature during the summer ranges from approximately 68–75°F (20–24°C) and during the fall from 53–65°F (12–18°C). The lowest average air temperatures occur in January and the highest in July (NJDEP 2010; NCDC 2021a). Recent offshore air temperature data were downloaded from NOAA buoys near the Offshore Project area. Data between the years 2014 and 2018 were downloaded from Atlantic City, New Jersey (Buoy No. ACYN4). Table I-1 summarizes average temperatures at the Atlantic City buoy.

Table I-1 Representative Temperature Data for the Project Area

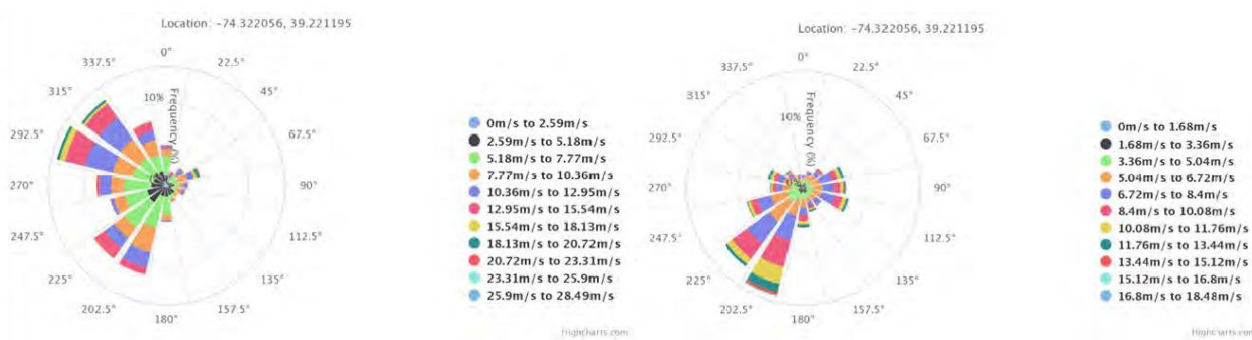
NOAA Station	Year	Annual Average °F/°C	No. of Observations
Atlantic City Buoy (No. ACYN4)	2014	53.8/12.1	86,432
	2015	55.4/13.0	86,357
	2016	55.6/13.1	81,252
	2017	55.9/13.3	85,57
	2018	52.9/11.6	63,856

Source: Ocean Wind 2023

I.1.2 Wind Conditions

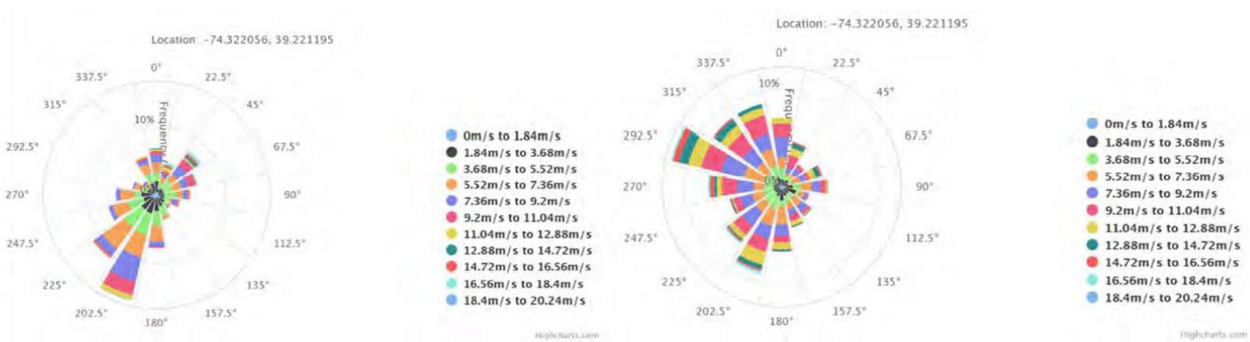
Prevailing winds in the middle latitudes over North America flow mostly west to east ("westerlies"). Westerlies within the Lease Area vary in strength, pattern, and directionality. Winds during the summer are typically from the southwest and flow parallel to the shore, and winds in the winter months are typically from the northwest and flow perpendicular to the shore. Spring and fall are more variable, with winds from either the southwest or northeast (Schofield et al. 2008). Ocean Wind has been collecting wind and wave data from two stations in the Lease Area: stations F220 and F230. In addition, the Metocean Data Portal, maintained by the Danish Hydrological Institute, provides wind data for the entire U.S. East Coast that has been generated through numerical models (Danish Hydrological Institute 2018). Data for the Project were generated using a location within the Lease Area. Data from 2017 indicate wind speeds reached 63.8 miles per hour (28.5 m/s). The highest-frequency wind directions generally were from south-southwest to northwest. Throughout the year, wind direction is variable. However, seasonal wind directions are primarily from the west/northwest during the winter months (December through February) and from the south/southwest during the summer months (June through August). Figure I-1 and Figure I-2 show 3-month wind roses for January through June 2017 and July through December 2017, respectively, for a location within the Lease Area (-74.322056, 39.221195). Top wind speeds within the Lease Area peaked between the months of January and March at 18.13 m/s to 20.72 m/s from the northwest.

Extreme wind conditions on the U.S. East Coast are influenced by both winter storms and tropical systems. Several northeasters occur each winter season, while hurricanes are rarer but potentially more extreme. The tropical systems therefore define the wind farm design, based on extreme wind speeds (those with recurrence periods of 50 years and beyond).



Source: Danish Hydrological Institute 2018

Figure I-1 Wind Rose Graphs for the Lease Area: January through March 2017 and April through June 2017



Source: Danish Hydrological Institute 2018

Figure I-2 Wind Rose Graphs for the Lease Area: July through September 2017 and October through December 2017

Table I-2 summarizes wind conditions in the region. This table shows the monthly average wind speeds, monthly average peak wind gusts, and hourly peak wind gusts for each individual month. Data from 1984 through 2008 show that monthly mean wind speeds range from a low of 10.9 miles per hour (17.6 kilometers per hour) in July to a high of 17.4 miles per hour (28.0 kilometers per hour) in January. The monthly wind mean peak gusts reach a maximum during January at 24.1 miles per hour (38.7 kilometers per hour). The 1-hour average wind gusts reach a maximum during September at 63.3 miles per hour (101.9 kilometers per hour) (National Data Buoy Center 2018).

Table I-2 Representative Wind Speed Data

Month	Monthly Average Wind Speed		Monthly Average of Hourly Peak Gust		Monthly Maximum Hourly Peak Gust	
	mph	km/hr	mph	km/hr	mph	km/hr
January	17.4	28.0	24.1	38.7	61.6	99.1
February	16.2	26.1	21.9	35.2	56.8	91.5
March	15.5	25.0	20.5	33.0	57.5	92.6
April	14.0	22.6	19.0	30.6	56.8	91.5
May	12.7	20.4	16.2	26.1	60.2	96.9
June	11.5	18.5	15.3	24.6	47.6	76.7
July	10.9	17.6	14.7	23.7	50.1	80.6
August	11.2	18.0	15.2	24.4	48.6	78.2
September	13.0	20.9	18.0	28.9	63.3	101.9
October	14.8	23.9	20.5	33.0	60.6	97.6
November	16.3	26.3	21.8	35.0	57.3	92.2
December	17.1	27.6	23.8	38.3	56.2	90.4
Annual	14.0	22.6	19.1	30.7	63.3	101.9

Source: National Data Buoy Center 2018
Note: Data presented are for National Data Buoy Center buoy station #44009 (southeast of Cape May, New Jersey).
km/hr = kilometers per hour; mph = miles per hour

I.1.3 Precipitation and Fog

Data from a study conducted by the NJDEP indicate the Lease Area is characterized by mild seasons and storms throughout the year, with precipitation in the form of rain and snow being most common (NJDEP 2010). Average monthly precipitation data from the National Climatic Data Center are presented in Table I-3.

Table I-3 Monthly Precipitation Data[1]

Month	Precipitation (inches/centimeters)	
	Atlantic City Marina, New Jersey	Brant Beach, Beach Haven, New Jersey
January	3.08/7.82	3.25/8.26
February	2.87/7.29	2.86/7.26
March	4.02/10.21	3.97/10.08
April	3.39/8.61	3.26/8.28
May	3.22/8.18	2.78/7.06
June	2.68/6.81	3.05/7.75
July	3.31/8.41	3.92/9.96

Month	Precipitation (inches/centimeters)	
	Atlantic City Marina, New Jersey	Brant Beach, Beach Haven, New Jersey
August	3.92/9.96	3.71/9.42
September	3.08/7.82	2.78/7.06
October	3.47/8.81	3.65/9.27
November	3.35/8.51	2.91/7.39
December	3.62/9.19	3.36/8.53
Annual Average	3.33/8.47	3.29/8.36

Sources: NCDC 2021a, 2021b
[1] Precipitation is recorded in melted inches (snow and ice are melted to determine monthly equivalent).

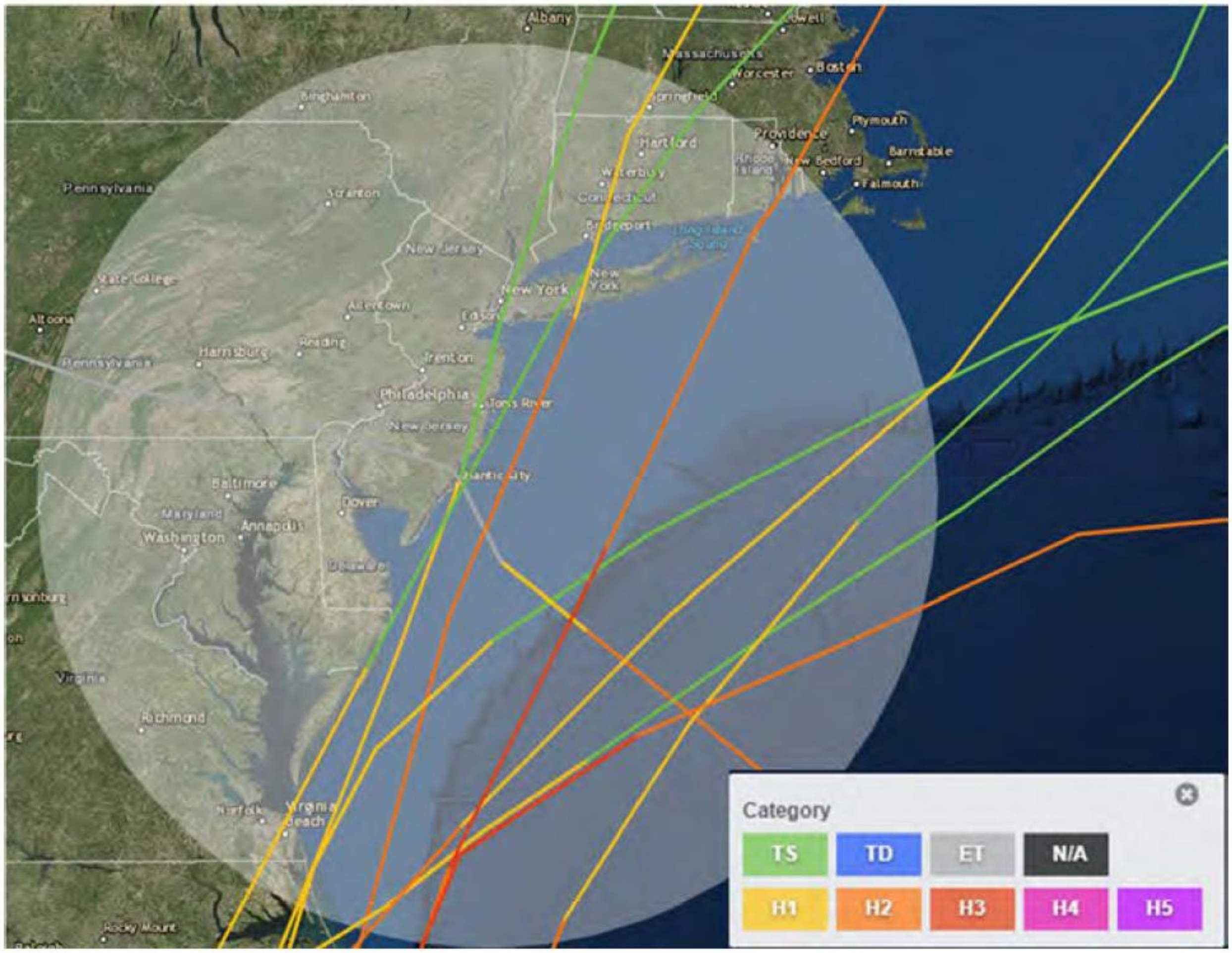
Snowfall amounts can vary quite drastically within small distances. Data from Lewes, Delaware show that the annual snowfall average is approximately 12 inches (30.5 centimeters), and the month with the highest snowfall is January, averaging around 4 inches (10.2 centimeters) (WRCC 2020).

Given the cold air temperatures experienced during many Mid-Atlantic winters, there is potential for icing of equipment and vessels above the water line in the Lease Area. Cook and Chatterton (2008) analyzed icing events in Delaware Bay for winters from 1997 to 2007 and found that icing events are a common occurrence during the months of January, February, and March. The worst winter, as far as icing is concerned, experienced by the Delaware Bay region from 1997 through 2007 was in 2002 to 2003, during which 21 icing events occurred. Delaware Bay experiences approximately eight events annually where the variables favoring icing are consistent for 3 or more hours.

The occurrence of fog in the Mid-Atlantic states is driven by regional-scale weather patterns and local topographic and surface conditions. The interaction between various weather systems and the physical state of the local conditions is complex. Ward and Croft (2008) found that high-pressure systems result in heavy fog over the Delaware Bay and nearby Atlantic coastal areas. During the 2006–2007 winter season (December–February), Sussex County Airport reported 45 fog events, four of which were described as dense fog (Ward and Croft 2008).

I.1.4 Hurricanes and Tropical Storms

Coastal New Jersey is subject to extratropical and tropical storm systems. Records of cyclone track locations, central pressures, and wind speeds are documented by several government agencies. Extratropical storms, including northeasters, are common in the Lease Area from October to April. These storms bring high winds and heavy precipitation, which can lead to severe flooding and storm surges. Most hurricane events within the Atlantic generally occur from mid-August to late October, with the majority of all events occurring in September (Donnelly et al. 2004). On average, hurricanes occur every 3 to 4 years within 90 to 170 miles of the New Jersey coast (NJDEP 2010). Figure I-3 identifies the hurricane tracks within the Lease Area and surrounding areas since 1979 (NOAA 2018). The category for each storm is designated by a color for each track. Extratropical storms are captured by gray line segments, tropical depressions are captured in blue, tropical storms are depicted in green, Category 1 storms are yellow line segments, Category 2 storms are in light orange, and Category 3 storms are dark orange.



Source: NOAA 2018

Figure I-3 Overview of Storm Tracks Since 1979 in the Vicinity of the Lease Area

Although data on tropical systems go back to 1851, the quality and consistency of the data are lacking the further back one looks. The storm period was selected based on the availability of consistent wind data for tropical and extratropical systems. The majority of historical cyclones affecting the Project area are tropical storms, and storms as powerful as Category 3 hurricanes have affected the area.

Regional storm events are recorded in NOAA's National Centers for Environmental Information Storm Events Database (NOAA 2018). Notable events are recorded when there is sufficient intensity to cause loss of life, injuries, significant property damage, or disruption to commerce. Storms that have occurred within 200 nm of the Lease Area since 1979 are indicated in Table I-4.

Table I-4 Named Storms that Have Occurred within 200 nm of the Lease Area Since 1979

Storm Name	Date	Storm Category (Within 200 nm of Lease Area)
Gloria	1985	Category 1 and Category 2 Hurricane
Bob	1991	Category 2 and Category 2 Hurricane
Emily	1993	Category 2 and Category 2 Hurricane
Charley	1998	Tropical Storm and Category 1 Hurricane

Storm Name	Date	Storm Category (Within 200 nm of Lease Area)
Floyd	1999	Tropical Storm and Category 1 Hurricane
Earl	2010	Tropical Storm and Category 1 Hurricane
Irene	2011	Tropical Storm and Category 1 Hurricane
Sandy	2012	Extratropical Cyclone, Category 1 and Category 2 Hurricane
Arthur	2014	Category 1 Hurricane

Source: NOAA 2018

Hurricane Sandy occurred in 2012 and caused the highest storm surges and greatest inundation on land in New Jersey. The storm surge and large waves from the Atlantic Ocean meeting up with rising waters from back bays such as Barnegat Bay and Little Egg Harbor caused barrier islands to be completely inundated (Blake et al. 2013). In Atlantic City and Cape May, tide gauges measured storm surges of 5.8 feet and 5.2 feet, respectively (Blake et al. 2013). Atlantic City International Airport recorded maximum sustained wind speeds of 44.3 knots (51 miles per hour) and a peak wind speed of 55.6 knots (64 miles per hour) on the coast (Ocean Wind 2023 citing NOAA 2012). Marine observations at the Cape May National Ocean Service (CMAN4) recorded sustained wind speeds at 52 knots and an estimated inundation of 3.5 feet (Blake et al. 2013).

I.1.5 Mixing Height

The mixing height is the altitude above ground level to which air pollutants vertically disperse. The mixing height affects air quality because it acts as a lid on the height pollutants can reach. Lower mixing heights allow less air volume for pollutant dispersion and lead to higher ground-level pollutant concentrations than do higher mixing heights. Table I-5 presents atmospheric mixing height data from the nearest measurement location to the Project area (Atlantic City, New Jersey). As shown in the table, the minimum average mixing height is 390 meters (1,279 feet), while the maximum average mixing height is 1,218 meters (3,996 feet). The minimum average mixing height is much higher than the height of the top of the proposed WTG rotors (262 meters [860 feet]).

Table I-5 Representative Seasonal Mixing Height Data

Season	Data Hours Included[1]	Atlantic City, New Jersey Average Mixing Height (meters)
Winter (December, January, February)	Morning: no-precipitation hours	624
	Morning: all hours	617
	Afternoon: no-precipitation hours	774
	Afternoon: all hours	390
Spring (March, April, May)	Morning: no-precipitation hours	545
	Morning: all hours	640
	Afternoon: no-precipitation hours	1,196
	Afternoon: all hours	499
Summer (June, July, August)	Morning: no-precipitation hours	511
	Morning: all hours	566
	Afternoon: no-precipitation hours	1,218
	Afternoon: all hours	695

Season	Data Hours Included[1]	Atlantic City, New Jersey Average Mixing Height (meters)
Fall (September, October, November)	Morning: no-precipitation hours	484
	Morning: all hours	649
	Afternoon: no-precipitation hours	988
	Afternoon: all hours	476
Annual Average	Morning: no-precipitation hours	539
	Morning: all hours	620
	Afternoon: no-precipitation hours	1,052
	Afternoon: all hours	508

Source: USEPA 2021
[1] Missing values are not included.

I.2. Finfish and Other Species of Commercial Importance

Three finfish species of particular commercial importance known to occur within the Project area include summer flounder, black sea bass, and striped bass. Additional discussion of these species is provided below.

I.2.1 Summer Flounder

Summer flounder occurs in both nearshore and offshore waters along the East Coast of North America from Nova Scotia, Canada to Florida; however, their greatest abundance occurs in the Mid-Atlantic region between Cape Cod, Massachusetts to Cape Fear, North Carolina (ASMFC 2021). Adult summer flounder occur at the sea bottom where they burrow into sandy substrates. Juveniles begin migrating offshore from nearshore nursery habitats after their first year of life.

As recently as 2018 and 2021 stock assessment, summer flounder was determined to not be overfished or experiencing pressure from overfishing, which represents an improvement from the 2016 stock assessment where summer flounder stock was determined to not be overfished but is experiencing overfishing (ASMFC 2021, 2017). Currently, spawning stock biomass is estimated at 104 million pounds, which is 86 percent of the target of 122 million pounds (ASMFC 2021). Based on the 2021 ASMFC Stock Assessment for summer flounder, total fishing mortality was estimated at 0.340, which is below the fishing mortality threshold of 0.422. Recruitment was estimated at 49 million fish at age 0, below the time series average of 53 million fish at age 0. Data analyzed by NEFSC for the assessment indicate an expanded age structure relative to the stock observed in the 1980s and 1990s. However, the data also indicate that recruitment has remained generally below average this past decade, and the reason is not known. Additionally, the last benchmark stock assessment found the spatial distribution of the resource is continuing to shift northward and eastward (ASMFC 2023).

I.2.2 Black Sea Bass

Black sea bass occurs in coastal waters along the eastern United States from the Gulf of Maine to the Florida Keys, with the greatest abundance occurring in the area from Cape Cod, Massachusetts to Cape Canaveral, Florida. This species prefers to occupy rocky-bottom habitat, especially near pilings, wrecks, and jetties (ASMFC 2021). Distribution of this species has been expanding northward since the mid-2000s as a result of rising ocean temperatures; this trend would be expected to continue as a result of climate change (ASMFC 2018). Eggs are larvae for this species are found in mid-shelf coastal waters from late spring to late summer (ASMFC 2018).

A recent stock assessment that was peer reviewed in August 2019 found that black sea bass stock was not overfished and overfishing was not occurring in the stock north of Cape Hatteras, North Carolina (ASMFC 2021). In 2018, the spawning stock biomass for black sea bass stock was estimated at 73.6 million pounds, which was considerably higher than the biomass target of 31.07 million pounds (ASMFC 2021). Consistent with this, average fishing morality in 2018 was 0.42, which was 91 percent of the fishing mortality threshold of 0.46 (ASMFC 2021).

I.2.3 Striped Bass

Striped bass occurs along the eastern coast of North America ranging from the St. Lawrence River in Canada to the Roanoke River and tributaries of the Albemarle Sound, North Carolina (ASMFC 2019). Striped bass is an anadromous fish species, spending the majority of its adult life in ocean waters and returning to natal rivers to spawn in during the spring season. Two major spawning grounds include rivers feeding into Chesapeake Bay and the Delaware and Hudson Rivers (ASMFC 2019).

Based on the 2018 stock assessment, striped bass is overfished and subject to pressure from overfishing (NOAA 2019). Female spawning stock biomass estimates were at 151 million pounds, which was considerably less than the spawning stock biomass threshold of 202 million pounds. Fishing mortality was estimated at approximately 0.307, which was higher than the fishing morality threshold of 0.24 (ASMFC 2019). Striped bass recruitment in 2017 was estimated at 108.8 million age-1 fish, which was below the time series average of 140.9 million fish (ASMFC 2019).

I.2.4 Impacts

Impacts from the Project are unlikely to affect these commercially and recreationally important species, as offshore habitat requirements are widely available throughout the geographic analysis area as well the region of the Project. Additionally, permanent ground disturbance could result in a loss of 231 acres of WTG foundation scour protection and 55 acres of new hard protection atop cables. Loss of habitat would primarily be limited to sandy-bottom habitat, which is considered suitable for summer flounder; however, this habitat type is among the most common throughout the geographic analysis area. More complex habitat such as rocky outcrops would experience little loss; moreover, addition of new complex structures as a result of the Project could result in a net increase in suitable complex habitat for black sea bass and striped bass.

I.2.5 Common Finfish Species

The following finfish species are considered to have moderate to high likelihood of occurrence within the Project area based on EFH analysis as well as studies of nearby areas, including Barnegat Bay, New Jersey. Table I-6 includes a list of the finfish species that have been documented within or near the Project area, whether the species has EFH within or in the vicinity of the Project area, and if the species has commercial or recreational importance.

Table I-6 Common and Federally Managed Finfish Species Known to Inhabit the Project Area

Common Name	Scientific Name	EFH Presence by Life Stage	Commercial/ Recreational Importance
Atlantic angel shark	*Squatina dumeril*	N, J, A	--
Atlantic butterfish	*Peprilus triacanthus*	E, L, J, A	X
Atlantic cod	*Gadus morhua*	E, L, A	X
Atlantic croaker	*Micropogonias undulatus*	--	--

Common Name	Scientific Name	EFH Presence by Life Stage	Commercial/ Recreational Importance
Atlantic herring	*Clupea harengus*	L, J, A	X
Atlantic mackerel	*Scomber scombrus*	E, L, J, A	X
Atlantic menhaden	*Brevoortia tyrannus*	--	X
Atlantic moonfish	*Selene setapinnis*	--	--
Atlantic needlefish	*Strongylura marina*	--	--
Atlantic sharpnose shark	*Rhizoprionodon terraenovae*	A	--
Atlantic silverside	*Menidia menidia*	--	--
Basking shark	*Cetorhinus maximus*	N, J, A	--
Blackcheek tonguefish	*Symphurus plagiusa*	--	--
Black drum	*Pogonias cromis*	--	X
Black sea bass	*Centropristis striata*	L, J, A	X
Bluefin tuna	*Thunnus thynnus*	J, A	X
Bluefish	*Pomatomus saltatrix*	E, L, J, A	X
Bluegill	*Lepomis macrochirus*	--	X
Blue shark	*Prionace glauca*	N, J, A	--
Bluntnose stingray	*Dasyatis say*	--	--
Clearnose skate	*Raja eglanteria*	J, A	X
Cobia	*Rachycentron*	E, L, J, A	X
Common thresher shark	*Alopias vulpinus*	N, J, A	--
Cunner	*Tautogolabrus adspersus*	--	--
Dusky shark	*Carcharhinus obscurus*	N, J, A	--
Feather blenny	*Hypsoblennius hentz*	--	--
Flathead grey mullet	*Mugil cephalus*	--	--
Flying gurnard	*Dactylopterus volitans*	--	--
Gag grouper	*Mycteroperca microlepis*	--	X
Green goby	*Microgobius thalassinus*	--	--
Hogchoker	*Trinectes maculatus*	--	--
Inland silverside	*Menidia beryllina*	--	--
Inshore lizardfish	*Synodus foetens*	--	--
King mackerel	*Scomberomorus*	E, L, J, A	X
Little skate	*Leucoraja erinacea*	J, A	X
Lookdown	*Selene vomer*	--	--
Mangrove snapper	*Lutjanus griseus*	--	X
Monkfish	*Lophius americanus*	E, L, J, A	X
Mummichog	*Fundulus heteroclitus*	--	--
Naked goby	*Gobiosoma bosc*	--	--
Northern kingfish	*Menticirrhus saxatilis*	--	X
Northern pipefish	*Syngnathus fuscus*	--	--
Northern puffer	*Sphoeroides maculatus*	--	--
Northern searobin	*Prionotus carolinus*	--	--

Common Name	Scientific Name	EFH Presence by Life Stage	Commercial/ Recreational Importance
Ocean pout	*Macrozoarces americanus*	E, J, A	X
Oyster toadfish	*Opsanus tau*		--
Pinfish	*Lagodon rhomboides*	--	--
Pollock	*Pollachius pollachius*	L	X
Rainwater killifish	*Lucania parva*	--	--
Red hake	*Urophycis chuss*	E, L, J, A	X
Sandbar shark	*Carcharhinus plumbeus*	N, J, A	--
Sand tiger shark	*Carcharias taurus*	N, J	--
Scup	*Stenotomus chrysops*	J, A	X
Seaboard goby	*Gobiosoma ginsburgi*	--	--
Shortfin mako shark	*Isurus oxyrinchus*	N, J, A	--
Silver hake	*Merluccius bilnearis*	E, L, J, A	X
Skilletfish	*Gobiesox strumosus*	--	--
Skipjack tuna	*Katsuwonus pelamis*	J, A	X
Smoothhound shark complex (Atlantic stock)	*Mustelus canis*	N, J, A	--
Smooth dogfish	*Mustelus canis*	--	--
Spanish mackerel	*Scomberomorus maculatus*	E, L, J, A	X
Spiny dogfish	*Squalus acanthias*	J, A	--
Spot	*Leiostomus xanthurus*	--	--
Spotfin killifish	*Fundulus luciae*	--	--
Spotted hake	*Urophycis regia*	--	--
Striped bass	*Morone saxatilis*	--	X
Summer flounder	*Paralichthys dentatus*	E, L, J, A	X
Swordfish	*Xiphias gladius*	J	X
Tautog	*Tautoga onitis*	--	X
Tiger shark	*Galeocerdo cuvieri*	J, A	--
Weakfish	*Cynoscion regalis*	--	--
White hake	*Urophycis tenuis*	A	X
White mullet	*Mugil curema*	--	--
White perch	*Morone americana*	--	X
White shark	*Carcharodon carcharias*	N, J, A	--
Windowpane flounder	*Scophthalmus aquosus*	E, L, J, A	X
Winter flounder	*Pseudopleuronectes americanus*	E, L, J, A	X
Winter skate	*Leucoraja ocellata*	J, A	X
Witch flounder	*Glyptocephalus cynoglossus*	E, L, A	X
Yellow perch	*Perca flavescens*	--	X
Yellowfin tuna	*Thunnus albacares*	J	X

A = adult; E = egg; L = larvae; J = juvenile; N = neonate; -- = not applicable

I.3. Invertebrates

Invertebrate resources assessed in this section include the planktonic zooplankton community and megafauna species that have benthic, demersal, or planktonic life stages. Macrofaunal and meiofaunal invertebrates associated with the benthic resources are assessed in Section 3.6. Studies specific to the offshore wind lease areas that either focused on or included the Lease Area are described below.

- Inspire 2021: Geophysical data were collected by multibeam echosounder and sidescan sonar. Five surveys covering 217 sites within the Wind Farm Area and export cable routes were conducted to collect site-specific benthic data from 2017 through 2020 to verify the multibeam echosounder and sidescan sonar results. Survey methodologies included bottom grabs for grain size analysis and benthic invertebrate community characterization, as well as drop-camera footage for habitat characterization. Geophysical data provide delineations of different types of surface sediments within the Project area.
- Guida et al. 2017: A collaborative effort among NEFSC, Woods Hole Oceanographic Institute, and University of Massachusetts-Dartmouth School for Marine Science conducted a multi-scale benthic assessment of wind energy leases in the Northwest Atlantic OCS. This study compiled data from numerous sources, including the NOAA National Centers for Environmental Information for bathymetric data, NEFSC for physical and biological oceanography, NOAA NEFSC fisheries independent trawl survey for demersal fish and shellfish, and the U.S. Geological Survey usSEABED website for surficial sediment data.
- NJDEP 2010: Ocean/Wind Power Ecological Baseline Studies. January 2008 to December 2009. Final Report.
- NEFSC conducted shelf-wide trawl surveys across the OCS and slope of the northeastern United States from the Mid-Atlantic to the Gulf of Maine. In 2021, seasonal surveys included spring bottom trawl survey (March to May), sea scallop/integrated benthic survey (May to June), Atlantic surf clam/ocean quahog survey (starting in August), and fall bottom trawl survey (September to November).
- NEFSC Ecosystem Monitoring (EcoMon) conducts program surveys concurrently with the spring and fall bottom trawl surveys since 1992. The OCS and slope of the northeastern United States is surveyed, i.e., the Mid-Atlantic Bight, Southern New England, Georges Bank, and the Gulf of Maine. In each survey plankton are sampled from approximately 30 randomly selected stations within each of the four regions.
- The NEAMAP Near Shore Trawl Survey was developed in 2006 to provide annual data to support fisheries management and stock assessment in the northeastern United States spring and fall surveys. Invertebrates surveyed include American lobster (*Homarus americanus*), horseshoe crab (*Limulus polyphemus*), longfin inshore squid (*Doryteuthis pealeii*), and shrimp species.
- The Barnegat Bay Research Program (2011 to 2015) was designed to evaluate environmental management issues, address water quality and ecosystem health concerns, address critical gaps, and characterize baseline conditions for future comparisons (Buchanan et al. 2017). Surveys included zooplankton, hard clams (northern quahog) (*Mercenaria mercenaria*), and blue crab (*Callinectes sapidus*).

The Ocean Wind 1 geographic analysis area exhibits substantial seasonal changes in water temperature due to the influence of the Gulf Stream and ocean circulation patterns, which strongly regulate the productivity, species composition, and spatial distribution of zooplankton (NJDEP 2010). The following zooplankton taxa were found to be abundant in the vicinity of the Project area by NJDEP (2010) citing Judkins et al. (1980), with copepods accounting for 62 percent of the zooplankton community.

- **Inner shelf** (less than 164-foot [50-meter] water depth) included C. *typicus*, *Penilia avirostris*, *T. longicornis*, *Evadne* spp., *Acartia tonsa*, and doliolids. Maximum abundance in July is dominated by *C. typicus* and *T. longicornis*.
- **Outer shelf** (more than 164-foot [50-meter] water depth) included *Calanus finmarchicus*, *Oithona similis*, *O. atlantica*, *M. lucens*, and *Clausocalanus pergens*. Maximum abundance during March is dominated by *L. retroversa*, *Pseudocalanus* sp., *O. similis*, *Paracalanus parvus*, and *M. lucens* and in May is dominated by *Pseudocalanus* sp., *Calanus finmarchicus*, and *O. similis*.

Major invertebrate species found in the geographic analysis area are listed in Table I-7. Some species are migratory (American lobster, Jonah crab, longfin inshore squid [*Doryteuthis pealeii*], and northern shortfin squid [*Illex illecebrosus*]), while others are sessile or have more limited mobility (e.g., large bivalve species, some crab species, ocean quahog). While most life stages for invertebrates (i.e., egg, larvae, juvenile, adult) within the geographic analysis area are benthic, larval lobster, horseshoe crab, and Jonah crab are pelagic, as are adult shortfin squid and juvenile and adult longfin squid.

Table I-7 Common and Federally Managed Major Invertebrate Species Known to Inhabit the Project Area

Common Name	Scientific Name	Benthic/ Demersal Life Stages	Pelagic Life Stages	Commercial/ Recreational Importance
American lobster	*Homarus americanus*	E, J, A	L	X
Atlantic sea scallop	*Placopecten magellanicus*	J, A	E, L	X
American horseshoe crab	*Limulus polyphemus*	E, J, A	L	--
Jonah crab	*Cancer borealis*	E, J, A	L	X
Lady crab	*Ovalipes ocellatus*	E, J, A	L	--
Spider crab	*Libinia emarginata*	E, J, A	L	--
Hermit crab	*Pagurus* spp.	E, J, A	L	--
Blue crab	*Callinectes sapidus*	E, J, A	L	X
Atlantic rock crab	*Cancer irroratus*	E, J, A	L	X
Longfin inshore squid	*Doryteuthis pealeii*	E	J A	X
Ocean quahog	*Arctica islandica*	J, A	E, L	X
Northern shortfin squid	*Illex illecebrosus*	--	J A	X
Atlantic Surfclam	*Spisula solidissima*	, J, A	E, L	X
Hard clam	*Mercenaria*	, J, A	E, L	X
Common octopus	*Octopus vulgaris*	E	L J A	--

A = adult; E = egg; L = larvae; J = juvenile; -- = not applicable

Invertebrate species with designated EFH that will be included in the EFH Assessment are described further below based on information provided in the Ocean Wind Offshore Wind Farm EFH Assessment Technical Report (COP Volume III, Appendix P; Ocean Wind 2023) and additional references as cited below. A description of the various life stages for these invertebrates will be provided in the forthcoming EFH Assessment to be completed by BOEM.

I.3.1 Atlantic Sea Scallop

The Atlantic sea scallop is a commercially important marine bivalve that is present from the Gulf of St. Lawrence to Cape Hatteras, North Carolina. In the Mid-Atlantic, these sea scallops typically inhabit waters less than 68°F (20°C) at depths of 66 to 262 feet (20 to 80 meters).

I.3.2 Longfin Inshore Squid

Longfin inshore squid inhabit pelagic waters from Newfoundland to the Gulf of Venezuela. This schooling species undertakes seasonal migrations, wherein they move offshore in a southerly direction in late fall and winter on the OCS edge. As water temperatures rise in spring, they move inshore again and head north. Longfin inshore squid is a commercially important species from Georges Bank to Cape Hatteras. Eggs for the longfin inshore squid occur in inshore and offshore bottom habitats from Georges Bank southward to Cape Hatteras, generally where bottom water temperatures are between 50°F and 73°F (10°C and 23°C), salinities are between 30 and 32 parts per thousand, and depth is less than 164 feet (50 meters). Like most loliginid squids, longfin inshore squid egg masses or "mops" are demersal and anchored to the substrates on which they are laid, which include a variety of hard-bottom types (e.g., shells, lobster pots, piers, fish traps, boulders, and rocks), SAV (e.g., *Fucus* sp.), sand, and mud.

I.3.3 Northern Shortfin Squid

Northern shortfin squid has a range extending from Newfoundland to Cape Hatteras, North Carolina. The Project area contains designated EFH for the juvenile (pre-recruit) life stage.

I.3.4 Ocean Quahog

The ocean quahog is a commercially important marine bivalve mollusk found along the OCS, with a range from Newfoundland to Cape Hatteras. Peak offshore densities of this species are found south of Nantucket to the Delmarva Peninsula.

I.3.5 Surfclam

The surfclam is a commercially important marine bivalve that inhabits sandy habitats along the OCS, with a range from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina. This clam species is found in concentrated numbers on Georges Bank, south of Cape Cod, off Long Island, southern New Jersey, and the Delmarva Peninsula.

I.4. Marine Mammals

There are 17 species (18 stocks) of marine mammals that are likely to have regular or common occurrences in the Project area (Table I-8). Species' federal protection status, occurrence in the geographic analysis area and Project area, critical habitat, population size trends, and mortality data must be considered to understand the potential impacts and their magnitude from the Proposed Action, action alternatives (B, C, D, and E), and the No Action Alternative (ongoing and planned activities and future offshore wind activities). Although beaked whales can occur in relatively high numbers in the geographic analysis area (see Figure F-10), their distribution is generally concentrated near the shelf edge (BOEM 2014) approximately 69 miles (110 kilometers) outside of the Project area. Therefore, beaked whales have not been included in the assessment of the Proposed Action. Rare observations of the West Indian manatee have occurred in the coastal areas and rivers of New Jersey. However, manatees cannot tolerate temperatures below 68°F for extended periods of time (USFWS 2014); therefore, their occurrence in the marine mammal geographic analysis area is considered extremely rare and is not considered further in the EIS. For an in-depth discussion of marine mammals in the vicinity of the Project area and the analysis of impacts, refer to Chapter 3, Section 3.15.

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Table I-8 Marine Mammal Species Documented, or Likely to Occur, in the Project Area and their Status, Population, Abundance, Seasonal Occurrence, Critical Habitat Near the Offshore Project Area, Stock, Best Population Estimate, Population Trend, Annual Caused Mortality, Effects of Human-caused Mortality, and Source of Population and Mortality Data

Common Name	Scientific Name	ESA/MMPA[1] Status	Occurrence in Northwest-Atlantic OCS[2]	Annual Peak Occurrence in the Northwest-Atlantic OCS[11]	Seasonal Occurrence in Marine Mammal Project Area[3]	Occurrence within Project Area[4]	Critical Habitat in Area of Direct Effects	Stock (NMFS)	Best Population Estimate from SAR[5]	Population Trend[6]	Annual Human-Caused Mortality[7]	Effects of Human-Caused Mortality[8]	Reference for Population & Mortality Data
Low-frequency Cetaceans													
Blue whale	*Balaenoptera musculus*	endangered/ strategic	rare	winter	spring, summer	rare	Not yet designated	Western North Atlantic	402[9]	unavailable	unknown	unknown	Hayes et al. (2020)
Fin whale	*Balaenoptera physalus*	endangered/ strategic	common	year-round	spring, summer, fall (possibly year-round)	regular	Not yet designated	Western North Atlantic	6,802	unavailable	2.35	significant	Hayes et al. (2021)
Humpback whale	*Megaptera novaeangilae*	delisted/none	common	year-round (winter–spring)	spring, summer, fall (possibly year-round)	regular	N/A	Gulf of Maine	1,396	+2.8%/year	15.25	significant	Hayes et al. (2021)
North Atlantic right whale	*Eubalaena glacialis*	endangered/ strategic	common	year-round (winter–spring)	year-round	regular	No[13]	Western North Atlantic	412	decreasing	8.15	significant	Hayes et al. (2021)
Sei whale	*Balaenoptera borealis*	endangered/ strategic	regular	year-round (spring)	spring, summer	rare	Not yet designated	Nova Scotia	6,292	unavailable	1.2	significant	Hayes et al. (2021)
Minke whale	*Balaenoptera acutorostrata*	none/none	common	year-round (summer–fall)	spring, summer, winter (possibly year-round)	regular	N/A	Canadian East Coast	21,968	unavailable	10.55	insignificant	Hayes et al. (2021)
Mid-frequency Cetaceans													
Sperm whale	*Physeter macrocephalus*	endangered/ strategic	common	year-round (summer–fall)	spring, summer, fall	uncommon	Not yet designated	North Atlantic	4,349[10]	unavailable	unknown	unknown	Hayes et al. (2020)
Short-finned pilot whale	*Globicephala macrorhynchus*	none/strategic	rare	year-round	year-round	uncommon	N/A	Western North Atlantic	28,924	unavailable	unknown	unknown	Hayes et al. (2020)
Long-finned pilot whale	*Globicephala melas*	none/strategic	common	year-round (spring–summer)	year-round	rare	N/A	Western North Atlantic	39,215	unavailable	21	insignificant	Hayes et al. (2020)
Risso's dolphin	*Grampus griseus*	none/none	Common	year-round (spring–fall)	year-round	uncommon	N/A	Western North Atlantic	35,493[10]	unavailable	53.9	significant	Hayes et al. (2020)
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	none/none	regular	year-round (spring–fall)	winter	regular	N/A	Western North Atlantic	93,233	unavailable	26	insignificant	Hayes et al. (2020)
Common bottlenose dolphin (coastal)[8]	*Tursiops truncatus*	none/strategic	common	year-round	year-round (most frequently in spring and summer)	regular	N/A	Western North Atlantic, Northern Migratory Coastal	3,751	decreasing	unknown	unknown	Hayes et al. (2021)
Common bottlenose dolphin (offshore)[8]	*Tursiops truncatus*	none/none	common	year-round	year-round (most frequently in spring and summer)	regular	N/A	Western North Atlantic, Offshore	62,851	unavailable	28	insignificant	Hayes et al. (2020)
High-frequency Cetaceans													
Harbor porpoise	*Phocoena phocoena*	none/none	common	year-round (fall–spring)	winter (possibly during spring and summer)	regular	N/A	Gulf of Maine-Bay of Fundy	95,543	unavailable	150	significant	Hayes et al. (2021)

Common Name	Scientific Name	ESA/MMPA[1] Status	Occurrence in Northwest-Atlantic OCS[2]	Annual Peak Occurrence in the Northwest-Atlantic OCS[11]	Seasonal Occurrence in Marine Mammal Project Area[3]	Occurrence within Project Area[4]	Critical Habitat in Area of Direct Effects	Stock (NMFS)	Best Population Estimate from SAR[5]	Population Trend[6]	Annual Human-Caused Mortality[7]	Effects of Human-Caused Mortality[8]	Reference for Population & Mortality Data
Phocid Pinnipeds													
Harbor seal[8]	*Phoca vitulina concolor*	none/none	common	year-round (fall–spring)	spring, fall, winter	regular	N/A	Western North Atlantic	75,834	unavailable	150	significant	Hayes et al. (2021)
Gray seal[8]	*Halichoerus grypus*	none/none	common	year-round	spring, fall	regular	N/A	Western North Atlantic	451,431	increasing	5,410	significant	Hayes et al. (2021)

Notes:
[1] The MMPA defines a "strategic" stock as a marine mammal stock (a) for which the level of direct human-caused mortality exceeds the potential biological removal level; (b) which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; (c) which is listed as a threatened or endangered species under the ESA; or (d) is designated as depleted.
[2] Data from NEFSC and SEFSC (2018) and Davis et al. (2020).
[3] Seasonal abundance estimates for marine mammals, derived from density models in the New Jersey wind energy study area. From: Supplement to Final Report BOEM 2017-071, AMAPPS: 2010–2014 Appendix I (Kenney and Vigness-Raposa 2010; Ocean Wind 2023 citing Kraus et al. 2016; Ocean Wind 2023 citing Roberts et al. 2016; Ocean Wind 2023 citing Palka et al. 2017). Seasons are depicted as follows: spring (March–May); summer (June–August); fall (September–November); winter (December–February).
[4] Occurrence in the offshore survey corridor was derived from sightings and information in Ocean Wind 2023 citing NJDEP 2010; Ocean Wind 2023 citing NEFSC & SEFSC 2011, 2012, 2013, 2014, 2015a, 2015b, 2016, 2018, 2019, 2020; Ocean Wind 2023 citing Roberts et al. 2016; Ocean Wind 2023 citing Palka et al. 2017; and Hayes et al. 2020. The species known to occur in the Project area and vicinity, and expected to occur in the survey area, are addressed based on their reported occurrence of rare to regular (i.e., common).
[5] Best population estimates reported in the 2020 stock assessment report and most recently updated 2020 draft stock assessment report (Hayes et al. 2020, 2021; Ocean Wind 2023 citing NMFS 2020).
[6] Increasing = beneficial trend, not quantified; Decreasing = adverse trend, not quantified; Unavailable = population trend analysis not conducted on this species.
[7] Data based on Hayes et al. 2020, 2021; Waring et al. 2007; and Kenney and Vigness-Raposa 2010.
[8] Data based on Hayes et al. 2020, 2021; Waring et al. 2007; and Kenney and Vigness-Raposa 2010. Reflects human-caused mortality from all known sources, including fishing-related, vessel collisions, and other/unspecified. Per cited reference.
[9] The minimum population estimate is reported as the best population estimate in the most recently updated 2020 draft stock assessment report (Ocean Wind 2023 citing NMFS 2020).
[10] Density models (Palka et al. 2017) predicted that typically deep-water species such as Risso's dolphins and sperm whales are present at very low densities in offshore edges of several wind energy study areas that are either close to the OCS break or extend into deeper waters.
[11] Kenney and Vigness-Raposa (2010): common = more than 100 observations; regular = 10–100 observations; rare = fewer than 10 observations.
[12] Kenney and Vigness-Raposa (2010) and NEFSC and SEFSC (2018) and Davis et al. (2020). common = more than 100 observations; regular = 10–100 observations; rare = fewer than 10 observations.
[13] Critical habitat areas approximately 260 miles north of the marine mammal geographic analysis area: Cape Cod Bay, Stellwagen Bank, and the Great South Channel and calving areas off Cape Canaveral, FL to Cape Fear, NC
FL = Florida; N/A = not applicable; NC = North Carolina; SAR = stock assessment report

I.5. Water Quality

Figure I-4 shows the 303(d) impaired waters in the water quality geographic analysis area. In New Jersey, impaired waters are mapped by an assessment unit similar to a watershed, while Virginia maps impaired waterbodies. South Carolina maps impaired waters by assessment points.

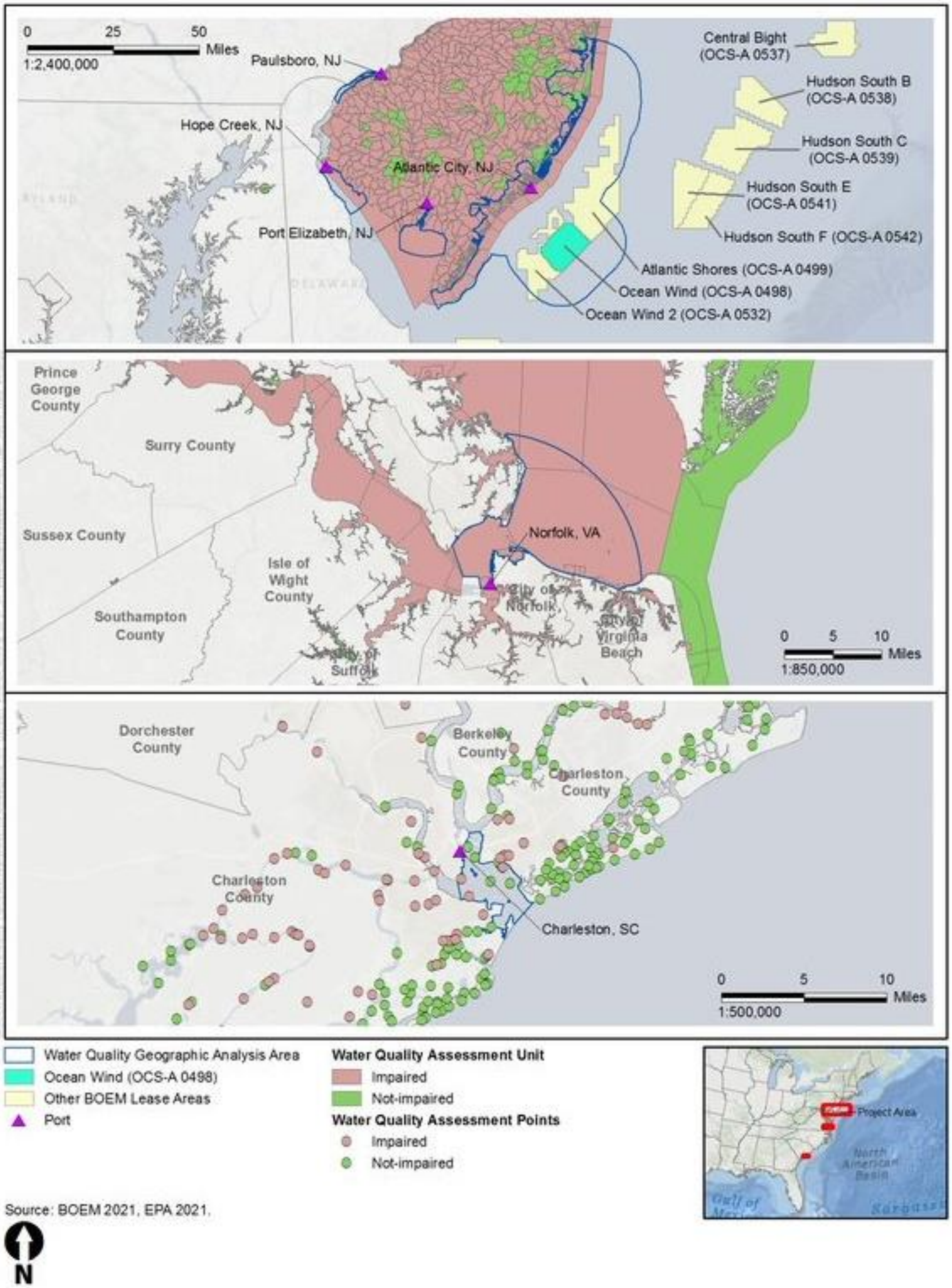


Figure I-4 Impaired Waters in the Geographic Analysis Area

I.6. Wetlands

Table I-9 and Table I-10 summarize NWI wetland communities in the geographic analysis area and NWI wetland impacts along the onshore export cable routes. These tables are equivalent to Tables 3.22-1 and 3.22-3 in Section 3.22, *Wetlands*, but show NWI data instead of NJDEP wetland data.

Figure I-5 shows NJDEP wetlands in the Oyster Creek Onshore Project area, and Figure I-6 shows NJDEP wetlands in the BL England Onshore Project area.

Table I-9 NWI Wetland Communities in the Geographic Analysis Area

Wetland Community	Acres	Percent of Total
Estuarine and Marine Deepwater	144,898	82
Estuarine and Marine Wetland	23,134	13
Freshwater Emergent Wetland	589	<1
Freshwater Forested/Shrub Wetland	8,291	5
Riverine	53	<1
Freshwater Pond	273	<1
Total	**177,238**	**100%**

Source: USFWS 2021

Table I-10 Summary of Wetland Impacts Along Onshore Export Cable Routes by NWI Wetland Community Type

Onshore Export Cable Route	NWI Wetland Community Type	Acres of Temporary Impact	% Relative to Wetlands in GAA	Duration of Impact
BL England	Estuarine and Marine Deepwater	0.72	< 0.01	Short term: 1–3 years
	Estuarine and Marine Wetland	0.49	< 0.01	Short term: 1–3 years
Oyster Creek	Estuarine and Marine Deepwater	0.29	< 0.01	Short term: 1–3 years
	Estuarine and Marine Wetland	8.23	0.03	Short term: 1–3 years
	Freshwater Forested/Shrub Wetland	4.81	0.06	Long Term: 3 to greater than 5 years
	Riverine	0.05	0.02	Short term: 1–3 years
	Freshwater Emergent Wetland	0.29	0.05	Short term: 1–3 years
	Freshwater Pond	0.14	0.05	Short term: 1–3 years

Source: Ocean Wind 2021
GAA = geographic analysis area

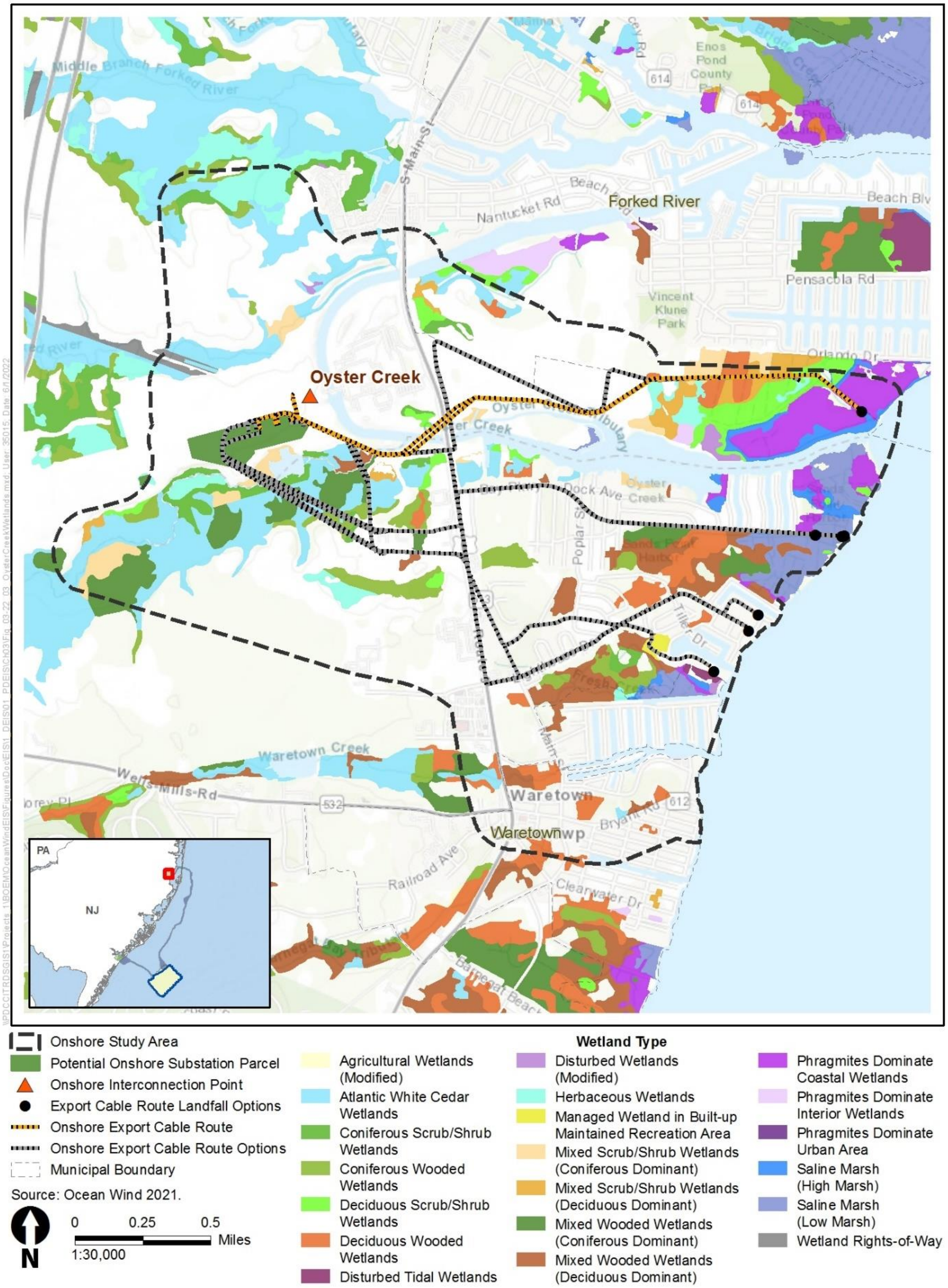


Figure I-5 Wetlands in the Oyster Creek Onshore Project Area

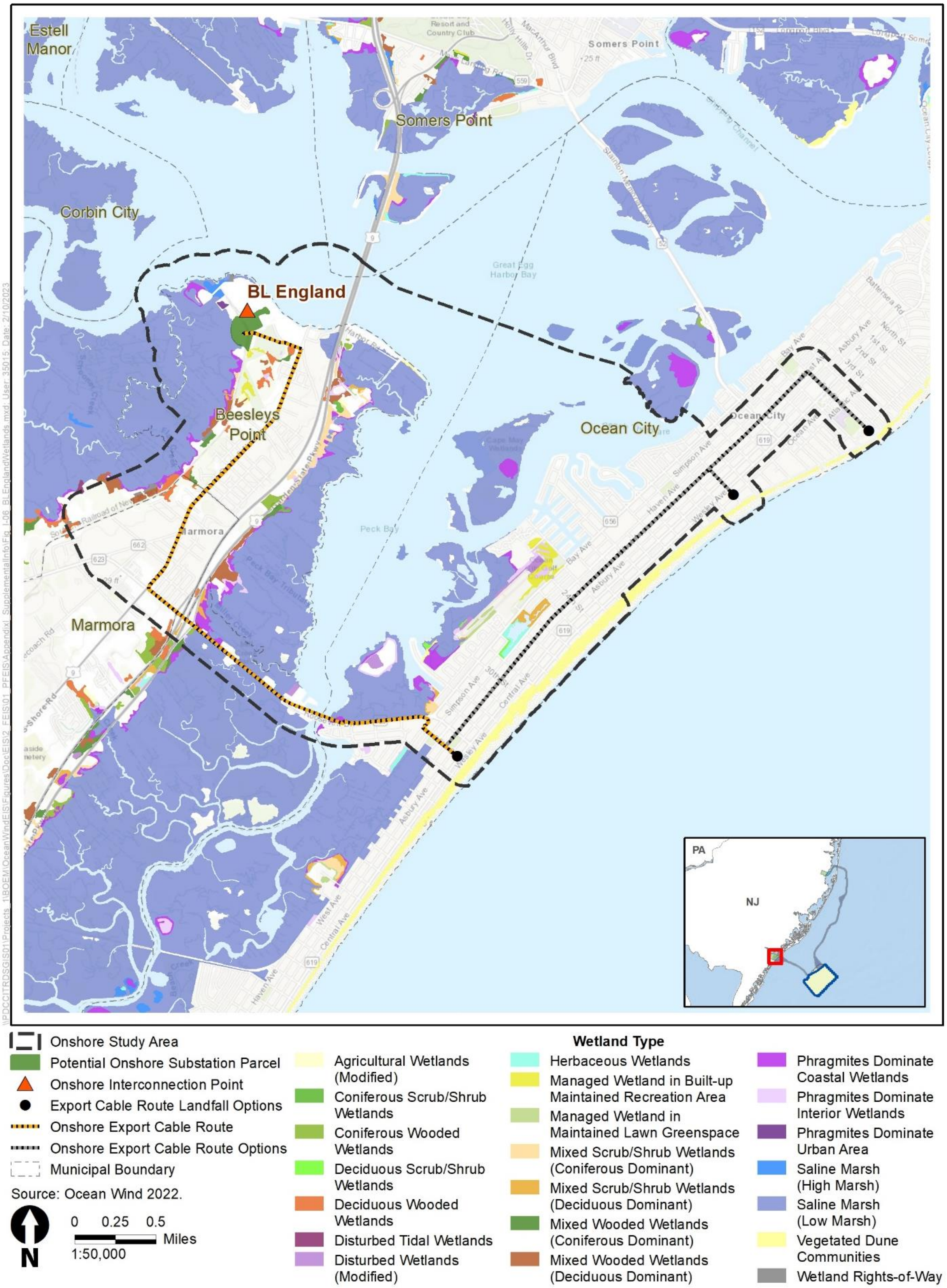


Figure I-6 Wetlands in the BL England Onshore Project Area

I.7. Benthic Habitat Delineation Maps

Figure I-7, Figure I-8, and Figure I-9 delineate benthic habitat conditions in the Wind Farm Area and along the export cable corridors that are classified as either anthropogenic, complex, heterogeneous complex, or soft-bottom habitats. Figure I-10 shows completed and planned SAV survey areas.

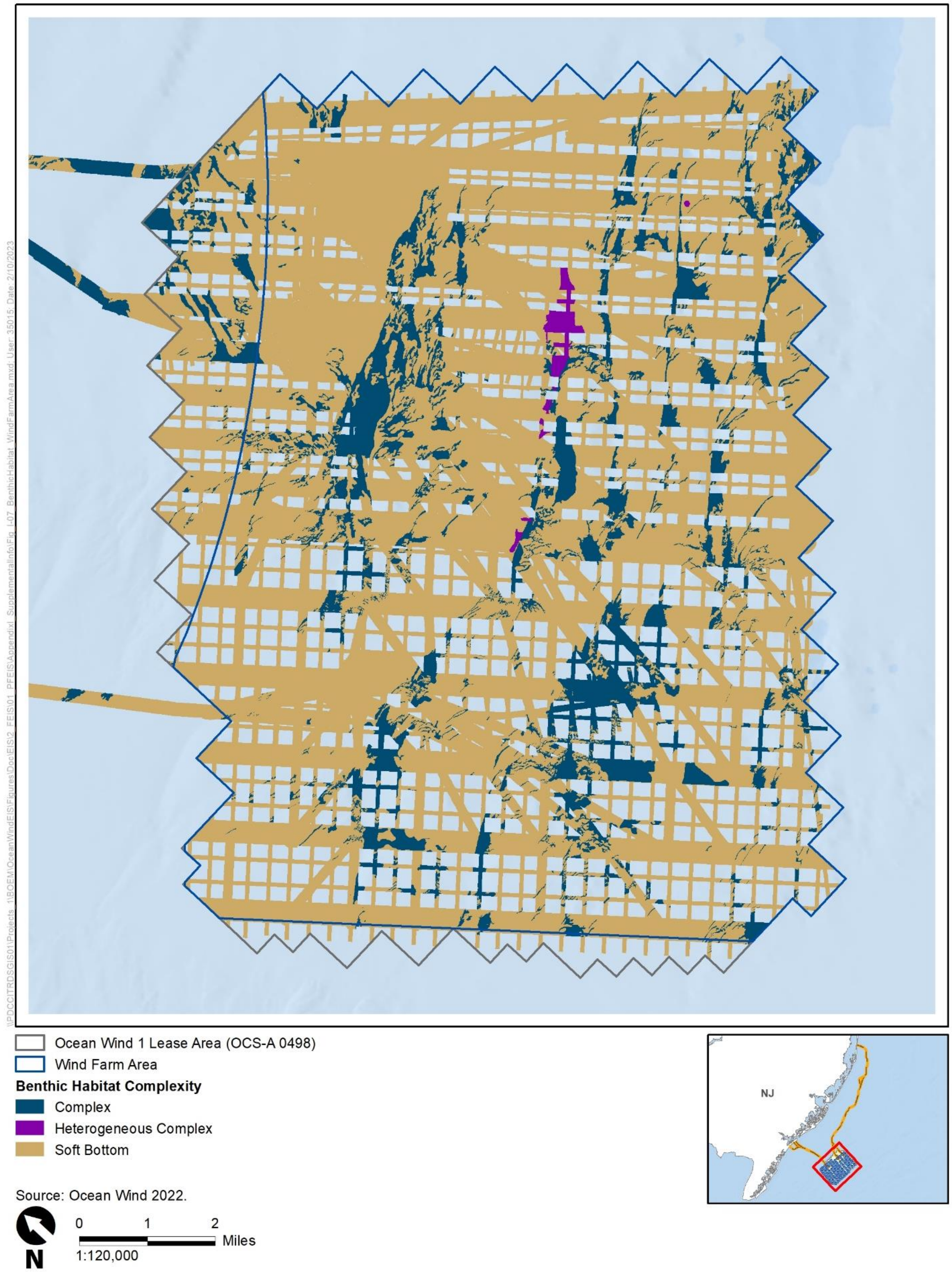


Figure I-7 Benthic Habitat in the Wind Farm Area

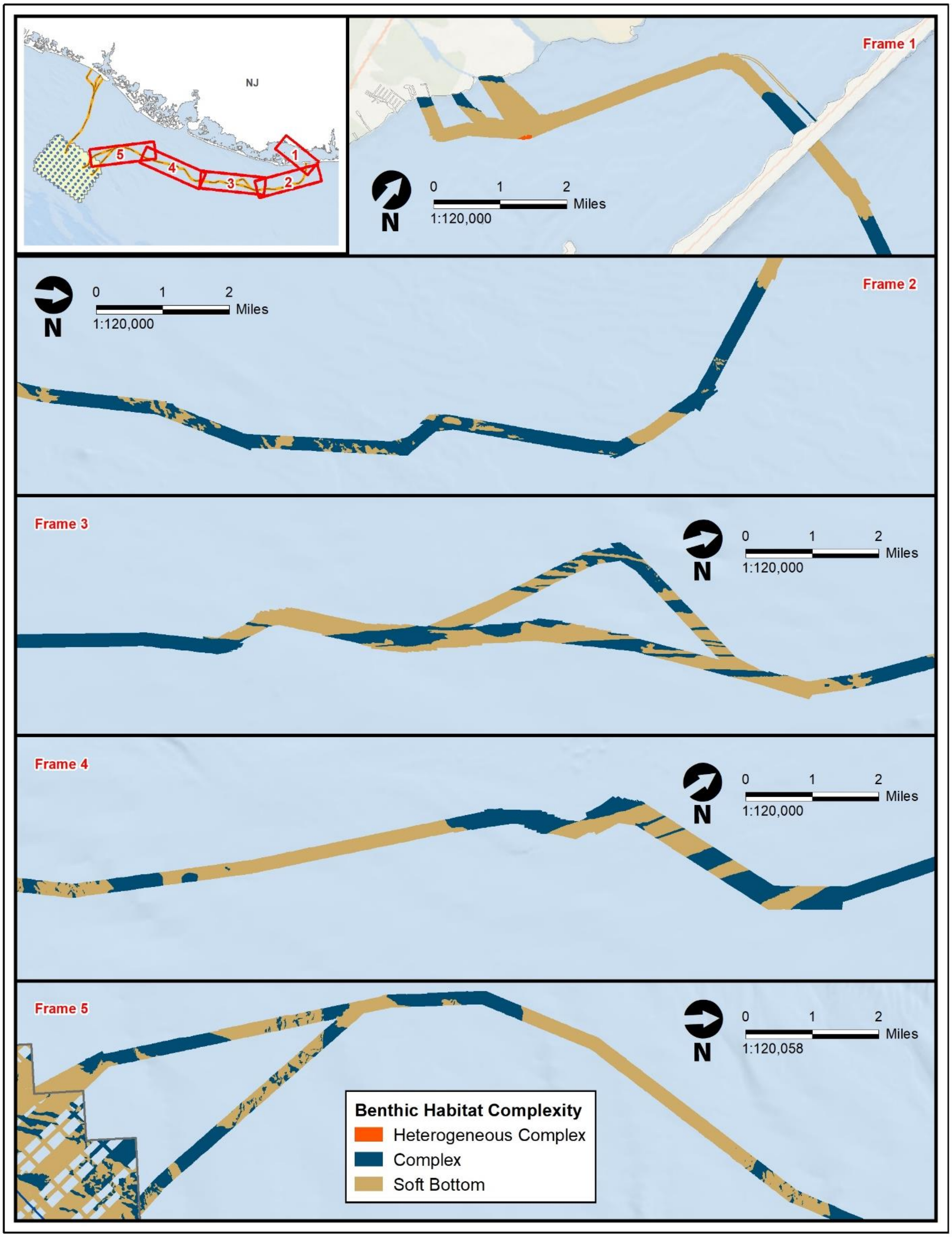


Figure I-8 Benthic Habitat in the Oyster Creek Export Cable Corridor

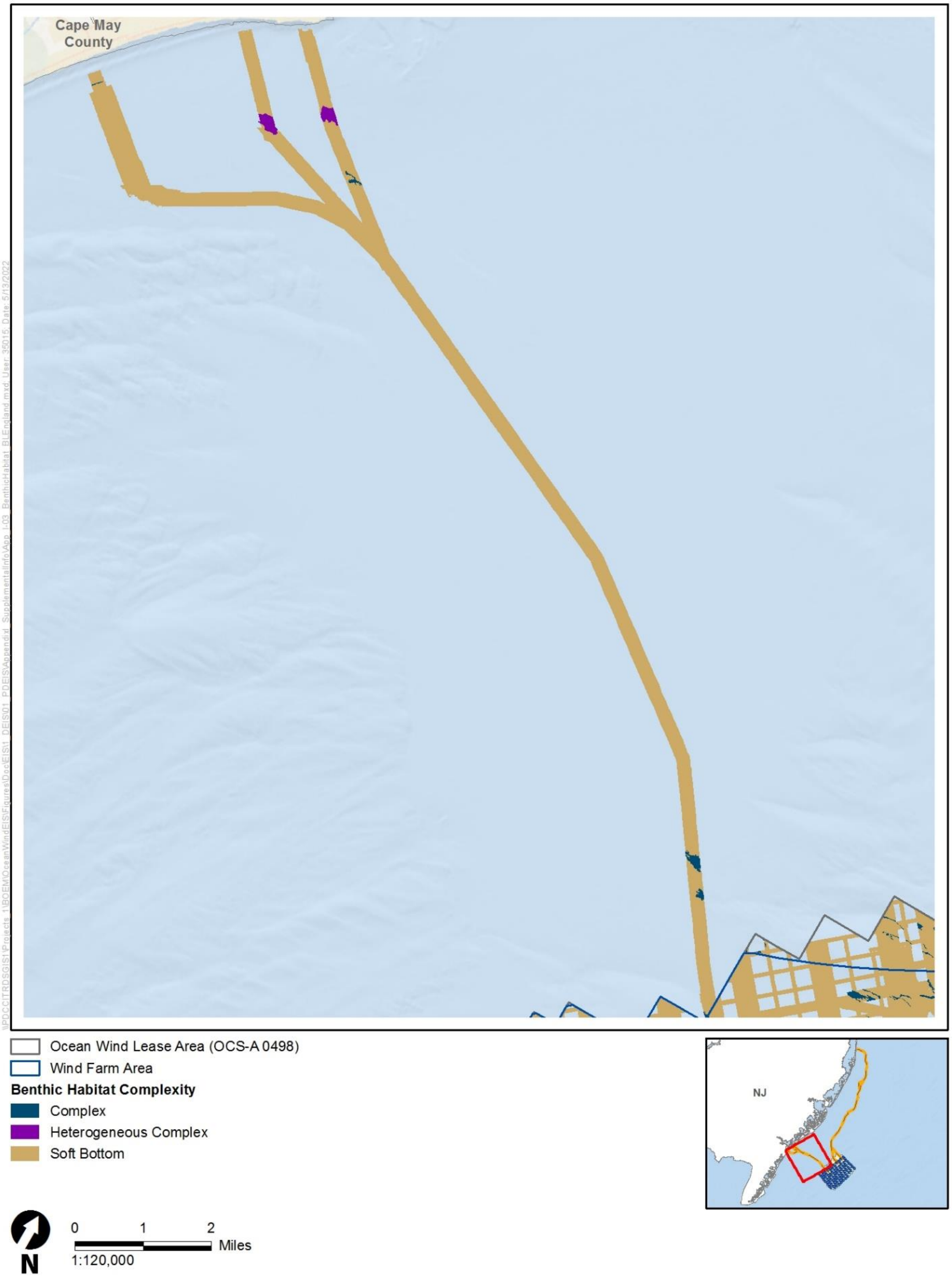


Figure I-9 Benthic Habitat in the BL England Export Cable Corridor

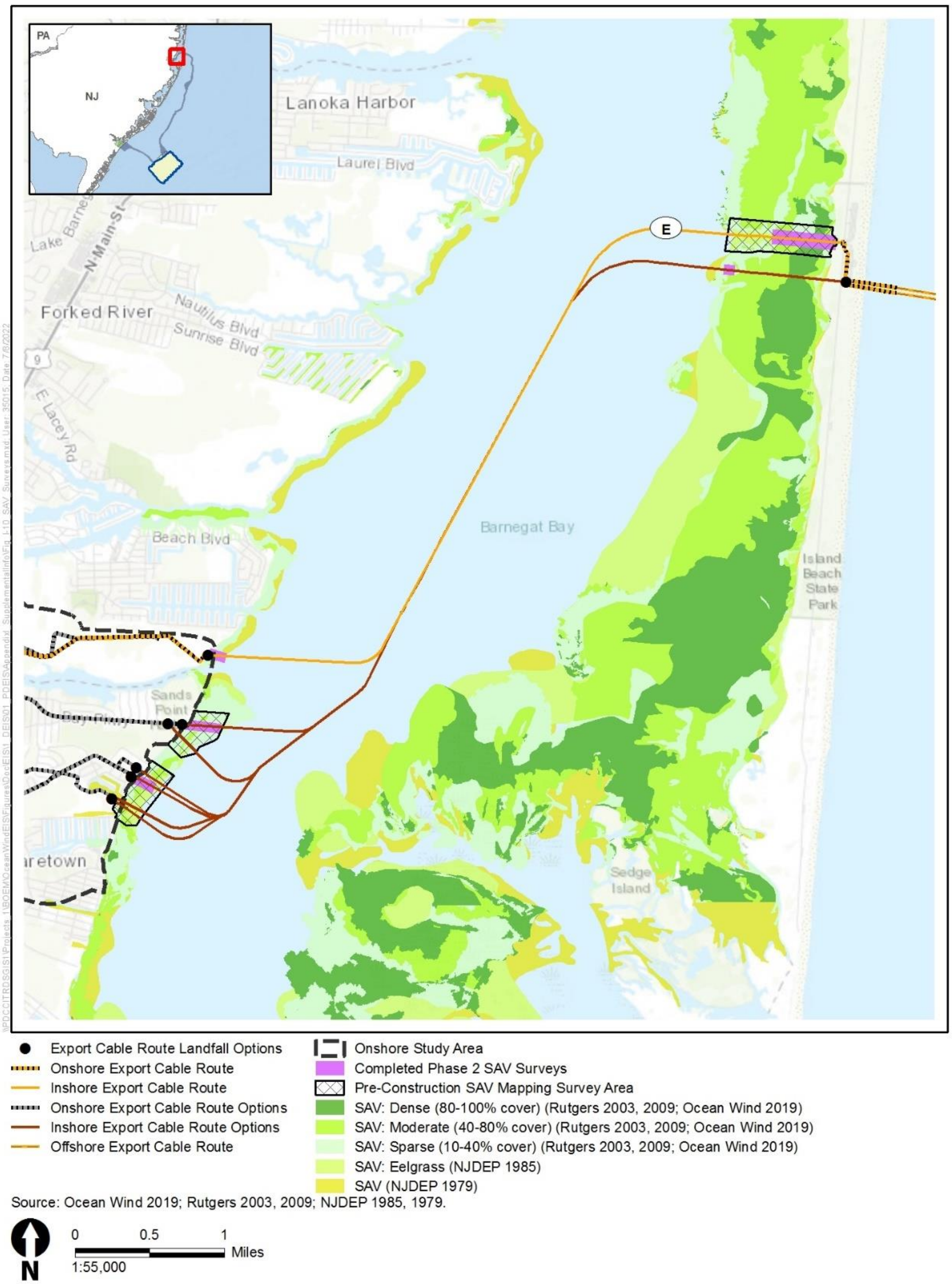


Figure I-10 SAV Survey Areas

I.8. Climate Resilience

Ocean Wind analyzed the resilience of proposed infrastructure that may be vulnerable to the impacts associated with climate change, such as sea level rise and more frequent storms. The TJBs have been identified as an asset potentially susceptible to impacts associated with climate change. The TJB is a large underground vault that serves as the location where the submarine and onshore cables are spliced together and anchored. An increased frequency of storm events could accelerate shoreline erosion. The TJBs potentially susceptible to shoreline erosion are those at the Oyster Creek landfalls. The BL England and Island State Park TJBs are within paved roadways, parking lots, or the gravel maintenance area, which are pre-developed areas and largely shielded from erosion. Factors for erosion were considered when developing the hardstand (i.e., stabilized area designed to support heavy vehicles or equipment) for the TJB compound for the Oyster Creek landfall, including locating the hardstand on existing features and building the hardstand to match nearby elevations rather than being built to withstand a certain flood elevation. Erosion prevention and protection measures were also considered, such as installation of sheet piles, gabion baskets, riprap, or a submerged or partially submerged barrier closer to the waterline. However, Ocean Wind anticipates that protection of the TJB from erosion by building up the area with imported fill and use of concrete mattress would provide the most accessibility, flexibility, and resilience.

Onshore substation location and design were analyzed to ensure that substation structures that could potentially be vulnerable to impacts associated with climate change met or exceeded Federal Emergency Management Agency recommendations. The BL England site is within a Coast A/AE Zone and is a Category IV Risk Structure, as it is a power-generating station. At the BL England site, the base flood elevation plus 3 feet is elevation 12 (100-year storm being elevation 9) and, based on the flood insurance study, the 500-year flood elevation is elevation 10.7. As such, the base flood elevation plus 3 feet is greater than the design flood elevation. The Project has chosen to elevate all substation equipment to elevation 12 (base flood elevation plus 3 feet) in accordance with the Federal Emergency Management Agency design guide document. In addition, these elevations will meet the newly proposed NJDEP Inland Flood Protection regulations flood elevations. Tidal flood elevations as a result of the effects of climate change at the Oyster Creek substation are not seen as a risk or concern. The lowest proposed elevation at the substation is elevation 21 (North American Vertical Datum of 1988), which is 14 feet above the flood hazard area design flood elevation based on Federal Emergency Management Agency flood insurance rate mapping. As such, the natural on-site topography would adequately protect the substation from increased flood depths due to sea level rise and more frequent high-intensity storm events resulting from climate change.

I.9. References Cited

I.9.1 Climate and Meteorology

Blake, E. S., T. B. Kimberlain, R. J. Berg, J. P. Cangialosi, and J. L. Beven II. 2013. Tropical cyclone report Hurricane Sandy (AL182012). Available: https://www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf.

Cook, J. C., and M. N. Chatterton. 2008. *The Effects of Icing on Commercial Fishing Vessels*. Worcester Polytechnic Institute. Interactive Qualifying Project Number 47-CXP-0805. Available https://digitalcommons.wpi.edu/cgi/viewcontent.cgi?article=1512&context=iqp-all. Accessed: March 24, 2020.

Danish Hydrological Institute. 2018. Metocean data portal. Available: http://www.metocean-on-demand.com/#/main.

Donnelly, J. P., J. Butler, S. Roll, M. Wengren, and T. Webb III. 2004. A backbarrier overwash record of intense storms from Brigantine, New Jersey. *Marine Geology* 210:107–121.

National Climatic Data Center (NCDC). 2021a. New Jersey Data Normals, 1981–2010: Brant Beach, Beach Haven, NJ. Available: https://www.ncdc.noaa.gov/cdo-web/datatools/normals. Accessed: September 2021.

National Climatic Data Center (NCDC). 2021b. New Jersey Data Normals, 1981–2010: Atlantic City Marina, NJ. Available: https://www.ncdc.noaa.gov/cdo-web/datatools/normals. Accessed: September 2021.

National Data Buoy Center. 2018. Lighted buoy 44009 data: Station 44009 (LLNR 168) – DELAWARE BAY 26 NM Southeast of Cape May, NJ. National Oceanic and Atmospheric Administration. Available: https://www.ndbc.noaa.gov/station_history.php?station=44009. Accessed: March 24. 2020.

National Oceanic and Atmospheric Administration (NOAA). 2018. Historical Hurricane Mapper. Available: https://coast.noaa.gov/hurricanes/.

National Oceanic and Atmospheric Administration (NOAA). 2021. *Location of US Climate Divisions*. Physical Sciences Laboratory. Available: https://psl.noaa.gov/data/usclimate/data/map.html#New%20York. Accessed: September 2021.

New Jersey Department of Environmental Protection (NJDEP). 2010. Ocean/Wind Power Ecological Baseline Studies. Available: https://www.nj.gov/dep/dsr/ocean-wind/Ocean%20Wind%20Power%20Ecological%20Baseline%20Studies_Volume%20One.pdf. Accessed: September 2021.

New Jersey Geological Society. 2003. *Physiographic Provinces of New Jersey*. Available: https://www.state.nj.us/dep/njgs/enviroed/infocirc/provinces.pdf. Accessed: September 2020.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Ocean Wind LLC (Ocean Wind). 2023. Citing National Oceanic and Atmospheric Administration (NOAA). 2012. National Environmental Satellite, Data, and Information Service. Daily Summary October 2012. Generated on 4/13/20. Station: Atlantic City International Airport, NJ WBAN: 72407093730.

Rutgers University. 2020. New Jersey State Climatologist. *New Jersey Climate Publications*. Available: https://climate.rutgers.edu/stateclim_v1/njclimoverview.html. Accessed: September 2020.

Schofield, O., R. Chant, B. Cahill, R. Castelao, D. Gong, A. Kahl, J. Kohut, M. Montes-Hugo, R. Ramadurai, P. Ramey, X. Yi, and S. Glenn. 2008. The decadal view of the mid-Atlantic the inner continental shelf of the Middle Atlantic Bight, USA. *Marine and Coastal Fisheries* 2:277–298.

U.S. Environmental Protection Agency (USEPA). 2021. SCRAM Mixing Height Data. Index page available: https://www.epa.gov/scram/scram-mixing-height-data. Data file available: https://gaftp.epa.gov/Air/aqmg/SCRAM/met_files/mixing_hghts/njmix.zip. Accessed: September 14, 2021.

Ward, B., and P. J. Croft. 2008. "Use of GIS to examine winter fog occurrences." *Electronic Journal of Operational Meteorology* 9:1–33.

Western Regional Climate Center (WRCC). 2020. Period of Record Monthly Climate Summary: Lewes, Delaware. Available: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?de5320. Accessed: March 24, 2020.

I.9.2 Finfish and Invertebrates

Atlantic States Marine Fisheries Commission (ASMFC). 2017. Fisheries Focus – Species Profile: Summer Flounder. Volume 26, Issue 2.

Atlantic States Marine Fisheries Commission (ASMFC). 2018. Black Sea Bass (*Centropristis striata*). Available: http://www.asmfc.org/uploads/file/5dfd4b90BlackSeaBass.pdf. Accessed: November 2021.

Atlantic States Marine Fisheries Commission (ASMFC). 2019. ASMFC Stock Assessment Overview: Summer Flounder. Available: http://www.asmfc.org/uploads/file/5d44850e2018SummerFlounderStockAssessmentOverview_July2019.pdf. Accessed: November 2021.

Atlantic States Marine Fisheries Commission (ASMFC). 2021. Summer Flounder. Available: http://www.asmfc.org/species/summer-flounder. Accessed: November 2021.

Atlantic States Marine Fisheries Commission (ASMFC). 2023. Summer Flounder. Available: http://www.asmfc.org/species/summer-flounder. Accessed: January 30.

Buchanan, G. A., T. J. Belton, and B. Paudel (eds.). 2017. The Comprehensive Barnegat Bay Research Program. In: A Comprehensive Assessment of Barnegat Bay-Little Egg Harbor, New Jersey. *Journal of Coastal Research*, Special Issue No. 78:1–6. Coconut Creek (Florida), ISSN 0749-0208.

Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, and E. Estela-Gomez. 2017. *Habitat Mapping and Assessment of Northeast Wind Energy Areas*. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088. November 1, 2013. Prepared in Collaboration between Gulf of Maine Research Institute and University of Maine.

Inspire. 2021. *Ocean Wind Offshore Wind Farm Benthic Habitat Mapping and Benthic Assessment to Support Essential Fish Habitat Consultation*. Prepared for HDR Engineering. June 2021. Ocean Wind Construction and Operations Plan, Appendix E Supplement.

National Oceanic and Atmospheric Administration (NOAA). 2019. *66th Northeast Regional Stock Assessment Workshop (66th SAW) Assessment Report*. Prepared by Northeast Fisheries Center. Available: http://www.asmfc.org/uploads/file/60a6b8822018StripedBassBenchmarkStockAssessment_SAW66.pdf. Accessed: November 2019.

New Jersey Department of Environmental Protection (NJDEP). 2010. *Ocean/Wind Power Ecological Baseline Studies. January 2008–December 2009*. Volume I: Overview Summary, and Application. Final Report. Prepared by Geo-Marine Inc.

New Jersey Department of Environmental Protection (NJDEP). 2010. Citing Judkins, D. C., C. D. Wirick, and W. E. Esaias. 1980. Composition, abundance, and distribution of zooplankton in the New York Bight, September 1974–September 1975. *Fishery Bulletin* 77:669–683.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

I.9.3 Marine Mammals

Bureau of Ocean Energy Management (BOEM). 2014. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts: Revised Environmental Assessment*. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2014-603. Available: https://www.boem.gov/sites/default/files/renewable-energyprogram/State-Activities/MA/Revised-MA-EA-2014.pdf.

Davis, G. E., M. F. Baumgartner, and P. J. Corkeron. 2020. Exploring movement patterns and changing distributions of baleen whales in the western North Atlantic using a decade of passive acoustic data. *Global Change Biology* 26:4812–4840. doi.org/10.1111/gcb.15191.

Hayes, S. A., E. Josephson, K. Maze-Foley, and P. E. Rosel. 2020. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2019*. NOAA Tech Memo NMFS-NE 264.

Hayes, S. A., E. Josephson, K. Maze-Foley, P. E. Rosel, and J. Turek. 2021. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2020*. NOAA Tech Memo NMFS-NE 271.

Kenney, R. D., and K. J. Vigness-Raposa. 2010. *Marine mammals and sea turtles of Narragansett Bay, Block Island Sound, Rhode Island Sound, and nearby waters: an analysis of existing data for the Rhode Island Ocean Special Area Management Plan*. In: Ocean SAMP, Vol 2. Rhode Island Coastal Resources Management Council, Wakefield, RI.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Ocean Wind LLC (Ocean Wind). 2023. Citing Kraus, S. D., S. Leiter, K. Stone, B. Wikgren, C. Mayo, P. Hughes, R. D. Kenney, C. W. Clark, A. N. Rice, B. Estabrook, and J. Tielens. 2016. *Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles*. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2016-054. Sterling, VA.

Ocean Wind LLC (Ocean Wind). 2023. Citing National Marine Fisheries Service (NMFS). 2020. *Draft 2020 Marine Mammal Stock Assessment Report, U.S. Atlantic and Gulf of Mexico Draft Marine Mammal Stock Assessment*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Draft published on December 9, 2020.

Ocean Wind LLC (Ocean Wind). 2023. Citing New Jersey Department of Environmental Protection (NJDEP). 2010. *Ocean/Wind Power Ecological Baseline Studies January 2008–December 2009*. Final Report. Prepared for New Jersey Department of Environmental Protection Office of Science by Geo-Marine, Inc., Plano, Texas. Available: http://www.nj.gov/dep/dsr/ocean-wind/report.htm. July 2010.

Ocean Wind LLC (Ocean Wind). 2023. Citing Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2011. *2010 Annual Report to the Inter-Agency Agreement M10PG00075/0001: A Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Ocean Wind LLC (Ocean Wind). 2023. Citing Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2012. *2011 Annual Report to the Inter-Agency Agreement M10PG00075/0001: A Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Ocean Wind LLC (Ocean Wind). 2023. Citing Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2013. *2012 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Ocean Wind LLC (Ocean Wind). 2023. Citing Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2014. 2013 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Ocean Wind LLC (Ocean Wind). 2023. Citing Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2015a. *2014 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Ocean Wind LLC (Ocean Wind). 2023. Citing Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2015b. *2015 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean – AMAPPS II*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Ocean Wind LLC (Ocean Wind). 2023. Citing Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2016. *2016 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean - AMAPPS II*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Ocean Wind LLC (Ocean Wind). 2023. Citing Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2018. *2017 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean – AMAPPS II*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Ocean Wind LLC (Ocean Wind). 2023. Citing Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2019. *2018 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean – AMAPPS II*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Ocean Wind LLC (Ocean Wind). 2023. Citing Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2020. *2019 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean – AMAPPS II*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.

Ocean Wind LLC (Ocean Wind). 2023. Citing Palka, D. L., S. Chavez-Rosales, E. Josephson, D. Cholewiak, H. L. Haas, L. Garrison, M. Jones, D. Sigourney, G. Waring, M. Jech, E. Broughton, M. Soldevilla, G. Davis, A. DeAngelis, C. R. Sasso, M. V. Winton, R. J. Smolowitz, G. Fay, E. LaBrecque, J. B. Leiness, K. Dettloff, M. Warden, K. Murray, and C. Orphanides. 2017. *Atlantic Marine Assessment Program for Protected Species: 2010-2014*. OCS Study BOEM 2017-071. Bureau of Ocean Energy Management, Washington, DC. Available: https://espis.boem.gov/final%20reports/5638.pdf.

Ocean Wind LLC (Ocean Wind). 2023. Citing Roberts, J. J., B. D. Best, L. Mannocci, E. Fujioka, P. N. Halpin, D. L. Palka, L. P. Garrison, K. D. Mullin, T. V. Cole, C. B. Khan, and W. A. McLellan. 2016. *Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico*. *Scientific Reports* 6:22615.

U.S. Fish and Wildlife Service (USFWS). 2014. West Indian Manatee (*Trichechus manatus*) Florida Stock (Florida subspecies, *Trichechus manatus latirostris*). Jacksonville, Florida. Available: https://www.fws.gov/northflorida/Manatee/SARS/20140123_FR00001606_Final_SAR_WIM_FL_Stock.pdf.

Waring, G. T., E. Josephson, C. P. Fairfield, and K. Maze-Foley, eds. 2007. *US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments—2006*. NOAA Technical Memorandum NMFS-NE-201. National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA.

I.9.4 Wetlands

Ocean Wind LLC (Ocean Wind). 2021. Response to the Bureau of Ocean Energy Management, Request for Information #15, Ocean Wind Construction and Operations Plan. November 17.

U.S. Fish and Wildlife Service (USFWS). 2021. National Wetland Inventory GIS data. Available: https://www.fws.gov/wetlands/Data/State-Downloads.html. Accessed: December 1, 2021.

Appendix J. Underwater Sound and Acoustic Modeling Results

J.1. Introduction

This appendix provides an overview of underwater sound sources, summarizes the regulation of underwater sound for marine mammals and fish/invertebrates, and identifies thresholds for explosives. In addition, this appendix summarizes the methods, assumptions, and results of the technical acoustic modeling report prepared for the Project.

J.2. Sources of Underwater Sound

Ocean sounds originate from a variety of sources. Some come from non-biological sources such as wind and waves, while others come from the movements or vocalizations of marine life (Hildebrand 2009). In addition, humans introduce sound into the marine environment through activities like oil and gas exploration, construction, military sonars, and vessel traffic (Hildebrand 2009). The acoustic environment or "soundscape" of a given ecosystem comprises all such sounds—biological, non-biological, and anthropogenic (Pijanowski et al. 2011). Soundscapes are highly variable across space, time, and water depth, among other factors, due to the properties of sound transmission and the types of sound sources present in each area. A soundscape is sometimes called the "acoustic habitat," as it is a vital attribute of a given area where an animal may live (i.e., habitat) (Hatch et al. 2016).

J.3. Physics of Underwater Sound

Sounds are created by the vibration of an object within its medium (Figure J-1). This movement generates kinetic energy, which travels as a propagating wave away from the sound source. As this wave moves through the medium, the particles undergo tiny back-and-forth movements ("particle motion") along the axis of propagation, but the particles themselves do not travel with the wave. Instead, they oscillate in roughly the same location, transferring their energy to surrounding particles. Instead, the vibration is transferred to adjacent particles, which are pushed into areas of high pressure (compression) and low pressure (rarefaction). Acoustic pressure is a non-directional (scalar) quantity, whereas particle motion is an inherently directional quantity (a vector) taking place in the axis of sound transmission. The total energy of the sound wave includes the potential energy associated with the sound pressure as well as the kinetic energy from particle motion.

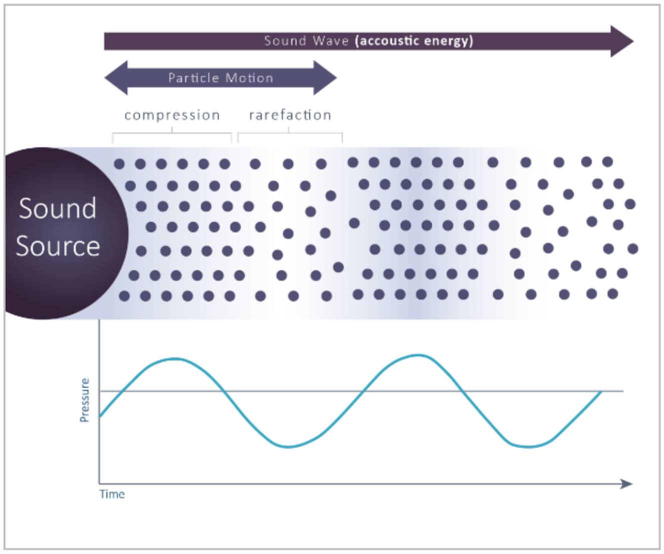
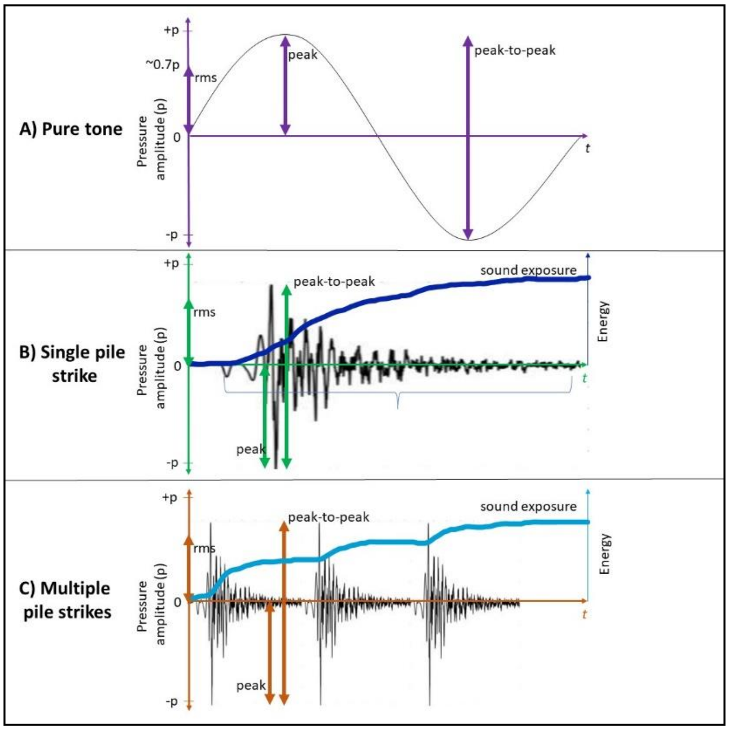


Figure J-1 Basic Mechanics of a Sound Wave

J.3.1 Units of Measurement

Sound can be quantified and characterized based on a number of physical parameters. A complete description of the units can be found in ISO 18405:2017. Some of the major parameters and their units (in parentheses) are:

Acoustic pressure (pascal): The values used to describe the acoustic (or sound) pressure are peak pressure (L_{pk}), peak-to-peak pressure (L_{pk-pk}), and RMS pressure (L_{RMS} or SPL) deviation. The peak sound pressure is defined as the maximum absolute sound pressure deviation within a defined time period and is considered an instantaneous value. The peak-to-peak pressure is the range of pressure change from the most negative to the most positive pressure amplitude of a signal (Figure J-2), whereas the RMS sound pressure represents a time-averaged pressure and is calculated as the square root of the mean (average) of the time-varying sound pressure over a given period (Figure J-2). The L_{pk}, L_{pk-pk}, and SPL are computed by multiplying the logarithm of the ratio of the peak or RMS pressures to a reference pressure (1 μPa in water) by a factor of 20 and are reported in dB; see sound levels described below.



A) A sine wave of a pure tonal signal with equal positive and negative peaks, so peak-to-peak is exactly twice the peak and RMS is approximately 0.7 x peak. B) A single pile-driving strike with one large positive pulse and a large negative pulse that is not necessarily the same magnitude. In this example, the negative pulse is more extreme so the reported peak value and peak-to-peak are less than double that. Sound exposure is shown as it accumulates across the time window. The final sound exposure would be considered the "single-shot" exposure and the RMS value is that divided by the duration of the pulse. C) Three consecutive pile-driving strikes with peak and peak-to-peak assessed the same way as in B). Sound exposure is shown accumulating across all three strikes and RMS is the total sound exposure divided by the entire time window shown. The cumulative sound exposure for this series of signals would be considered the total energy from all three pile-strikes.

Figure J-2 Sound Pressure Wave Representations of Four Metrics: Root-mean-square (L_{RMS}), Peak (L_{pk}), Peak-to-peak (L_{pk-pk}), and Sound Exposure (SEL)

Particle velocity (m/s): Particle velocity describes the change in position of the oscillating particles about its origin over a unit of time. Similar to sound pressure, particle velocity is dynamic and changes as the particles move back and forth. Therefore, peak particle velocity and RMS particle velocity can be used to describe this physical quantity. One major difference between sound pressure and particle velocity is that the former is a scalar (i.e., without the directional component) and the latter is a vector (i.e., includes both magnitude and direction). Particle acceleration can also be used to describe particle motion, and is defined as the rate of change of velocity of a particle with respect to time. It is measured in units of meters per second squared, or m/s^2.

Sound exposure (pascal-squared second): Sound exposure is proportional to the acoustic energy of a sound. It is the time-integrated squared sound pressure over a stated period or acoustic event (see Figure J-2). Unlike sound pressure, which provides an instantaneous or time-averaged value of acoustic pressure, sound exposure is cumulative over a period of time.

Acoustic intensity (watts per square meter): Acoustic or sound intensity is the amount of acoustic energy that passes through a unit area normal to the direction of propagation per second. It is the product of the sound pressure and the sound velocity. With an idealized constant source, the pressure and particle velocity will vary in proportion to each other at a given location, but the intensity will remain constant.

Sound levels: There is an extremely wide dynamic range of values when measuring acoustic pressure in pascals, so it is customary to use a logarithmic scale to compress the range of values. Aside from the ease it creates for comparing a wide range of values, animals (including humans) perceive sound on a logarithmic scale. These logarithmic acoustic quantities are known as *sound levels* and are expressed in dB, which is the logarithmic ratio of the measurement in question to a fixed reference value. Underwater acoustic SPLs are referenced to a pressure of 1 μPa (equal to 10^{-6} pascals or 10^{-11} bar). Note: airborne SPLs have a different reference pressure: 20 μPa.

The metrics previously described (sound pressure, sound exposure, and intensity) can also be expressed as levels, and are commonly used in this way:

- RMS sound pressure level (L_{RMS} or SPL, units of dB re 1 μPa)
- peak pressure level (L_{pk}, units of dB re 1 μPa)
- peak-to-peak pressure level ($L_{pk\text{-}pk}$, units of dB re 1 μPa)
- SEL (units of dB re 1 μPa^{2}s)

There are a few commonly used time periods used for SEL, including a 24 hour period (used in the U.S. for the regulation of noise impacts on marine mammals [SEL_{24}]), or the duration of a single event, such as a single pile-driving strike or an airgun pulse, called the single-strike SEL (SEL_{ss}). A sound exposure for some other period of time, such as the entire installation of a pile, may be written without a subscript (SEL) but, in order to be meaningful, should always denote the duration of the event.

Source Level: Another commonly discussed concept is source level. Source level is a representation of the amount of acoustic power radiated from the sound source being described. It describes how loud a particular source is in a way that can inform expected received levels at various ranges. It can be conceptualized as the product of the pressure at a particular location and the range from that location to a spherical (omnidirectional) source in an idealized infinite lossless medium. The source level is the sum of the received level and the propagation loss to that receiver. It is often discussed as what the received level would be 1 meter from the source, but this can lead to confusion as an actual measurement at 1 meter is likely to be impossible for large or non-spherical sources. The most common type is an SPL source level in units of dB re 1 µPa-m, although in some circumstances a SEL source level (in dB re 1 µPa^{2}s-m^2) may be expressed; peak source level (in units of dB re 1 µPa-m) may also be appropriate for some sources.

J.3.2 Propagation of Sound in the Ocean

Underwater sound can be described through a source-path-receiver model. An acoustic source emits sound energy that radiates outward and travels through the water and the seafloor. The sound level decreases with increasing distance from the acoustic source as the sound travels through the environment. The amount by which the sound levels decrease between the theoretical source level and a receiver is called *propagation loss*. Among other things, the amount of propagation loss that occurs depends on the source-receiver separation, the geometry of the environment the sound is propagating through, the frequency of the sound, the properties of the water column, and the properties of the seafloor and sea surface.

When sound waves travel through the ocean, they may encounter areas with different physical properties that will likely alter the propagation pathway of the sound, compared to a homogenous and boundaryless environment. For example, near the ocean's surface, water temperature is usually higher, resulting in relatively fast sound speeds. As temperature decreases with increasing depth, the sound speed decreases. Sounds bend toward areas with lower speeds (Urick 1983). Ocean sound speeds are often slowest at mid-latitude depths of about 1,000 meters and, because of sound's preference for lower speeds, sound waves above and below this "deep sound channel" often bend toward it. Sounds originating in this layer can travel great distances. Sounds can also be trapped in the mixed layer near the ocean's surface (Urick

1983). Latitude, weather, and local circulation patterns influence the depth of the mixed layer, and the propagation of sounds near the surface is highly variable and difficult to predict.

At the boundaries near the sea surface and the sea floor, acoustic energy can be scattered, reflected, or attenuated depending on the properties at the surface (e.g., roughness, presence of wave activity, or bubbles) or seafloor (e.g., bathymetric features, substrate heterogeneity). For example, fine-grain sediments tend to absorb sounds well, while hard-bottom substrates reflect much of the acoustic energy back into the water column. The presence of ice on the ocean's surface can also affect sound propagation. For example, the presence of solid ice may dampen sound levels by blocking surface winds. The presence of ice can also increase sound levels when pieces of ice break or scrape together (Urick 1983). The effect will also depend on the thickness and roughness of the ice, among many other factors related to the ambient conditions. As a sound wave moves from a source to a receiver (i.e., an animal), it may travel on multiple pathways that may be direct, reflected, refracted, or a combination of these mechanisms, creating a complex pattern of transmission across range and depth. The patterns may become even more complicated in shallow waters due to repeated interactions with the surface and the bottom, frequency-specific propagation, and more heterogenous seafloor properties. All of these variables contribute to the difficulty in reliably predicting the sound field in a given marine environment at any particular time.

J.3.3 Sound Source Classification

In the current regulatory context, anthropogenic sound sources are divided into four types: impulsive, non-impulsive, continuous, and intermittent, based on their differing potential to affect marine species (NMFS 2018). Specifically, when it comes to potential damage to marine mammal hearing, sounds are classified as either impulsive or non-impulsive, and when considering the potential to affect behavior or acoustic masking, sounds are classified as either continuous or intermittent.

Impulsive noises are characterized as having (ANSI S1.13-2005 [Finneran 2016]):

- Broadband frequency content
- Fast rise times and rapid decay times
- Short durations (i.e., less than 1 second)
- High peak sound pressures

The characteristics of non-impulsive sound sources are less clear but may:

- Be variable in spectral composition, i.e., broadband, narrowband, or tonal
- Have longer rise time/decay times and total durations compared to an impulsive sound
- Be continuous (e.g., vessel engine radiated noise) or intermittent (e.g., echosounder pulses)

It is generally accepted that sources like explosions, airguns, sparkers, boomers, and impact pile driving are impulsive and have a greater likelihood of causing hearing damage than non-impulsive sources (explosions are further considered for non-auditory injury; see Section J.5.3, *Thresholds for Non-auditory Injury for Explosives*). At close distances to impulsive sounds, physiological effects on an animal are likely, including TTS and PTS. This binary, at-the-source classification of sound types, therefore, provides a conservative framework upon which to predict potential adverse hearing impacts on marine mammals.

For behavioral effects of anthropogenic sound on marine mammals, NMFS classifies sound sources as either intermittent or continuous (NMFS 2018). Continuous sounds, such as drilling or vibratory pile-driving, remain "on," i.e., above ambient noise, for a given period of time, although this is not well defined. An intermittent sound typically consists of bursts or pulses of sound on a regular on/off pattern, also called the duty-cycle. Examples of intermittent sounds are those from scientific echosounders, sub-bottom profilers, and even pile driving. It is important to recognize that these delineations are not always practical in application, as a continuous yet moving sound source (such as a vessel passing over a fixed receiver) could be considered intermittent from the perspective of the receiver.

In reality, animals will encounter many signals in their environment that may contain many or all of these sound types, called complex sounds. Eeven for sounds that are impulsive at the source, as the signal propagates through the water, the degree of impulsiveness decreases (Martin et al. 2020). While there is evidence, at least in terrestrial mammals (Hamernik and Hsueh 1991), that complex sounds can be more damaging than continuous sounds, there is not currently a regulatory category for this type of sound. One current approach for assessing the impulsiveness of a sound that has gained attention is to compute the kurtosis of that signal. Kurtosis is a statistical measure that describes the prevalence of extreme values within a distribution of observations, in other words the “spikiness” of the data. Martin et al. (2020) showed that a sound with a kurtosis value of 3 or less has very few extreme values and is generally considered Gaussian (i.e., normally distributed) noise, whereas a kurtosis value greater than 40 represents a distribution of observations with many extreme values and is very spiky. This generally describes an impulsive noise. A distribution of sound level observations from a time series with a kurtosis value somewhere in between these two values would be considered a complex sound.

J.4. Sound Sources Related to Offshore Wind Development

J.4.1 Geophysical and Geotechnical Surveys

G&G surveys are conducted to characterize the bathymetry, sediment type, and benthic habitat characteristics of the marine environment. They may also be used to identify archaeological resources or obstacles on the seafloor. These types of surveys occur in the site assessment phase in order to inform the placement of offshore wind foundations but may also occur intermittently during and after turbine construction to identify, guide, and confirm the locations of turbine foundations. The suite of HRG sources that may be used in geophysical surveys includes side-scan sonars, multibeam echosounders, magnetometers and gradiometers, parametric sub-bottom profilers, compressed high-intensity radiated pulse sub-bottom profilers, boomers, or sparkers. Seismic airguns are not expected to be used for offshore wind applications. These HRG sources may be towed behind a ship, mounted on a ship’s hull, or deployed from remotely operated vehicles or autonomous underwater vehicles.

All HRG sources are active acoustic sources, meaning they produce sound deliberately in order to obtain information about the environment. With the exception of some multibeam echosounder and side-scan sonar, they produce sounds below 180 kilohertz and therefore may be audible to marine species. Source levels vary widely depending on source type and operational power level used, from approximately 145 dB re 1 µPa-m for towed sub-bottom profilers up to 245 dB re 1 µPa-m for some multibeam echosounders (Crocker and Fratantonio 2016). Generally speaking, sources that emit sound in narrow beams directed at the seafloor are less likely to affect marine species because they ensonify a small portion of the water column, thereby reducing the likelihood that an animal encounters the sound. While sparkers are omnidirectional, most other HRG sources have narrow beamwidths (e.g., multibeam echosounders: up to 6 degrees, parametric sub-bottom profilers: 30 degrees, boomers: 30–90 degrees) (Crocker and Fratantonio 2016). Most HRG sources emit short pulses of sound, with periods of silence in between. This means that only several “pings” emitted from a vessel towing an active acoustic source would reach an animal below, even if the animal was stationary (Ruppel et al. 2022). HRG surveys may occur throughout the construction area with the potential for greater effort in some areas.

Geotechnical surveys may use vibracores, jet probes, bottom-grab samplers, deep borings, or other methods to obtain samples of sediments at each potential turbine location and along the cable route. For most of these methods, source levels have not been measured, but it is generally assumed that low-frequency, low-level noise would be introduced as a byproduct of these actions. It is likely that the sound of the vessel would exceed that generated by the geotechnical method itself.

J.4.2 Unexploded Ordnance Detonations

UXO may be discovered on the seabed in offshore wind lease areas or along export cable routes. While non-explosive methods may be employed to lift and move these objects, some may need to be detonated. Underwater explosions of this type create a shock wave with a nearly instantaneous rise in pressure, followed by a series of symmetrical bubble pulses. Shock waves are supersonic, so they travel faster than the speed of sound. The explosive sound field extremely is complex, especially in shallow waters. In 2015, von Benda-Beckmann et al. measured received levels of explosions in shallow waters at distances ranging from 100–2,000 meters from the source in water depths ranging from 6–22 meters. The measured SEL from the explosive removal of a 263-kilogram charge was 216 dB re 1 $\mu Pa^2 s$ at a distance of 100 meters and 196 dB re 1 $\mu Pa^2 s$ at 2,000 meters. They found that SELs were lower near the surface than near the seafloor or in the middle of the water column, suggesting that if an animal is near the surface, the effects may be less damaging. Most of the acoustic energy for underwater explosions is below 1,000 Hz.

As an alternative to traditional detonation, a newer method called deflagration allows for the controlled burning of underwater ammunition. Typically, a remotely operated vehicle uses a small, targeted charge to initiate rapid burning of the ordnance; once this process is complete, the remaining debris can be cleared away. Recent work has demonstrated that both peak sound pressure (L_{pk}) and SEL measured from deflagration events may be as much as 20 dB lower than equivalently sized high-order detonations (Robinson et al. 2020).

J.4.3 Construction and Installation

J.4.3.1. Impact and Vibratory Pile Driving

At present, the installation of turbine foundations is largely done using pile driving. There are several techniques, including impact and vibratory driving, and many pile designs and sizes, including monopile and jacket foundations. Impact pile driving employs a hammer to strike the pile head and force the pile into the sediment with a typical hammer strike rate of approximately 30–50 strikes/minute. Typically, force is applied over a period of less than 20 milliseconds, but the pile can generate sound for upward of 0.5 second. Pile-driving noise is characterized as impulsive because of its high peak pressure, short duration, and rapid onset time. Underwater sound levels generated during pile driving depend on many factors including the pile material and size, characteristics of the substrate, penetration of the pile in the seabed, hammer energy and size, and water depth. Currently the design envelope for most offshore wind turbine installations anticipates hammer energy between 2,500 and 4,000 kilojoules (kJ) but, generally speaking, with increasing pile diameter, greater hammer energy is used. The propagation of pile-driving sounds depends on factors such as the sound speed in the water column (influenced by temperature, salinity, and depth), the bathymetry, and the composition of sediments in the seabed and will therefore vary among sites. Due to variation in these features, sounds may not radiate symmetrically outward from a pile.

Measurements of impact-pile driving are generally derived from measurements at facilities in Europe; see Bellman et al. (2020) for a complete report of expected sound levels and a discussion of noise abatement methods. In the U.S. OCS, BOEM has invested in the Realtime Opportunity for Development of Environmental Observations efforts to measure sound installation and operation of two wind farms: Block Island Wind Farm and Coastal Virginia Offshore Wind. At Block Island Wind Farm, 50-inch-diameter jacket foundations were installed in 30-meter water depth. Jacket foundations typically use using pin piles, which are generally substantially smaller than monopiles, but more pin piles are needed per foundation. The sound levels generated will vary depending on the pile material, size, substrate, hammer energy, and water depth. At Block Island Wind Farm, Amaral et al. (2018) measured sound levels at various distances during pile driving and reported SPL received levels between 150–160 dB re 1 µPa at approximately 750 meters from the piles. It should be noted that the slant range of the jacket piles influenced the measurements, so caution is encouraged with interpretation. At Coastal Virginia Offshore Wind, two monopiles (7.8-meter diameter) were installed off in 27-meter water depth in 2020. Dominion Energy (2020) recorded sounds during this process; without noise mitigation, L_{pk} source levels were back-calculated to be 221 dB re 1 µPa-m, but with a double bubble curtain, L_{pk} source levels were around 212 dB re 1 µPa-m because a good portion of energy greater than 200 Hz was attenuated by the bubble curtain. The unmitigated SPL source level was 213 dB re 1 µPa-m; the mitigated SPL source level was 204 dB re 1 µPa-m.

Vibratory hammers may be used as an alternative to impact pile driving. The vibratory hammer continuously exerts vertical vibrations into the pile, which causes the sediment surrounding the pile to liquefy, allowing the pile to penetrate the substrate. The vibratory hammer typically oscillates at a frequency of 20–40 Hz (Matuschek and Betke 2009) and produces most of its acoustic energy below 2 kilohertz. While measurements of vibratory pile driving of large monopiles have not been reported, Buehler et al. (2015) measured sound levels at 10 meters distance from a 72-inch steel pile, and found them to be 185 dB re 1 µPa. Vibratory pile driving is a non-impulsive sound source but, because the hammer is on continuously, underwater sound introduced would be into the water column for a longer period of time than with impact pile driving.

A technique that is quickly gaining use for installation in hard rock substrates is down-the-hole pile driving, which uses a combination of percussive and drilling mechanisms, with a hammer acting directly on the rock to advance a hole into the rock and also advance the pile into that hole (Guan et al. 2022). Noise characteristics for down-the-hole pile driving include both impulsive and non-impulsive components. The impulsive component of the down-the-hole pile driving is the result of a percussive hammer striking the bedrock, while the non-impulsive component is from drilling and air lifting of cuttings and debris from the pile. While only limited studies have been conducted on down-the-hole pile-driving noise, its characteristics strongly resemble those of impact pile driving but with a higher hammer striking rate (approximately 10–15 Hz). The dominant frequencies from down-the-hole pile driving are below 2 kilohertz, similar to those of conventional impact pile driving. Due to the high rate of hammer striking along with the sounds of drilling and debris clearing out, sound levels in between the pulses are much higher than for conventional impact pile driving (Guan et al. 2022).

Various noise abatement technologies, such as bubble curtains, arrays of enclosed air resonators, or segmented nets of rubber or foam, may be employed to reduce noise from impact pile driving. Measurements from European wind farms have shown that a single noise abatement system can reduce broadband sound levels by 10–15 dB, while using two systems together can reduce sound levels as much as 20 dB (Bellmann et al. 2020). Based on Realtime Opportunity for Development of Environmental Observations measurements from Coastal Virginia Offshore Wind, double big bubble curtains are shown to be most effective for frequencies above 200 Hz, and greater noise reduction was seen in measurements taken in the middle of the water column compared to those near the seabed. Approximate sound level reduction is 3–5 dB below 200 Hz and 8–20 dB above 200 Hz, depending on the characteristics of the bubble curtain (Amaral et al. 2020).

J.4.3.2. Vessels

During construction, vessels and aircraft may be used to transport crew and equipment. See Section J.4.4, *Operations and Maintenance*, for further detail about sounds related to those activities. Large vessels would also be used during the construction phase to conduct pile driving and may use dynamic positioning systems. Dynamic positioning is the process by which a vessel holds station over a specific seafloor location for some time period using input from gyrocompasses, motion sensors, global positioning systems, active acoustic positioning systems, and wind sensors to determine relative movement and environmental forces at work. Generally speaking, most acoustic energy is less than 1,000 Hz, often below 50 Hz, with tones related to engine and propeller size and type. The sound can also vary directionally, and this directionality is much more pronounced at higher frequencies. Because this is a dynamic operation, the sound levels produced will vary based on the specific operation, dynamic positioning system used (e.g., jet or propeller rotation versus a rudder or steering mechanism), and factors such as the blade rate and cavitation, in some cases. Representative sound field measurements from the use of dynamic positioning are difficult to obtain because the sound transmitted is often highly directional and context specific. The direction of sound propagation may change as different dynamic positioning needs requiring different configurations are applied.

Many studies have found that the measured sound levels of dynamic positioning alone are, counterintuitively, higher than those of dynamic positioning combined with the intended activities such as drilling (Jiménez-Arranz et al. 2020; Kyhn et al. 2011; Nedwell and Edwards 2004) and coring (Warner and McCrodan 2011). Nedwell and Edwards (2004) reported that dynamic positioning thrusters of the semi-submersible drill rig Jack Bates produced periodic noise (corresponding to the rate of the thruster blades) with most energy between 3–30 Hz. The received SPL measured at 100 meters from the vessel was 188 dB re 1 µPa. Warner and McCrodan (2011) found that most dynamic positioning related sounds from the self-propelled drill ship R/V Fugro Synergy were in the 110–140 Hz range, with an estimated source level of 169 dB re 1 µPa-m. Sounds in this frequency range varied by 12 dB during dynamic positioning, while the broadband levels, which also included diesel generators and other equipment sounds, varied by only 5 dB over the same time period. All of the above sources report high variability in levels with time. This is due in part to the intermittent usage and relatively slow rotation rates of thrusters used in dynamic positioning. It is also difficult to provide a realistic range of source levels from the data thus far because most reports do not identify the direction from which sound was measured relative to the vessel, and dynamic positioning thrusters are highly directional systems.

The active acoustic positioning systems used in dynamic positioning can be additional sources of high-frequency sound. These systems usually consist of a transducer mounted through the vessel’s hull and one or more transponders affixed to the seabed. Kongsberg High-Precision Acoustic Positioning systems produce pings in the 10–32-kilohertz frequency range. The hull-mounted transducers have source levels of 188–206 dB re 1 µPa-m depending on adjustable power settings (Kongsberg Maritime AS 2013). The fixed transponders have maximum source levels of 186–206 dB re 1 µPa-m depending on model and beam width settings from 15 to 90 degrees (Jiminez-Arranz et al. 2020). These systems have high source levels, but beyond 2 kilometers they are generally quieter than other components of the sound from dynamic positioning vessels for various reasons, including that their pulses are produced in narrowly directed beams, each individual pulse is very short, and their high-frequency content leads to faster attenuation.

J.4.3.3. Dredging, Trenching, and Cable Laying

The installation of cables can be done by towing a tool behind the installation vessel to simultaneously open the seabed and lay the cable, or by laying the cable and following with a tool to embed the cable. Possible installation methods for these options include jetting, vertical injection, controlled-flow excavation, trenching, and plowing. Burial depth of the cables is typically 1–2 meters. Cable installation vessels may use utilize dynamic positioning to lay the cables (see Section J.4.3.2, *Vessels*).

Nedwell and Edwards (2004) measured sounds from a 130-meter-long trenching vessel and found that sound levels were similar to those produced during pipeline laying in the same area (see below), with the exception of a 20-kilohertz tonal sound, which they attributed to the vessel’s dynamic positioning thrusters. Source levels for trenching were not reported. Nedwell et al. (2003) recorded underwater sound

160 meters from trenching activity with the hydrophone 2 meters below the surface (and water depth 7–11 meters) and back-calculated the SPL source level of trenching to be 178 dB re 1 µPa-m (assuming propagation loss of 22logR). They describe the sound as generally spanning a wide range of frequencies, variable over time, and accompanied by some tonal machinery noise and transients associated with rock breakage.

Mechanical dredges mechanically dig or gather sediment from the bottom using a bucket. They may also be called backhoe dredges, grab dredges, bucket dredges, bucket ladder dredges, or clamshells. These dredges are usually fixed via anchoring or dynamic positioning systems. Material is scraped off the bottom and lifted up to the ship using a winch. Mechanical dredging is widely used in the research community to sample hard materials from the seafloor for studies of volcanic areas (e.g., mid-ocean ridges) and deep-sea minerals. These dredges may be used in offshore wind projects to reach cable-burying depths in problematic areas where simple jetting cannot be used.

Dredging produces distinct sounds during each specific phase of operation: excavation, transport, and placement of dredged material (Central Dredging Association 2011; Jiménez-Arranz et al. 2020). Engines, pumps, and support vessels used throughout all phases may introduce low-level, continuous noise into the marine environment. The sounds produced during excavation vary depending on the sediment type—the denser and more consolidated the sediment is, the more force the dredger needs to impart, and the higher sound levels that are produced (Robinson et al. 2011). Hydraulic dredges (with cutterheads or drag arms in continuous contact with the seabed) produce nearly continuous sounds during the excavation process. On the other hand, sounds from mechanical dredges occur in intervals as the dredge lowers a bucket, digs, and raises the bucket with a winch. During the sediment transport phase, many factors—including the load capacity, draft, and speed of the vessel—influence the sound levels that are produced (Reine et al. 2014b). Sounds are also produced during pump-out operations when dredge plant pumps are operated (Central Dredging Association 2011). Dredging activities as a whole generally produce low-frequency sounds; most energy is below 1,000 Hz, with peaks typically occurring between 150–300 Hz (McQueen et al. 2018).

McQueen et al. (2018) summarized results from several studies that measured sounds during dredging operations. For cutterhead suction dredges, SPL source levels were 168–175 dB re 1 µPa-m (Greene 1987; Reine et al. 2012b, 2014a). Trailing suction hopper dredges were slightly louder, with SPL source levels ranging from 172–190 dB re 1 µPa-m (McQueen et al. 2018). Dickerson et al. (2001) recorded a maximum SPL of 124 dB re 1 µPa at 154 meters during the moment when the grab hit the seabed; during other phases of operation (e.g., raising and lowering of grab dredge, dumping sediment on barge), the received SPL was closer to approximately 110–115 dB re 1 µPa at 154 meters. Finally, SPL source levels during backhoe dredge operations ranged from 163–179 dB re 1 µPa-m (Nedwell et al. 2008; Reine et al. 2012a). Hydraulic dredges are generally louder than mechanical dredges, and dredging of coarser sediments usually produces more noise than softer sediments (Jiménez-Arranz et al. 2020). Additional detail and measurements of dredging sounds can be found in Jiménez-Arranz et al. (2020), McQueen et al. (2018), and Robinson et al. (2011).

J.4.4 Operations and Maintenance

J.4.4.1. Aircraft

Manned aircraft consist of propeller and jet engines, fixed-wing craft, and helicopters. Unmanned systems also exist. For jet engine aircraft, the engine is the primary source of sound. For propeller-driven aircraft and helicopters, the propellors and rotors also produce noise. Aircraft generally produce low-frequency sound below 500 Hz (Richardson et al. 1995). While aircraft noise can be substantial in air, penetration of aircraft noise into the water is limited because much of the noise is reflected off the water's surface (Richardson et al. 1995). The noise that does penetrate into the water column does this via a critical incident angle or cone. With an idealized flat sea surface, the maximum critical incident angle is approximately 13 degrees (Urick 1983); beyond this, sound is reflected off the surface. When the sea surface is not flat, there may be some additional penetration into the water column in areas outside of this 13-degree cone. Nonetheless, the extent of noise from passing aircraft is more localized in water than it is in air.

Jiménez-Arranz et al. (2020) reviewed Richardson et al.'s (1995) sound measurements recorded below passing aircraft of various models. These SPL measurements included 124 dB re 1 µPa (dominant frequencies between 56–80 Hz) from a maritime patrol aircraft with an altitude of 76 meters, 109 dB re 1 µPa (dominant frequency content below 22 Hz) from a utility helicopter with an altitude of 152 meters, and 107 dB re 1 µPa (tonal, 82 Hz) from a turbo propeller with an altitude of 457 meters. Recent published levels associated with unmanned aircraft (Christiansen et al. 2016; Erbe et al. 2017) indicate source levels around or below 100 dB re 1 µPa-m.

J.4.4.2. Vessels in Transit

During operations, small vessels may be used to transport crew and supplies. Noise from vessel transit is considered to be continuous, with a combination of broadband and tonal sounds (Richardson et al. 1995; Ross 1976). Transiting vessels generate continuous sound from their engines, propeller cavitation, onboard machinery, and hydrodynamics of water flows (Ross 1976). The actual radiated sound depends on several factors, including the type of machinery on the ship, the material conditions of the hull, how recently the hull has been cleaned, interactions with the sea surface, and shielding from the hull, which reduces sound levels in front of the ship.

In general, vessel noise increases with ship size, power, speed, propeller blade size, number of blades, and rotations per minute. Source levels for large container ships can range from 177 to 188 dB re 1 µPa-m (McKenna et al. 2013) with most energy below 1 kilohertz. Smaller vessels typically produce higher-frequency sound concentrated in the 1–5 kilohertz range. Kipple and Gabriele (2003) measured underwater sound from vessels ranging from 14 to 65 feet long (25 to 420 horsepower) and back-calculated source levels to be 157–181 dB re 1 µPa-m. Similar levels are reported by Jiménez-Arranz et al. (2020), who provide a review of measurements for support and crew vessels, tugs, rigid-hull inflatable boats, icebreakers, cargo ships, oil tankers, and more.

During transit to and from shore bases, survey vessels typically travel at speeds that optimize efficiency, except in areas where transit speed is restricted. The vessel strike speed restrictions in place along the Atlantic OCS are expected to offer a secondary benefit of underwater noise reduction. For example, recordings from a speed reduction program in the Port of Vancouver (210–250-meter water depths) showed that reducing speeds to 11 knots reduced vessel source levels by 5.9–11.5 dB, depending on the vessel type (MacGillivray et al. 2019). Vessel noise is also expected to be lower during G&G surveys, as they typically travel around 5 knots when towing instruments.

J.4.4.3. Turbine Operations

Once wind farms are operational, low-level sounds are generated by each WTG, but sound levels are much lower than during construction. This type of sound is considered to be continuous, omnidirectional radially from the pile, and non-impulsive. Most of the energy associated with operations is below 120 Hz. Sound levels from WTG operations are likely to increase somewhat with increasing generator size and power ratings, as well as with wind speeds. Recordings from Block Island Wind Farm indicated that there was a correlation between underwater sound levels and increasing wind speed, but this was not clearly influenced by turbine machinery; rather it may have been explained by the natural effects that wind and sea state have on underwater sound levels (Elliott et al. 2019; Urick 1983).

A recent compilation (Tougaard et al. 2020) of operational noise from several wind farms, with turbines up to 6.15 MW in size, showed that operational noise generally attenuates rapidly with distance from the turbines (falling to near-ambient sound levels within approximately 1 kilometer from the source), and the combined noise levels from multiple turbines is lower or comparable to that generated by a small cargo ship. Tougaard et al. (2020) developed a formula predicting a 13.6-dB increase for every tenfold increase in WTG power rating. This means that operational noise could be expected to increase by 13.6 dB when increasing in size from a 0.5-MW turbine to a 5-MW one, or from 1 MW to 10 MW. The least squares fit of that dataset would predict that the SPL measured 100 meters from a hypothetical 15-MW turbine in operation in 10-m/s (19-knot or 22-mile-per-hour) wind would be 125 dB re 1 µPa. However, all of the 46 data points in that dataset—with the exception of the two from Block Island Wind Farm—were from WTGs operated with gear boxes of various designs rather than the newer use of direct-drive technology, which is expected to lower underwater noise levels substantially. Stöber and Thomsen (2021) make predictions for source levels of 10-MW turbines based on a linear extrapolation of maximum received levels from WTGs with ratings up to 6.15 MW. The linear fit is likely inappropriate, and the resulting predictions may be exaggerated. Tougaard et al. (2020) point out that received level differences among different pile types could be confounded by differences in water depth and turbine size. In any case, additional data are needed to fully understand the effects of size, foundation type properties (e.g., structural rigidity and strength), and drive type on the amount of sound produced during turbine operation.

J.4.5 Decommissioning

The methods that may be used for decommissioning are not well understood at this time. It is possible that explosives may be used (see Section J.4.2, *Unexploded Ordnance Detonations*). However, given the general trend of reducing the use of underwater explosives that has been observed in the oil and gas industry, it is likely that offshore wind structures will instead be removed by cutting. While it is difficult to extrapolate directly, we can glean some insights from a recent study that measured received sound levels during the mechanical cutting of well conductor casings on oil and gas platforms in California. The cutters operated at 60–72 revolutions per minute, and the cutting time varied widely between cuts (on the order of minutes to hours). At distances of 106–117 meters from the cutting, received SPLs were 120–130 dB re 1 µPa, with most acoustic energy falling between 20 and 2,000 Hz (Fowler et al. 2022). This type of sound is considered to be non-impulsive and intermittent (i.e., continuous while cuts are actually being made, with quieter periods between cuts). Additional noise from vessels (see Section J.4.3.2, *Vessels*) and other machinery may also be introduced throughout the decommissioning process.

J.5. Regulation of Underwater Sound for Marine Mammals

The MMPA prohibits the “take” of marine mammals, defined as the harassment, hunting, capturing, killing, or an attempt of any of those actions on a marine mammal. This act requires that an incidental take authorization be obtained for the incidental take of marine mammals as a result of anthropogenic activities. MMPA regulators divide the effects on marine mammals that could result in a take into Level A and Level B, defined as follows:

- Level A: Any act of pursuit, torment, or annoyance that has the potential to <u>injure</u> a marine mammal or marine mammal stock in the wild
- Level B: Any act of pursuit, torment, or annoyance that has the potential to <u>disturb</u> a marine mammal or marine mammal stock in the wild by causing a disruption of behavioral patterns including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but that does not have the potential to injure a marine mammal or marine mammal stock in the wild (16 USC 1362)

With respect to anthropogenic sounds, Level A takes generally include injury impacts like PTS, whereas Level B takes include behavioral effects as well as TTS. The current regulatory framework used by

NMFS for evaluating an acoustic take of a marine mammal involves assessing whether the animal's received sound level exceeds a given threshold. For Level A, this threshold differs by functional hearing group, but for Level B, the same threshold is used across all marine mammals.

J.5.1 Thresholds for Injury

The current NMFS (2018) injury (Level A) thresholds consist of dual criteria of L_{pk} and 24-hour cumulative SEL thresholds (Figure J-1). These criteria are used to predict the potential range from the source within which injury may occur. The criterion that results in the larger physical impact range is generally used to be most conservative. The SEL thresholds are frequency weighted, which means that the sound is essentially filtered based on the animal's frequency-specific hearing sensitivity, de-emphasizing the frequencies at which the animal is less sensitive (see Section J.17 for the frequency range of hearing for each group). The frequency weighting functions are described in detail in Finneran (2016).

Table J-1 The Acoustic Thresholds for Onset of Permanent Threshold Shift and Temporary Threshold Shift for Marine Mammals for Both Impulsive and Non-impulsive Sound Sources

Marine Mammal Functional Hearing Group	Effect	Impulsive Source		Non-impulsive Source
		L_{pk} (dB re 1 μPa)	Weighted SEL_{24h} (dB re 1 μPa²s)	Weighted SEL_{24h} (dB re 1 μPa²s)
LFC	PTS	219	183	199
	TTS	213	168	179
MFC	PTS	230	185	198
	TTS	224	170	178
HFC	PTS	202	155	173
	TTS	196	140	153
Phocid pinnipeds underwater	PTS	218	185	201
	TTS	212	170	181
Otariid pinnipeds underwater	PTS	232	203	199
	TTS	226	188	199

Source: NMFS 2018
Note: L_{pk} values are unweighted within the generalized hearing range of marine mammals (i.e., 7 Hz to 160 kilohertz): Values presented for SEL use a 24-hour accumulation period unless stated otherwise, and are weighted based on the relevant marine mammal functional hearing group (Finneran 2016).
dB re 1 μPa = decibels relative to 1 μPa; dB re 1 μPa^{2}s = decibels relative to 1 μPa^{2}s.

J.5.2 Thresholds for Behavioral Disturbance

NMFS currently uses a threshold for behavioral disturbance (Level B) of 160 dB re 1 μPa SPL for non-explosive impulsive sounds (e.g., airguns, impact pile driving) and intermittent sound sources (e.g., scientific and non-tactical sonar), and 120 dB re 1 μPa SPL for continuous sounds (e.g., vibratory pile driving, drilling (NMFS 2022). This is an "unweighted" criterion that is applicable for all marine mammal species. In-air behavioral thresholds exist for harbor seals and non-harbor seal pinnipeds at 90 dB re 20 μPa SPL and 100 dB re 20 μPa SPL, respectively (NMFS 2022). Unlike with SEL-based thresholds, the accumulation of acoustic energy over time is not relevant for this criterion, meaning that a Level B take can occur even if an animal experiences a received SPL of 160 dB re 1 μPa very briefly just once.

While the Level B criterion is generally applied in a binary fashion, as alluded to previously, there are numerous factors that determine whether an individual will be affected by a sound, resulting in substantial variability even in similar exposure scenarios. In particular, it is recognized that the context in which a sound is received affects the nature and extent of responses to a stimulus (Ellison et al. 2012; Southall et al. 2007). Therefore, a "step function" concept for Level B harassment was introduced by Wood et al. (2012) whereby proportions of exposed individuals experience behavioral disturbance at different received levels, centered at an SPL of 160 dB re 1 μPa. These probabilistic thresholds reflect the higher sensitivity that has been observed in beaked whales and migrating mysticete whales (Table J-2). At the moment, this step function provides additional insight to calculating Level B takes for certain species groups. The M-weighting functions, described by Southall et al. (2007) and used for the Wood et al. (2012) probabilistic disturbance step thresholds, are different from the weighting functions by Finneran (2016) previously mentioned. The M-weighting was specifically developed for interpreting the likelihood of audibility, whereas the Finneran weighting functions were developed to predict the likelihood of auditory injury.

Table J-2 Probabilistic disturbance SPL_{RMS} thresholds (M-weighted) used to predict a behavioral response. Probabilities are not additive and reflect single points on a theoretical response curve

Marine Mammal Group	Probabilistic Disturbance RMS Thresholds M-weighted dB re: 1 μPa RMS			
	120	140	160	180
Porpoises/beaked whales	50%	90%	--	--
Migrating mysticetes whales	10%	50%	90%	--
All other species/behaviors	--	10%	50%	90%

Source: Wood et al. 2012

J.5.3 Thresholds for Non-auditory Injury for Explosives

Shock waves associated with underwater detonations can induce non-auditory physiological effects, including mortality and direct tissue damage (i.e., severe lung injury, slight lung injury, and gastrointestinal tract injury). To predict non-auditory lung injury and mortality, the acoustic impulse, measured in pascal-seconds, is the integral of the pressure shock pulse over time and serves as the threshold. Because lung capacity or size is generally directly related to the size of an animal, body mass is one parameter used to predict the likelihood of lung injury. In addition, the depth of the animal is used, as this represents the ambient pressure conditions of the animal and its vulnerability to a rapid change in pressure. Gastrointestinal tract injury potential is identified using the peak SPL and is considered to occur beginning at levels of 237 dB re 1 μPa. The U.S. Navy established thresholds to identify to assess the potential for mortality and slight lung injury from explosive sources based on a modified Goertner equation; this assessment adopts and applies these thresholds (Navy 2017). Table J-3 provides an estimate of mass of the different marine mammal species covered in this assessment. Table J-4 lists the equations used to calculate thresholds based on effects observed in 1 percent of animals.

Table J-3 Representative Calf/Pup and Adult Mass Estimates Used for Assessing Impulse-based Onset of Lung Injury and Mortality Threshold Exceedance Distances

Impulse Animal Group	Representative Species	Calf/Pup Mass (kilograms)	Adult Mass (kilograms)
Baleen whales and sperm whale	Sei whale (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*)	650	16,000
Pilot and minke whales	Minke whale (*Balaenoptera acutorostrata*)	200	4,000

Impulse Animal Group	Representative Species	Calf/Pup Mass (kilograms)	Adult Mass (kilograms)
Beaked whales	Gervais' beaked whale (*Mesoplodon europaeus*)	49	366
Dolphins, Kogia, pinnipeds, and sea turtles	Harbor seal (*Phoca vitulina*)	8	60
Porpoises	Harbor porpoise (*Phocoena phocoena*)	5	40

Table J-4 Marine Mammal Acoustic Thresholds used by NMFS for Non-auditory Injury and Mortality from Explosives

Mammals	Mortality (Severe Lung Injury) (Pa·s)	Slight Lung Injury (Pa·s)	G.I. Tract Injury (L_{pk}, dB re 1 µPa)
All marine mammals	$I=103M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$	$I=47.5M^{1/3}\left(1+\frac{D}{10.1}\right)^{1/6}$	237

Impulse thresholds for mortality and slight lung injury are calculated using the modified Goertner equation presented in Navy 2017, equations 11 (slight lung injury) and 12 (mortality), where *M* is the animal's mass in kilograms and *D* is the depth of the animal at exposure in meters.
Lung injury (severe and slight) thresholds are dependent on animal's mass, *M, in* kilograms (see Table C.9 in Navy 2017) and the animal's depth, *D,* in meters.
G.I. = gastrointestinal; Pa s = pascal-second

J.6. Thresholds for Auditory Injury for Explosives

The supersonic shock wave from an explosion transitions to normal pressure wave at a range determined by the weight and type of the explosive used. The range to the TTS and PTS threshold are outside of these radii, and the normal impulsive TTS and PTS thresholds (Table J-1) are applicable for determining auditory injury impacts (NMFS 2018).

J.7. Thresholds for Behavioral Disturbance for Explosives

Single blast events within a 24-hour period are not presently considered by NMFS to produce behavioral effects if they are below the onset of TTS thresholds for frequency-weighted SEL and peak pressure level. Only short-term startle responses are expected as far as behavioral responses. For multiple detonations, the threshold applied for behavioral effects is that same TTS threshold minus 5 dB.

J.7.1 Approach to Acoustic Exposure Modeling

In order to predict the number of individuals of a given species that may be exposed to harmful levels of sound from a specific activity, a series of modeling exercises are conducted. First, the sound field of a sound-generating activity is modeled based on characteristics of the source and the physical environment. From the sound field, the range to the U.S. regulatory acoustic threshold isopleths can be predicted. This approach is referred to as *acoustic modeling*. By overlaying the marine mammal density information for a certain species or population in the geographical area of the activity, the number of animals exposed within the acoustic threshold isopleths is then predicted. This is called *exposure modeling*. Some models further incorporate animal movement to make more realistic predictions of exposure numbers. Animal movement models may incorporate behavioral parameters including swim speeds, dive depths, course changes, or reactions to certain sound types, among other factors. Exposure modeling may be conducted for a range of scenarios including different seasons, energy (e.g., pile-driving hammers), mitigation strategies (e.g., 6 dB versus 10 dB of attenuation), and levels of effort (e.g., number of piles per day).

J.8. Regulation of Underwater Sound for Fishes and Invertebrates

J.8.1 Thresholds for Injury

During construction of the Bay Bridge in California, researchers observed dead fish near pile-driving operations, suggesting that fish could be killed when in very close proximity (less than 10 meters) to the pile (Caltrans 2004). Further work around this construction project led to the formation of dual interim criteria by the Fisheries Hydroacoustic Working Group (2008), which were later adopted by NMFS. With these interim criteria, the maximum permitted peak SPL for a single pile-driving strike is 206 dB re 1 µPa, and the maximum accumulated SEL is 187 dB re 1 µPa^{2}s for fishes greater than 2 grams, and 183 dB re 1 µPa^{2}s for fishes below 2 grams (Table J-5). These criteria are still being used by NMFS but, given the new information obtained since 2008, the appropriateness of these thresholds is being reconsidered (Popper et al. 2019).

These early findings prompted a suite of laboratory experiments in which a special testing apparatus was used to simulate signals from pile driving that a fish would encounter around 10 meters from a pile (Casper et al. 2012, 2013a, 2013b; Halvorsen et al. 2011, 2012a, 2012b). An important component of this work was the ability to simulate both the pressure and particle motion components of the sound field, which is rarely done in laboratory experiments. These studies showed that effects are greater in fishes with swim bladders than those without, and that species with closed swim bladders experienced greater damage than those with open swim bladders. Evidence of barotrauma was observed starting at peak pressures of 207 dB re 1 µPa (Halvorsen et al. 2012a). Larger animals seem to have a higher susceptibility to injury than smaller animals (Casper et al. 2013a). The researchers found that most of the species tested showed recovery from injury within 10 days of exposure, but they note that injured animals may be more vulnerable to predation while they are recovering, and these secondary effects have not been studied. The authors also conclude that SEL alone is not enough to predict potential impacts on fishes; the energy in a given strike and the total number of strikes are also important factors. These studies formed the foundation of the *Guidelines for Fish and Sea Turtles* by Popper et al. (2014), which became ANSI standard (#ASA S3/SC1.4 TR-2014) and have become widely accepted hearing thresholds for fishes and turtles.

No studies have directly measured TTS in fishes as a result of exposure to pile-driving noise. Popper et al. (2005) exposed caged fish to sounds of seismic airguns (an impulsive signal that can serve as a proxy) and tested their hearing sensitivity afterward. Three species with differing hearing capabilities were exposed to five pulses at a mean received L_{pk} of 207 dB re 1 µPa (186 dB re 1 µPa^{2}s SEL). None of the fish showed evidence of barotrauma or tissue damage, and there was no damage to the hearing structures (Song et al. 2008). The species with the least-sensitive hearing—the broad whitefish—showed no evidence of TTS. The northern pike and lake chub, species with more sensitive hearing, did exhibit TTS after exposure to seismic pulses but showed recovery after 18 hours. The findings suggest that there is a relationship between hearing sensitivity and level of impact, and that species without a connection between the swim bladder and ear are unlikely to experience TTS. Nonetheless, Popper et al. (2014) propose 186 dB re 1 µPa^{2}s SEL as a conservative TTS threshold for all fishes exposed to either seismic airguns or pile driving, regardless of hearing anatomy. They acknowledge that research is needed on potential TTS due to exposure to pile-driving noise and that future work should measure particle motion as the relevant cue.

A handful of studies have directly investigated the effects of impulsive sounds on eggs and larvae of marine fishes and invertebrates, and most have taken place in the laboratory. Bolle et al. (2012) used a device similar to that used by Halvorsen et al. (2012a) to simulate pile-driving sounds and found no damage to larvae of common sole (which has a swim bladder at certain larval stages) from an SEL of 206 dB re 1 uPa^{2}s, which the authors surmise is equivalent to the received level at approximately 100 meters from a 4-meter-diameter pile. Further work by Bolle et al. (2014) tested larvae of seabass and herring (both species have swim bladders). Several different life stages were tested, but none of the species showed a difference in mortality between control and exposed animals. The seabass were exposed to SELs up to 216 dB re 1 μPa^{2}s and maximum L_{pk} of 217 dB re 1 μPa, while herring were exposed to SELs up to 212 dB re 1 μPa^{2}s and maximum L_{pk} of 207 dB re 1 μPa. Together, the tested larvae represent the entire range of swim bladder shape types described by Popper et al. (2014). There was no difference in impacts experienced by species with and without a swim bladder or between those with open or closed swim bladders. Based on this work, Popper et al. (2014) use 210 dB re 1 uPa^{2}s SEL as a threshold for mortality after exposure to both pile driving and seismic airguns.

Popper et al. (2014) provide thresholds for non-recoverable injury, recoverable injury (i.e., mild forms of barotrauma), and TTS for the three hearing groups, plus an additional category for eggs and larvae (Table J-5). Unlike with marine mammals, Popper et al. (2014) do not distinguish between impulsive and non-impulsive sounds; instead they provide thresholds for each sound type (explosions, pile-driving, seismic airguns, sonars, and continuous sounds). That said, studies focused on pile-driving are sometimes used to draw conclusions about impacts from seismic airguns, and vice versa. This is simply due to a lack of comprehensive data for each source type. The thresholds are all given in terms sound pressure, not particle motion, though many have acknowledged that these would be more appropriate (Popper and Hawkins 2018). Currently, there are no underwater noise thresholds for invertebrates, but the effect ranges are expected to be similar to those predicted for fishes in Group 1.

Table J-5 Acoustic Thresholds for Exposure to Pile-driving Sound

Fish Hearing Group	Mortality and Non-Recoverable injury		Recoverable Injury		TTS
	L_{pk}	SEL	L_{pk}	SEL	SEL
Fish without swim bladder (Group 1)[1]	>213	>219	>213	>216	>>186
Fish with swim bladder not involved in hearing (Group 2)[1]	>207	210	>207	203	>186
Fish with swim bladder involved in hearing (Group 3)[1]	>207	207	>207	203	186
Eggs and Larvae[1]	>207	>210	--	--	--
Fish ≥ 2 grams[2]	--	--	206	187	--
Fish < 2 grams[2]	--	--	206	183	--

[1] Popper et al. (2014) Sound Exposure Guidelines. Note that Popper et al. (2014) use the notation "SEL_{cum}," but SEL without a subscript is the preferred nomenclature, used here to describe the energy that would be accumulated over an entire pile-driving event (i.e., installation of a pile).
[2] Fisheries Hydroacoustic Working Group (2008)

J.8.2 Thresholds for Behavioral Disturbance

NOAA Fisheries currently uses an SPL criterion of 150 dB re 1 μPa for the onset of behavioral effects in fishes (GARFO 2020). The scientific rationale for this criterion is not well supported by the data (Hastings 2008), and there has been criticism about its use (Popper et al. 2019). Most notably, the differences in hearing anatomy among fishes suggest the use of a single criterion may be too simplistic. Furthermore, a wide range of behavioral responses have been observed in the empirical studies thus far (ranging from startle responses to changes in schooling behavior), and it is difficult to ascertain which, if any, of those responses may lead to significant biological consequences. Interestingly, several recent studies on free-ranging fishes (e.g., Hawkins et al. 2014; Roberts et al. 2016) have observed the onset of different behavioral responses at similar received levels ($L_{pk\text{-}pk}$ of 152–167 dB re 1 µPa), and Popper et al. (2019) suggest that a received level of 163 dB re 1 µPa $L_{pk\text{-}pk}$ might be more appropriate than the current criterion of 150 re 1 µPa L_{RMS}. Finally, given that most species are more sensitive to particle motion and not acoustic pressure, the criteria should, at least in part, be expressed in terms of particle motion. However, until there is further empirical evidence to support a different criterion, the 150 dB re 1 µPa L_{RMS} threshold remains in place as the interim metric that regulatory agencies have agreed upon.

J.8.3 Thresholds for Explosives

Popper et al. (2014) present criteria for mortality and non-recoverable injury as a result of exposure to detonations. They note that it is difficult to disentangle the effects of the compressive forces of the shock wave (very close to the explosion) versus the decompressive effect (area of negative pressure, farther from the explosion), but either can lead to barotrauma or mortality in fishes. Several studies (e.g., Goertner 1978; Yelverton 1975) have worked with different species, with different charge sizes and water depths, all of which are important factors in predicting the effects of explosives. Yet Popper et al. (2014) derive their thresholds using data from an older study that represent the lowest amplitude that caused consistent mortality across species (Hubbs and Rechnitzer 1952). Therefore, for all fishes, regardless of hearing anatomy, the threshold for mortality and non-recoverable injury is given as a range: 229–234 dB re 1 µPa L_{pk} by Popper et al. (2014), but in practice, 229 dB is likely used.

J.9. Short Project Description

This section is focused on providing an overview of the methods, assumptions, and results of the technical acoustic modeling report prepared for the Project (Ocean Wind 2022; Küsel et al. 2022; Hannay and Zykov 2022; JASCO 2021). Readers who may be less familiar with acoustic terminology are recommended to refer to the glossary (COP Volume III, Appendix R-2; Ocean Wind 2023).

The Project would consist of up to 98 WTGs, up to three OSS, and interconnection and export cables. The Project would be on the OCS offshore New Jersey in BOEM Lease Area OCS-A 0498. The major underwater noise-producing activities of this Project would include impact pile driving during construction. The piles to be driven would include large (11-meter-diameter at the mudline) monopiles and 2.44-meter-diameter pin piles. This appendix summary focuses on the quantitative modeling of the impact pile driving, vibratory pile driving, HRG surveys, and UXO detonations. Qualitative assessments of lower noise level activities (dredging, vessel movements etc.) were also provided in the technical acoustic modeling report (COP Volume III, Appendix R-2; Ocean Wind 2023).

For the quantitative modeling assessment of impact pile driving, predicted sound fields were generated for one representative deep-water location for the monopiles and for one shallow-water location for the jacket foundation with pin piles (Figure 2 and Table 3; Küsel et al. 2022). Sound field predictions were made for both summertime and wintertime conditions. To predict sound fields, the sound produced at the pile as the hammer strikes it must be characterized. The propagation of the hammer-strike sound through the water column and the sediment is then predicted. The result is a set of predicted broadband sound fields, which are used to predict the ranges to U.S. regulatory isopleths as well as the number of marine animals that could be exposed to sound levels that exceed regulatory thresholds. Finally, the effects of sound source mitigation (e.g., bubble curtains) on impact pile-driving effects were explored.

A practical spherical spreading model was used by JASCO (JASCO 2021) to estimate the extent of potential underwater noise effects as a result of vibratory driving of sheet piles. The sound level of the vibratory pile driver at 10 meters was assumed to be 165 dB re 1 µPa^2. The modeling assumed that the installation and removal of cofferdams would require 18 hours over 2 days to complete, with vibratory pile driving taking place for no longer than 12 hours each 24-hour period over the installation period.

A total of 31,375 kilometers of HRG surveys are estimated to be required in the Offshore Project area and export cable route area, with a single vessel being able to cover 43.5 miles (70 kilometers) per day. For purposes of analysis, a single vessel survey day is assumed to cover the maximum 70 kilometers. In years 1, 4, and 5, 88 survey days per year are expected. It is estimated that a total of 6,110 linear kilometers would be needed within the Wind Farm Area and export cable route area during this time. Survey effort would be split between the Wind Farm Area and the export cable route area: 3,000 kilometers for the array cable, 2,300 kilometers for the Oyster Creek export cable, 510 kilometers for the BL England export cable, and 300 kilometers for the OSS interconnector cable. During years 2 and 3 (when construction would occur), 180 survey days per year would be required. HRG surveys during WTG and OSS construction and operation would include up to 11,000 kilometers of export cable surveys, 10,500 kilometers of array cable surveys, 1,065 kilometers of foundation surveys, 250 kilometers of WTG surveys, and up to 2,450 kilometers of monitoring and verification surveys. To cover the requirements of the Project, several HRG surveys were considered in the modeling:

- Shallow-penetration, non-impulsive, non-parametric sub-bottom profilers (compressed high-intensity radiated pulses), 2 to 20 kilohertz
- Medium-penetration, impulsive boomers, 3.5 Hz to 10 kilohertz
- Medium-penetration, impulsive sparkers, 50 Hz to 4 kilohertz

For HRG surveys, the NMFS User Spreadsheet Tool and transmission loss equations were used to estimate the distances to thresholds. Source levels relied upon measurements recorded from equipment, the best available manufacturer specifications (representing maximum output), or the closest proxy source (Ocean Wind 2022).

A separate report (Hannay and Zykov 2022) explored the predicted effects of UXO removal by detonation at several locations. In this report, the ranges were calculated to a variety of regulatory thresholds for peak pressure, impulse, and SEL metrics. The modeling of acoustic fields generated by UXO detonations was performed using a combination of semi-empirical and physics-based computational models.

J.10. Acoustic Models and Assumptions

The acoustic assessment of Project activities relies upon a variety of models to predict the potential effect on marine animals. The models used in the quantitative analysis include:

1. GRLWEAP Model: to model the force applied to the pile by the hammer
2. Finite Difference Model: to compute pile vibrations after the hammer strikes the pile
3. Full Waveform Range-dependent Acoustic Model (FWRAM): to calculate the time-dependent sound field and PK sound levels
4. Marine Operation Noise Model (MONM): a parabolic equation model to calculate SEL values for both impulse pile driving and UXO detonations
5. JASMINE Model: the JASCO Applied Sciences animat[1] movement and exposure model
6. UXO Semi-empirical Models: to predict the shock pulse source waveform, the impulse amplitude, and their attenuation with range

[1] Animat = simulated animal

7. NMFS User Spreadsheet Tool (NMFS 2020): this tool, supplied by NMFS, is used to calculate distances to regulatory thresholds when more sophisticated modeling is not available or is not warranted; this tool was used for HRG modeling and assumes spherical spreading.

Both FWRAM and MONM predict the propagation of the source signal through the physical environment. As such, these models require accurate descriptions of the ocean bathymetry, seafloor sediment properties, water column sound velocity profile, and ocean surface roughness. The assumptions of these models and their inputs are critical to the accuracy of the model output.

J.10.1 Physical Environment

The bathymetry information used in the modeling was extracted from the General Bathymetric Chart of the Oceans (GEBCO Bathymetric Compilation Group 2020). A simplified model of the sediment properties (i.e., the Geoacoustic Model) was developed based on measurements made within the Project area. The water column properties (i.e., sound velocity profile) were extracted from the U.S. Navy's Generalized Digital Environmental Model (Carnes 2009). The water column properties change seasonally, and an average of all the summer months was used to represent the Project area for the times in which pile driving was expected to occur. Additional analyses using winter conditions were prepared in the technical acoustic modeling report (COP Volume III, Appendix R-2; Ocean Wind 2023) but were not used for exposure analysis because the proposed activities are intended to take place outside of the NARW seasonal closures.

J.10.2 Impact Pile Sound Source Details

Required inputs for the modeling are the assumed size and properties of the piles, as well as the hammer energy used to drive them into the sediment (Table J-6).

Table J-6 Key Assumptions About the Piles Used in the Underwater Acoustic Modeling

Foundation type	Modeled maximum impact hammer energy (kJ)	Number of Strikes	Strike Rate (min-1)	Pile diameter (m)	Pile wall thickness (mm)	Seabed penetra-tion (m)	Piles per day
Monopile	4,000	10,846	50	8 to 11	80	50	2
Jacket	2,500	13,191	50	2.44	75	70	2–3

m = meter; mm = millimeter

To estimate the number of marine animals likely to be exposed above the regulatory thresholds, a conservative construction schedule that maximized activity during the highest-density months for each species was assumed. Sixty WTG monopiles (two per day for 30 days) were assumed to be installed in the highest-density month of each species and an additional 38 WTG monopiles (two per day for 19 days) were assumed to be installed during the month with the second highest animal density. Two options are being considered for OSS foundations: either three monopiles (two per day for 1 day and one on a third day) or 48 pin piles (three per day for 16 days) in the highest-density month. Both options were modeled and evaluated.

Monopile installation was expected to begin with 500-kJ hammer strikes that would be scaled up to 4,000 kJ at the end of the pile progression. A total of 10,846 strikes are expected per pile, and the strike rate was estimated at 50 strikes per minute. Pin piles are expected to scale from 500 kJ to 2,500 kJ hammer strike energies during the piling progression. A total of 13,191 strikes are predicted for each pin pile, with a strike rate of 50 strikes per minute. Details of the pile progression are presented in the technical acoustic modeling report (COP Volume III, Appendix R-2, Tables 1 and 2; Ocean Wind 2023). No simultaneous pile driving was included in the modeling assumptions.

J.10.3 Vibratory Driving Source Details

The sound level of the vibratory pile driver was assumed to be 165 dB re 1 μPa^2 at 10 meters range. The NMFS (2020) practical spherical spreading model was used to estimate the range to regulatory thresholds. This modeling assumed that the installation and removal of cofferdams would each require 18 hours to complete over 2 days, with vibratory driving taking place for no longer than 12 hours each day.

J.10.4 UXO Sound Source Details

Five different charge sizes (Table J-7) were modeled at the four modeling sites with depths ranging from 12 meters to 45 meters in depth. The net explosive weights listed in Table J-7 include both the donor charge and UXO weights. Predictions for the range to thresholds were made with and without 10 dB of bubble curtain mitigation. As Ocean Wind has committed to attaining a 10-dB attenuation for all UXO detonation events, mitigated values are presented herein.

Table J-7 UXO Charge Sizes Used for Underwater Acoustic Modeling

Navy Bin	Maximum net equivalent weight TNT	
	kilograms	pounds
E4	2.3	5
E6	9.1	20
E8	45.5	100
E10	227	500
E12	454	1,000

TNT = trinitrotoluene

J.10.5 HRG Sound Source Details

Both non-impulsive and impulsive HRG sources were considered (Table J-8).

Table J-8 HRG Equipment Used for Underwater Acoustic Assessment

Equipment	Operating frequency (kHz)	SL_{RMS} (dB re 1 μPa-m)	$SL_{0\text{-}pk}$ (dB re 1 μPa-m)	Pulse duration (width) (mse)	Repetition rate (Hz)	Beam-width (degrees)	CF (2016) or MAN
Non-parametric shallow penetration SBPs (non-impulsive)							
ET 216 (2000DS or 3200 top unit)	2–16	195	--	20	6	24	MAN
	2–8	--	--	--	--	--	--
ET 424	4–24	176	--	3.4	2	71	CF
ET 512	0.7–12	179	--	9	8	80	CF
GeoPulse 5430A	2–17	196	--	50	10	55	MAN
Teledyne Benthos Chirp III - TTV 170	2–7	197	--	60	15	100	MAN
Medium penetration SBPs (impulsive)							
AA, Dura-spark UHD (400 tips, 500 J)	0.3–1.2	203	211	1.1	4	Omni	CF

Equipment	Operating frequency (kHz)	SL_{RMS} (dB re 1 µPa-m)	$SL_{0\text{-}pk}$ (dB re 1 µPa-m)	Pulse duration (width) (mse)	Repeti-tion rate (Hz)	Beam-width (degrees)	CF (2016) or MAN
AA, triple plate S-Boom (700–1,000 J)	0.1–5	205	211	0.6	4	80	CF

CF = Crocker and Fratantonio; dB re 1 µPa = decibel referenced to 1 micropascal; kHz = kilohertz; m = meter; MAN = manufacturer; $SL_{0\text{-}pk}$ = zero to peak source level; SL_{RMS} = root-mean-square source level; SBP = sub-bottom profilers

J.11. Details of Attenuation (Bubble Curtain) Method

As described in Ocean Wind's Application for MMPA Rulemaking and Letter of Authorization, Ocean Wind is proposing use of a dual noise mitigation system (e.g., bubble curtain system and an additional system) to achieve broadband noise attenuation during impact pile installation (Ocean Wind 2022). The same or a different noise mitigation system would be used during UXO detonations.

No specific sound source attenuation method was specified in the modeling report. However, the effect of sound source attenuation at 0, 6, 10, 15, and 20 dB for winter and summer conditions was presented in the report for the marine mammal regulatory SEL isopleths (COP Volume III, Appendix R-2, Tables H-45 and H-46; Ocean Wind 2023). These sound source attenuation effects are summarized for LFC (Figure J-3) to provide an illustration of the general effectiveness of different levels of sound source attenuation. An attenuation of 10 dB produces about a 50-percent reduction in the ranges to injury thresholds or isopleths. All the predicted exposures and ranges to thresholds were calculated using 10 dB of sound source attenuation.

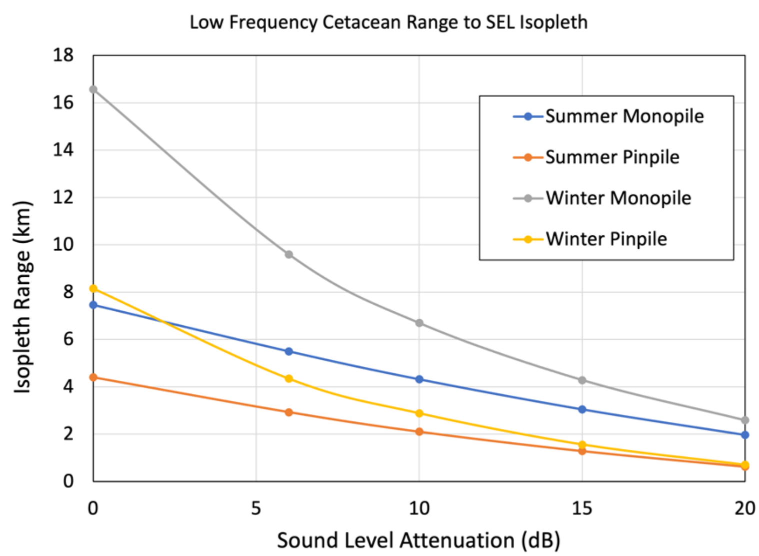


Figure J-3 Effect of Sound Source-Attenuation Levels on Ranges to SEL Isopleths for LFC in Summer and Winter Conditions

The effects of the five levels of sound attenuation on the distances to fish regulatory isopleths for the large monopoles were presented in the technical acoustic modeling report (COP Volume III, Appendix R-2; Ocean Wind 2023), Tables H-47 to H-54, with pin pile values presented in Tables H-55 to H-62.

J.12. Propagation Modeling Methods

To model the sound from the pile driving, the force of the pile-driving hammers was computed using the GRLWEAP 2010 wave equation model (Pile Dynamics 2010). The forcing functions from GRLWEAP were used as inputs to the Finite Difference model to compute the resulting pile vibrations. The sound radiating from the pile is simulated using a vertical array of discrete point sources. Their amplitudes were derived using an inverse technique, such that their collective particle velocity, calculated using a near-field wave-number integration model, matched the particle velocity in the water at the pile wall.

J.12.1 SEL Modeling

MONM was used to compute received SEL (L_E) for impact pile driving and UXO detonations. MONM uses a wide-angle parabolic equation solution to the acoustic wave equation (Collins 1993) based on a version of the U.S. Naval Research Laboratory's Range-dependent Acoustic Model that has been modified to account for a solid seabed (Zhang and Tindle 1995). Like all parabolic equation models, MONM requires environmental inputs such as bathymetry, the water sound speed profile, and seabed properties.

J.12.2 PK and SPL Modeling for Impact Pile Driving

Time-domain predictions of the pressure waves generated in the water are required for calculating SPL and PK pressure levels for impulsive sounds from impact pile driving. Furthermore, the pile must be represented as a distributed source to accurately characterize vertical directivity effects in the near-field zone. FWRAM computes synthetic pressure waveforms versus range and depth for range-varying marine acoustic environments (Figure J-4), and it requires the same environmental inputs as MONM. Synthetic pressure waveforms were modeled over the frequency range 10 to 2,048 Hz, inside a 0.5-second window. The synthetic pressure waveforms were post-processed, after applying a travel time correction, to calculate standard SPL and SEL metrics versus range and depth from the source.

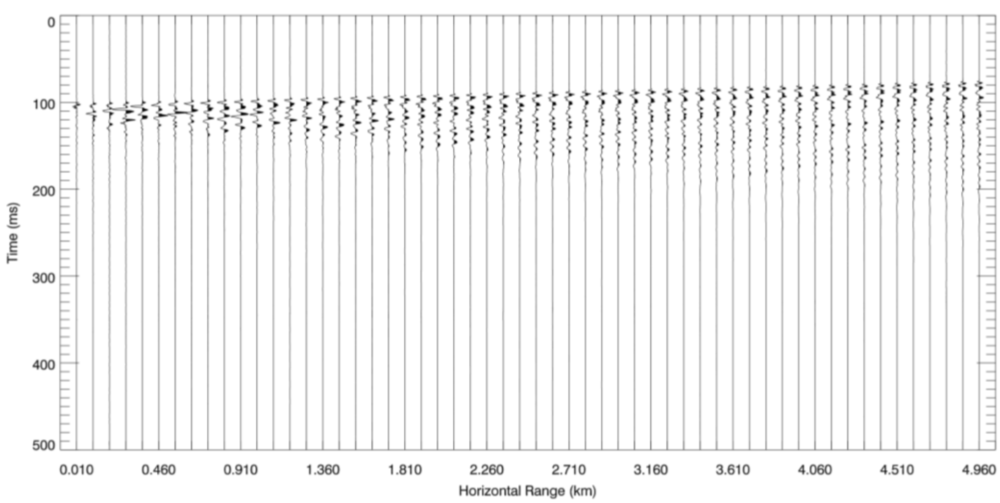


Figure J-4 Example of Synthetic Pressure Waveforms Computed by FWRAM at Multiple Range Offsets

J.12.3 Vibratory Pile-driving Modeling

Vibratory driving hammers are assumed to have a sound level of 165 dB re 1 μPa^2 at 10 meters range. Because the source level is so low, the simple NMFS (2020) practical spherical spreading model was used to predict the ranges to regulatory thresholds, which is a reasonable approach.

J.12.4 Peak Pressure and Impulse Modeling for UXO Detonations

The waveform of UXO detonations was predicted using the methodology of Arons and Yennie (1948, Küsel et. al. citing Arons and Yennie 1949). The shock wave peak pressure as a function of range was predicted using weak shock theory (Rogers 1977). These are both well-established prediction methods that have been validated.

J.12.5 HRG Acoustic Propagation Methods

Ranges to level A regulatory isopleths for the HRG sources were calculated using the NMFS (2020) User Spreadsheet Tool. This tool accounts for the source level, the speed of the vessel, the repetition rate of the source, the pulse duration, and frequency weighting for each source/animal hearing group combination. Ranges to behavioral thresholds were calculated using the NMFS (2020) practical spherical spreading model. Finally, isopleth distances for HRG sources with beamwidths less than 180° were calculated following NMFS Office of Protected Resources interim guidance (Guan 2020).

J.13. Animal Movement Model Methodology

The combination of the predicted sound fields and animal movements was used to derive the animal exposures. Movement predictions are typically created using an animat-based model (Dean 1998; Frankel et al. 2002). Such modeling is typically conducted for individual species, when sufficient data are available, or representative species groups. Animat models require the input of a variety of behavioral parameter values that reproduce the "behavioral envelope" of each species or group. Examples include the range of swimming speeds, dive depths, and course changes. The output can be thought of as a table of latitude, longitude, depth, and time values that represent the four-dimensional movements of the animat; the input values were not included in the report.

The JASMINE animat modeling program was used to simulate animal movement through the predicted sound fields. JASMINE simulates full four-dimensional movement (space and time). The direction of animats was predicted using either a random walk, correlated random walk, or correlated random walk with directional bias (used for migratory animals). The underwater acoustic and exposure modeling report (COP Volume III, Appendix R-2; Ocean Wind 2023) did not specify which directional model was used in the simulations they conducted.

Animat tracks begin with an initial position. The animal's direction is based on the input behavioral parameters, which, along with its speed and diving behavioral values, are used to create an individual movement leg (i.e., the course between two three-dimensional locations). The model then repeats the individual movement leg process to build a full track for the duration of the simulation.

Within each modeled species or species group, JASMINE can simulate different behavioral states (e.g., foraging, resting, or directed travel). A set of transition probabilities is used to control when or if an individual animat will switch behavioral states. However, the details of which behavioral states and the transition probabilities used in the animat modeling were not provided in the report.

JASMINE can include behavioral aversion to sound sources as a behavioral state. Aversion is used to explore how the predicted exposures of animals may differ between simulations where aversion to sound sources is included or not. The underwater acoustic and exposure modeling report (COP Volume III, Appendix R-2; Ocean Wind 2023) focused on exploring the differences caused by aversion in NARWs (a critically endangered species) and harbour porpoises (a common species in coastal waters known to have strong behavioral reactions to sound). Aversion for these two marine mammal species was implemented by allowing the animats to change course away from the sound source, with low levels of aversion at low sound received levels, moderate aversions at moderate sound levels, and strong aversion at higher sound levels. The specific values are shown in the underwater acoustic and exposure modeling report (COP Volume III, Appendix R-2, Tables J-1 and J-2; Ocean Wind 2023).

J.14. Ranges to Regulatory Thresholds Methods

The standard approach of taking the maximum sound received level across all depths was used to reduce the three-dimensional sound field to a two-dimensional plan view. The physical environment often produces an oddly shaped sound field. The 95th percentile of all the maximum ranges (R_{max}) for each direction from the source that exceeded the isopleth ($R_{95\%}$) was used to represent the range to regulatory isopleths (Figure J-5).

Two approaches were used to determine the ranges to regulatory level isopleths. The first was simply the $R_{95\%}$ value for the sound field, which is applied for fish. The second approach was based on the results of the animat modeling for marine mammals and sea turtles. This approach is called the Exposure Range. For each animat, the range to the closest point of approach that exceeds an acoustic threshold was determined, producing a distribution of ranges. The 95th percentile of this distribution was taken as the $ER_{95\%}$ and used to estimate the range to regulatory thresholds for the species represented by that animat.

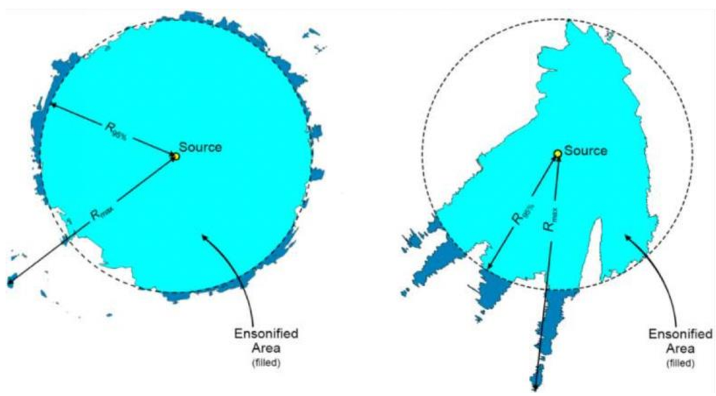


Figure J-5 Two Demonstrations of the Comparison Between the Maximum Range to the Regulatory Threshold (R_{max}) and the 95th percentile of All Maximum Threshold Ranges ($R_{95\%}$)

J.15. Marine Species Present in the Project Area

Thirty-nine marine mammal stocks (37 species) and four species of sea turtles potentially occur in the Offshore Project area (Table J-9). All the sea turtle species and six marine mammal species are listed under the ESA. Species with sufficient density to be potentially affected were modeled quantitatively. Rare species were not modeled because their low densities ensured that risks would approach zero.

Table J-9 Summarized List of Marine Mammal and Sea Turtle Species Present in the Project Area and their Abundance (rare species not modeled)

Species	Abundance	Modeled (Y/N)
Mysticetes		
Blue whale	402	Y
Fin whale	6,802	Y
Humpback whale	1,396	Y
Minke whale	21,968	Y
NARW	368	Y
Sei whale	6,292	Y

Species	Abundance	Modeled (Y/N)
Odontocetes		
Atlantic spotted dolphin	39,921	N
Atlantic white-sided dolphin	93,233	Y
Bottlenose dolphin (offshore)	62,851	Y
Bottlenose dolphin (coastal)	6,639	Y
Clymene dolphin	4,237	N
False killer whale	1,791	N
Fraser's dolphin	Unknown	N
Killer whale	Unknown	N
Melon-headed whale	Unknown	N
Pan tropical spotted dolphin	6,593	N
Pilot whale, long-finned	39,215	Y
Pilot whale, short-finned	28,924	Y
Pygmy killer whale	Unknown	N
Risso's dolphin	35,215	Y
Rough-toothed dolphin	136	N
Short-beaked common dolphin	172,974	Y
Sperm whale	4,349	Y
Spinner dolphin	4,102	N
Striped dolphin	67,036	N
Beaked Whales		
Cuvier's beaked whale	5,744	N
Blainville's beaked whale	10,107	N
Gervais' beaked whale		N
Sowerby's beaked whale		N
True's beaked whale		N
Northern bottlenose whale	Unknown	N
***Kogia* spp.**		
Dwarf sperm whale	7,750	N
Pygmy sperm whale	7,750	N
Porpoises		
Harbour porpoise	95,543	Y
Pinnipeds		
Gray seal	27,300	Y
Harbor seal	61,136	Y
Harp seal	Unknown	N
Hooded seal	Unknown	N
Sirenians		
Florida Manatee	4,834	N
Sea Turtles		
Leatherback sea turtle	--	Y
Loggerhead sea turtle	--	Y

Species	Abundance	Modeled (Y/N)
Kemp's ridley sea turtle	--	Y
Green sea turtle	--	N

Source: NMFS 2021.

J.15.1 Marine Mammal Seasonality and Densities for Project Duration

Mean monthly density estimates (animals per km^2) of all the marine mammal species in the Project area were derived using the Duke University Marine Geospatial Ecology Laboratory model results, which were updated on June 20, 2022 (Roberts and Halpin 2022). The new models resulted in updated density estimates for all taxa for which Ocean Wind is requesting take and serve as a complete replacement for the Roberts et al. (2016a) models and subsequent updates (Roberts et al. 2016b, 2017, 2018, 2021a, 2021b). Refer to Attachment J-1, *Updates to the Application for Marine Mammal Protection Act Rulemaking and Letter of Authorization*, for revised densities and take estimates.

J.15.2 Turtle Seasonality and Densities for Project Duration

At-sea density estimates for sea turtles are extremely limited, particularly in the Project area. For this reason, Küsel et al. (2022) used sea turtle densities estimated for a different geographic region as surrogates for the Project area. A multi-year series of seasonal aerial surveys was conducted in the New York Bight region by Normandeau Associates and APEM for the New York State Energy Research and Development Authority (Normandeau Associates and APEM 2018a, 2018b, 2019a, 2019b, 2020). Four sea turtle species were reported as being present in the area during these surveys: loggerhead, leatherback, Kemp's ridley, and green turtles. The Normandeau Associates and APEM density estimates were used in the Küsel et al. analysis of sea turtle impacts rather than the older Department of the Navy (2007) sea turtle density estimates.

To obtain the densities used in the current study, the maximum seasonal abundance for each species was extracted. The abundance was corrected to represent the abundance in the entire offshore planning area and then scaled by the full offshore planning area to obtain a density in units of animals per km^2. Two categories listed in the reports included more than one species: one combined loggerhead and Kemp's ridley turtles, and the other included turtles that were observed but not identified to the species level. The counts within the two categories that included more than one species were distributed amongst the relevant species with a weighting that reflected the recorded counts for each species. For example, loggerhead turtles were identified far more frequently than any other species; therefore, more of the unidentified counts were assigned to them. The underlying assumption is that a given sample of unidentified turtles would have a distribution of species that was similar to the observed distribution within a given season.

The New York State Energy Research and Development Authority study (Normandeau Associates and APEM 2018a, 2018b, 2019a, 2019b, 2020) reported that in the survey area, most of the sea turtles recorded were loggerhead sea turtles, by an order of magnitude. Seasonal sea turtle densities used in animal movement modeling are listed in Table J-10 for loggerhead, leatherback, Kemp's ridley, and green sea turtles.

Table J-10 Sea Turtle Density Estimates Derived from New York State Energy Research and Development Authority Annual Reports

Common name	Density (animals/100 km^2)			
	Spring	Summer	Fall	Winter
Kemp's ridley turtle	0.05	0.991	0.19	0

Common name	Density (animals/100 km^2)			
	Spring	Summer	Fall	Winter
Leatherback turtle	0	0.331	0.789	0
Loggerhead turtle	0.254	26.799	0.19	0.025
Green turtle	0	0.038	0	0

J.15.3 Seasonal Restrictions

There are two NARW seasonal management areas to the north and south of the Project area. Restrictions associated with these dynamic management areas are in effect between November 1 and April 30 annually. Vessels transiting these areas must comply with NMFS regulations and speed restrictions as applicable for NARWs.

J.16. Acoustic Impact Criteria

Marine mammal acoustic criteria used for the modeling effort were derived from the current U.S. regulatory acoustic criteria (Table J-11). PK pressure levels (L_{pk}) and frequency weighted accumulated SELs ($L_{E,24\mathrm{h}}$) were taken from the NOAA Technical Guidance (2018) for marine mammal injury thresholds. SPL (L_p) for marine mammal behavioral thresholds were based on the unweighted NOAA (2005) and the frequency-weighted Wood et al. (2012) criteria.

Table J-11 NMFS Regulatory Levels for Marine Mammals in dB for MMPA Level A and Level B Acoustic Threshold-Level Exposure from Impulsive and Non-impulsive Sources

Functional Hearing Group	Sound Source Type				
	Impulsive			Non-Impulsive	
	Level A SEL_{cum}	Level A SEL_{peak}	Level B dB_{RMS}	Level A SEL_{cum}	Level B dB_{RMS}
Low-frequency cetaceans	183	219	160	199	120
Mid-frequency cetaceans	185	230		198	
High-frequency cetaceans	155	202		173	
Phocid pinnipeds underwater	185	218		201	

Sources: NOAA 2005; Wood et al. 2012; NMFS 2018
SEL_{cum} = cumulative sound exposure level

Fish injury thresholds (PK and SEL) were derived from the Fisheries Hydroacoustic Working Group (2008) and Stadler and Woodbury (2009) for fish that are equal to, greater than, or less than 2 grams. Injury thresholds (PK and SEL) were obtained from Popper et al. (2014) for fish without swim bladders, fish with swim bladders not involved in hearing, and fish with swim bladders involved in hearing.

Behavioral thresholds for fish were developed by the NMFS Greater Atlantic Regional Fisheries Office (Andersson et al. 2007; Wysocki et al. 2007; Mueller-Blenkle et al. 2010; Purser and Radford 2011) (Table J-12).

Table J-12 Acoustic Metrics and Thresholds for Fish or Sea Turtles Currently Used by NMFS Greater Atlantic Regional Fisheries Office and BOEM for Impulsive Pile Driving

Faunal Group	Injury		Impairment		Behavior
	PTS[1]		TTS		
	L_{pk}	$L_{E,\ 24hr}$	L_{pk}	$L_{E,\ 24hr}$	L_p
Fish equal to or greater than 2 grams	206	187	--	--	150
Fish less than 2 grams		183	--	--	
Fish without swim bladder	213	216	--	--	--
Fish with swim bladder not involved in hearing	207	203	--	--	--
Fish with swim bladder involved in hearing	207	203	--	--	--
Sea turtles	232	204	226	189	175

[1] PTS thresholds are applicable only to sea turtles; physical injury thresholds are provided for fish.
L_E = SEL (dB re 1 µPa^{2}s); L_p = RMS sound pressure (dB re 1 µPa); L_{pk} = peak sound pressure (dB re 1 µPa)

PK pressure levels (L_{pk}) and frequency-weighted accumulated SEL ($L_{E,24h}$) from Finneran et al. (2017) were used for the onset of PTS and TTS in sea turtles (Table J-12). Behavioral response thresholds for sea turtles were obtained from McCauley et al. (2000).

J.17. Marine Animal Exposure Estimates

J.17.1 Marine Mammals

The numbers of individual marine mammals predicted to receive sound levels above threshold criteria were determined using animal movement modeling. The modeled results assumed broadband attenuation of 10 dB and a summer sound speed profile. The modeling used to produce these results does not include aversion behavior in the animats. Refer to Attachment J-1 for marine mammal exposure estimates.

J.17.2 Sea Turtles

The same type of animat modeling was also conducted for the sea turtle species in the Project area to determine the numbers of individual sea turtles predicted to receive sound levels above threshold criteria (Table J-13 to Table J-16). These animat modeling results assumed broadband attenuation of 10 dB, calculated in the same way as the marine mammal exposures.

J.18. Acoustic Exposures and Ranges to Acoustic Regulatory Thresholds for Impact Pile-driving Scenarios

The results in the acoustic modeling report of the multiple combinations of the two modeled seasons, varying levels of sound source attenuation, Acoustic Range method, and Exposure Range method are too numerous to replicate here but several marine mammal exposure and harassment take estimates are presented in Attachment J-1 for various impact pile-driving scenarios while exposure estimates for sea turtles for various pile-driving scenarios are included herein (Table J-13 to Table J-16).

Table J-13 WTG Monopile Foundations: Number of Sea Turtles Predicted to Receive Sound Levels Above Exposure Criteria with 10 dB Attenuation for a Total of 98 Monopiles

Sea Turtle Species	Injury		Behavior
	$L_{E,\ 24h}$	L_{pk}	L_p
Kemp's ridley turtle	0.83	0	15.00
Leatherback turtle	0.25	0	6.61
Loggerhead turtle	7.50	0	168.84
Green turtle	0.06	0	0.47

Source: COP Volume III, Appendix R-2, Table 19; Ocean Wind 2023
L_E = SEL (dB re 1 µPa^{2}s); L_p = RMS sound pressure (dB re 1 µPa); L_{pk} = peak sound pressure (dB re 1 µPa)

Table J-14 OSS Monopile Foundations: Number of Sea Turtles Predicted to Receive Sound Levels Above Exposure Criteria with 10 dB Attenuation for a Total of Three Monopiles

Sea Turtle Species	Injury		Behavior
	$L_{E,\ 24h}$	L_{pk}	L_p
Kemp's ridley turtle	0.02	0	0.43
Leatherback turtle	<0.01	0	0.18
Loggerhead turtle	0.23	0	5.97
Green turtle	<0.01	0	0.01

Source: COP Volume III, Appendix R-2, Table 20; Ocean Wind 2023
L_E = SEL (dB re 1 µPa^{2}s); L_p = RMS sound pressure (dB re 1 µPa); L_{pk} = peak sound pressure (dB re 1 µPa)

Table J-15 Pin Piles Supporting OSS Jacket Foundation: Number of Sea Turtles Predicted to Receive Sound Levels Above Exposure Criteria with 10 dB Attenuation for a Total of 48 Pin Piles

Sea Turtle Species	Injury		Behavior
	$L_{E,\ 24h}$	L_{pk}	L_p
Kemp's ridley turtle	0	0	0.31
Leatherback turtle	0	0	0.44
Loggerhead turtle	0	0	14.70
Green turtle	0	0	0.02

Source: COP Volume III, Appendix R-2, Table 21; Ocean Wind 2023
L_E = SEL (dB re 1 µPa^{2}s); L_p = RMS sound pressure (dB re 1 µPa); L_{pk} = peak sound pressure (dB re 1 µPa)

Table J-16 Exposure Ranges ($ER_{95\%}$) in Meters to Marine Mammal Threshold Criteria with 10-dB Sound Attenuation: Monopile Foundation (tapered 8- to 11-meter-diameter monopiles, two piles per day)

Species	$ER_{95\%}$ Injury (PTS) Threshold $L_{E\ 24h}$/ $SEL_{cum,\ 24h}$ (meters)		$ER_{95\%}$ Behavioral Threshold L_p/SPL_{RMS} (meters)	
	Summer (May through November)	Winter (December only)	Summer (May through November)	Winter (December only)
LFC	1,650	2,490	3,130	3,450
MFC	0	0	3,090	3,410
HFC	880	1,430	3,070	3,370
Pinnipeds in water	80	240	3,090	3,420
Sea turtles	300	440	1,060	1,260

J.19. Ranges to Acoustic Regulatory Thresholds for Vibratory Pile-driving Installation and Cofferdams Removal

Küsel et al. (2022) presented distance ranges to regulatory isopleths by marine mammal hearing groups for the vibratory installation and removal of cofferdams (Table J-17). The maximum distances to the Level A thresholds ranged from 7.7 meters for MFC to 128.2 meters for HFC. The maximum ranges to the Level B thresholds were 10,000 meters for all marine mammal hearing groups.

Table J-17 Distances to Weighted MMPA Level A Cumulative Sound Exposure Level Acoustic Thresholds (NMFS 2018) and Unweighted Level B root-mean-square Sound Pressure Level Acoustic Thresholds (NMFS 2012) for Marine Mammals Associated with Vibratory Pile Installation and Removal of Cofferdams

Marine Mammal Hearing Group	Level A Threshold SEL_{cum} (dB re 1 μPa^{2}s)	Maximum Distance (m) to Level A Threshold	Level B Threshold SPL_{RMS} (dB re 1 μPa^2)	Maximum Distance (m) to Unweighted Level B Threshold
Low-frequency cetaceans	199	86.7	120	10,000
Mid-frequency cetaceans	198	7.7	120	10,000
High-frequency cetaceans	173	128.2	120	10,000
Phocid pinnipeds in water	201	52.7	120	10,000

Source (thresholds): NMFS 2012, 2018; source (distances): Küsel et al. 2022.
dB re 1 μPa^2 = decibel referenced to 1 micropascal squared; m = meter; SEL_{cum} = cumulative sound exposure level; SPL_{RMS} = root-mean-square sound pressure level

J.20. Ranges to Acoustic Regulatory Thresholds for UXO Detonations

Hannay and Zykov (2022; Tables 9 to 36) present ranges to regulatory isopleths for the various sites, explosive weights, body sizes, and species groups of marine mammals, sea turtles, and marine fishes. Information on the total number of marine mammal takes for UXO surveys, maximum ranges to the regulatory thresholds for any site, and body size of marine mammals and sea turtles is summarized herein (Table J-18 and Table J-19) for mitigated (10-dB reduction) scenarios. The ranges for fish injury peak pressure were 290 meters with 10 dB of mitigation.

Determining the maximum UXO ranges to regulatory thresholds for impulse signals required assessing body size. A set of representative animal masses for smaller and larger animals in several species categories of marine mammals and sea turtles was selected (Hannay and Zykoy 2022, Section 7.1). Five body mass categories of marine mammals and sea turtles were developed, with high and low body mass ranges (Hannay and Zykoy 2022, Table 7), with turtles included in the group with HFC, with the body size masses ranging from 5 kilograms (harbour porpoise calf) to 16,000 kilograms (adult sperm whale).

Table J-18 Summary of Maximum UXO Ranges (meters) to Regulatory Thresholds for Auditory Injury in Marine Mammals and Sea Turtles for Peak Pressure and SEL Metrics ($R_{95\%}$) for Mitigated Scenario

Functional Hearing Group	Injury Type	Metric	
		Peak Pressure	SEL
LFC	Level A (PTS)	846	3,780
	Level B (TTS)	1,618	11,900
MFC	Level A (PTS)	258	4,61

Functional Hearing Group	Injury Type	Metric	
		Peak Pressure	SEL
	Level B (TTS)	4,94	2,550
HFC	Level A (PTS)	5,369	62,00
	Level B (TTS)	10,367	14,100
PW	Level A (PTS)	942	1,600
	Level B (TTS)	1,802	7,020
Turtle	Level A (PTS)	210	472
	Level B (TTS)	398	2,250

Note: Maximum ranges are based on worst-case scenario modeling results for charge size E12 (454 kilograms) and site (S1, S2, S3, S4) (Hannay and Zykov 2022).
PW = phocid pinnipeds in water

Table J-19 Summary of Maximum UXO Ranges (meters) to Regulatory Thresholds for Non-Auditory Injury and Mortality in Marine Mammals and Sea Turtles for Peak Pressure for Mitigated Scenario

Injury Type	Marine Mammal Species	Adult	Pup/Calf
Mortality	Baleen whale/sperm whale	34	109
	Minke whale	58	162
	Beaked whale	135	234
	Dolphins, kogia, pinnipeds, turtles	224	332
	Porpoise	243	353
Lung Injury	Baleen whale/sperm whale	237	81
	Minke whale	132	330
	Beaked whale	282	448
	Dolphins, kogia, pinnipeds, turtles	429	606
	Porpoise	465	648
Onset Gastrointestinal Injury		125	125

Note: Maximum ranges are based on worst-case scenario modeling results for charge size E12 (454 kilograms) and deepest water depth (45 meters) based on 1% of animals exposed (mortality/lung injury) (Hannay and Zykov 2022).

J.21. Ranges to Acoustic Regulatory Thresholds for HRG Survey Sources

Summarized here are the distances to the regulatory thresholds for marine mammal hearing groups associated with use of nine types of shallow and medium sound sources or comparable sound source categories during HRG surveys (Table J-20), which were presented in the MMPA Letter of Authorization application for the Project (Ocean Wind 2022).

Table J-20 Distance to Weighted MMPA Level A and Unweighted MMPA Level B Marine Mammal Hearing Group Thresholds Associated with Use of Each Type of HRG Sound Source or Comparable Sound Source Category

HRG Sound Source	Distance to MMPA Level A Threshold (meters)					Distance to MMPA Level B (meters)
	LFC (SEL_{cum} threshold)	MFC (SEL_{cum} threshold)	HFC (SEL_{cum} threshold)	HFC ($SPL_{0\text{-}pk}$ threshold)	PW (SEL_{cum} threshold)	All (SPL_{RMS} threshold)
Shallow Sub-Bottom Profilers						
ET 216 CHIRP	<1	<1	2.9	NA	0	9
ET 424 CHIRP	0	0	0	NA	0	4
ET 512i CHIRP	0	0	<1	NA	0	6
GeoPulse 5430	<1	<1	36.5	NA	<1	21
TB CHIRP III	1.5	<1	16.9	NA	<1	48
Medium Sub-Bottom Profilers						
AA Triple plate S-Boom (700/1,000J)	<1	0	0	4.7	<1	34
AA Dura-spark UHD (500J/400 tip)	<1	0	0	2.8	<1	141
AA Dura-spark UHD 400+400	<1	0	0	2.8	<1	141
GeoMarine Geo-Source Dual 400 Tip Sparker	<1	0	0	2.8	<1	141

Source: Application for MMPA Letter of Authorization, Ocean Wind 2022: Table 1-30
AA = Applied Acoustics; CHIRP = Compressed High-Intensity Radiated Pulse; ET = EdgeTech; NA=not applicable; PW = phocid pinnipeds in water; SEL_{cum} = cumulative sound exposure level; $SPL_{0\text{-}pk}$ = zero to peak source level; TB = Teledyne Benthos; UHD = Ultra-high Definition

J.22. References Cited

Amaral, J. L., R. Beard, R. J. Barham, A. G. Collett, J. Elliot, A. S. Frankel, D. Gallien, C. Hager, A, A. Khan, Y. Lin, T. Mason, J. H. Miller, A. E. Newhall, G. R. Potty, K. Smith, and K. J. Vigness-Raposa. 2018. *Field Observations During Wind Turbine Foundation Installation at the Block Island Wind Farm, Rhode Island*, Appendix D: Underwater Sound Monitoring Reports. OCS Study BOEM 2018-029. May.

Amaral, J. L., J. H. Miller, G. R. Potty, K. J. Vigness-Raposa, A. S. Frankel, Y. Lin, A. E. Newhall, D. R. Wilkes, and A. N. Gavrilov. 2020. Characterization of impact pile driving signals during installation of offshore wind turbine foundations. *J. Acoust. Soc. Am.* 147(4):2323–2333. Available: https://doi.org/10.1121/10.0001035.

Andersson, M. H., E. Dock-Åkerman, R. Ubral-Hedenberg, M. C. Öhman, and P. Sigray. 2007. “Swimming behavior of roach (*Rutilus rutilus*) and three-spined stickleback (*Gasterosteus aculeatus*) in response to wind power noise and single-tone frequencies.” *AMBIO* 36:636–638.

Arons, A. B., and D. R. Yennie. 1948. “Energy partition in underwater explosion phenomena.” *Reviews of Modern Physics* 20(3):519–536.

Bellmann, M. A., A. May, T. Wendt, S. Gerlach, P. Remmers, and J. Brinkmann. 2020. *Underwater noise during percussive pile driving: Influencing factors on pile-driving noise and technical possibilities to comply with noise mitigation values*. ERa Report. Supported by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. Commissioned and managed by the Federal Maritime and Hydrographic Agency, Order No. 10036866.

Bolle, L. J., C. A. F. de Jong, S. M. Bierman, P. J. G. van Beek, O. A. van Keeken, P. W. Wessels, C. J. G. van Damme, H. V. Winter, D. de Hann, and R. P. A. Dekeling. 2012. Common Sole Larvae Survive High Levels of Pile-Driving Sound in Controlled Exposure Experiments. *PLOS ONE* 7(3):e33052. DOI:10.1371/journal.pone.0033052.

Bolle, L. J., C. A. F. de Jong, E. Blom, P. W. Wessels, C. J. G. van Damme, and H. V. Winter. 2014. *Effect of pile-driving sound on the survival of fish larvae*. Institute for Marine Resources & Ecosystem Studies. Report number C182/14. December 2014.

Buehler, D., R. Oestman, J. Reyff, K. Pommerenck, and B. Mitchell. 2015. *Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish*. November 2015. Prepared for California Department of Transportation. Report number CTHWANP-RT-15-306.01.01.

California Department of Transportation (Caltrans). 2004. *San Francisco – Oakland Bay Bridge East Span Seismic Safety Project Fisheries and Hydroacoustic Monitoring Program Compliance Report*. June.

Carnes, M. R. 2009. *Description and Evaluation of GDEM-V 3.0*. Report Number NRL/MR/7330--09-9165. Stennis Space Center, MS: Naval Research Laboratory. 27 pages.

Casper, B. M., A. N. Popper, F. Matthews, T. J. Carlson, and M. B. Halvorsen. 2012. Recovery of Barotrauma Injuries in Chinook Salmon, Oncorhynchus tshawytscha from Exposure to Pile Driving Sound. *PLOS ONE* 7(6):e39593. DOI:10.1371/journal.pone.0039593.

Casper, B. M., M. B. Halvorsen, F. Matthews, T. J. Carlson, and A. N. Popper. 2013a. Recovery of Barotrauma Injuries Resulting from Exposure to Pile Driving Sound in Two Sizes of Hybrid Striped Bass. *PLOS ONE* 8(9):e73844. DOI:10.1371/journal.pone.0073844.

Casper, B. M., M. E. Smith, M. B. Halvorsen, H. Sun, T. J. Carlson, and A. N. Popper. 2013b. Effects of exposure to pile driving sounds on fish inner ear tissues. *Comparative Biochemistry and Physiology*, Part A 166:352–360. Available: http://dx.doi.org/10.1016/j.cbpa.2013.07.008.

Central Dredging Association. 2011. CEDA Position Paper: Underwater Sound in Relation to Dredging. *Terra Aqua*. Number 125. December 2011.

Christiansen, F., L. Rojano-Doñate, P. T. Madsen, and L. Bejder. 2016. Noise Levels of Multi-Rotor Unmanned Aerial Vehicles with Implications for Potential Underwater Impacts on Marine Mammals. *Front. Mar. Sci.* 3:277. DOI: 10.3389/fmars.2016.00277.

Collins, M. D. 1993. “A split-step Padé solution for the parabolic equation method.” *The Journal of the Acoustical Society of America* 93:1736–1742.

Crocker, S. E., and F. D. Fratantonio. 2016. *Characteristics of Sounds Emitted During High-Resolution Marine Geophysical Surveys*. NUWC-NPT Technical Report 12,203. Report by Naval Undersea Warfare Center Division, Newport, RI, USA. 266 p. Available: https://apps.dtic.mil/dtic/tr/fulltext/u2/1007504.pdf.

Dean, J. 1998. "Animats and what they can tell us." *Trends in Cognitive Sciences* 2:60–67.

Dickerson, C., K. J. Reine, and D. G. Clarke. 2001. *Characterization of underwater sounds produced by bucket dredging operations*. DOER Technical Notes Collection (ERDC TN-DOER-E14), U.S. Army Engineer Research and Development Center, Vicksburg, MS. Available: www.wes.army.mil/el/dots/doe.

Dominion Energy. 2020. *Dominion Energy CVOW Pilot Project – Revised Protected Species Observer (PSO) Monitoring Report and Pile Driving Noise Monitoring Report for WTG Construction and Observations*. Document No: JDN1823.REP.62.32. December.

Elliott, J., A. A. Khan, Y. Lin, T. Mason, J. H. Miller, A. E. Newhall, G. R. Potty, and K. J. Vigness-Raposa. 2019. *Field Observations During Wind Turbine Operations at the Block Island Wind Farm, Rhode Island*. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2019-028. Prepared by HDR. May.

Ellison, W. T., B. L. Southall, C. W. Clark, and A. S. Frankel. 2012. A New Context-Based Approach to Assess Marine Mammal Behavioral Responses to Anthropogenic Sounds. *Conservation Biology* 26(1):21–28. DOI: 10.1111/j.1523-1739.2011.01803.x.

Erbe, C., and C. McPherson. 2017. Underwater noise from geotechnical drilling and standard penetration testing. *J. Acoust. Soc. Am.* 142:EL281. DOI: 10.1121/1.5003328.

Finneran, J. J. 2016. *Auditory Weighting Functions and TTS/PTS Exposure Functions for Marine Mammals Exposed to Underwater Noise*. Technical Report 3026. Prepared by the Marine Mammal Scientific & Vet Support Branch of the Biosciences Division, Space and Naval Warfare Systems Center Pacific. San Diego, CA. December.

Finneran, J., E. Henderson, D. Houser, K. Jenkins, S. Kotecki, and J. Mulsow. 2017. *Criteria and thresholds for U.S. Navy acoustic and explosive effects analysis (Phase III)*. Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 pp.

Fisheries Hydroacoustic Working Group. 2008. "Agreement in principle for interim criteria for injury to fish from pile driving activities." Technical/Policy Meeting June 11, 2008, Vancouver, Washington.

Fowler K., P. Pellerin, and A. Zoidis. 2022. *Characteristics and contributions of noise generated by mechanical cutting during conductor removal operations*; Volume 1: Final report. Camarillo (CA): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2022-029. June.

Frankel, A. S., W. T. Ellison, and J. Buchanan, J. 2002. "Application of the Acoustic Integration Model (AIM) to predict and minimize environmental impacts." *IEEE Oceans* 2002:1438–1443.

GEBCO Bathymetric Compilation Group. 2020. The GEBCO_2020 Grid - a continuous terrain model of the global oceans and land. British Oceanographic Data Centre, National Oceanography Centre.

Greater Atlantic Regional Fisheries Office (GARFO). 2020. Section 7: Consultation Technical Guidance in the Greater Atlantic Region. Website. Available: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-consultation-technical-guidance-greater-atlantic.

Goertner, J. F. 1978. *Dynamical Model for Explosion Injury to Fish.* Research and Technology Department, Naval Surface Weapons Center. TR 76-155.

Greene, Charles R. 1987. *J.* Characteristics of Oil Industry Dredge and Drilling Sounds in the Beaufort Sea. *J. Acoust. Soc. Am.* 82(4):1315–1324. DOI: 10.1121/1.395265.

Guan, S. 2020. *Interim recommendations for sound source levels and propagation analysis for high resolution geophysical sources*. April 2, 2020.

Guan, S., T. Brookens, and R. Miner. 2022. Acoustic characteristics from an in-water down-the-hole pile drilling activity. *J. Acoust. Soc. Am.* 151(1):310–320.

Halvorsen, M. B., T. J. Carlson, A. N. Popper, B. M. Casper, and C. M. Woodley. 2011. Hydroacoustic Impacts on Fish from Pile Installation. *National Cooperative Highway Research Program, Research Results Digest 363.* October.

Halvorsen, M. B., B. M. Casper, F. Matthews, T. J. Carlson, and A. N. Popper. 2012a. Effects of exposure to pile-driving sounds on the lake sturgeon, Nile tilapia and hogchoker. *Proc. R. Soc. B.* DOI:10.1098/rspb.2012.1544.

Halvorsen, M. B., B. M. Casper, C. M. Woodley, T. J. Carlson, and A. N. Popper. 2012b. Threshold for Onset of Injury in Chinook Salmon from Exposure to Impulsive Pile Driving Sounds. *PLOS ONE* 7(6):e38968. DOI:10.1371/journal.pone.0038968.

Hamernik, R. P., and K. D. Hsueh. 1991. Impulse noise: Some definitions, physical acoustics and other considerations. *J. Acoust. Soc. Am.* 90(1):189–196. DOI: 10.1121/1.401287.

Hannay, D., and M. Zykov. 2022. *Underwater acoustic modeling of detonations of unexploded ordnance (UXO) for Ørsted wind farm construction, US East Coast*. Document 02604, Version 3.0. Report by JASCO Applied Sciences for Ørsted.

Hastings, Mardi C. 2008. Coming to Terms with the Effects of Ocean Noise on Marine Animals. *Acoustics Today.* April.

Hatch, L. T., C. M. Wahle, J. Gedamke, J. Harrison, B. Laws, S. E. Moore, J. H. Stadler, and S. M. Van Parijs. 2016. Can you hear me here? Managing acoustic habitat in US waters. *Endangered Species Research* 30:171–186. DOI: 10.3354/esr00722.

Hawkins, Anthony D. 2014. "Chapter 14, Examining Fish in the Sea: A European Perspective on Fish Hearing Experiments." Perspectives on Auditory Research, *Springer Handbook of Auditory Research* 50, DOI 10.1007/978-1-4614-9102-6_14. pp. 247–265.

Hildebrand, John A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. *Mar. Ecol. Prog. Ser.* 395:5–20. December. DOI: 10.3354/meps08353.

Hubbs, C. L., and A. B. Rechnitzer. 1952. *Report on Experiments Designed to Determine Effects of Underwater Explosions on Fish Life*. Scripps Institution of Oceanography, University of California, La Jolla, California.

JASCO Applied Sciences, Inc. (JASCO). 2021. *Distance to behavioral threshold for vibratory pile driving of sheet piles*. Technical Memorandum by JASCO Applied Sciences for Ocean Wind LLC. September 13, 2021.

Jiménez-Arranz, G., N. Banda, S. Cook, and R. Wyatt. 2020. *Review on Existing Data on Underwater Sounds Produced by the Oil and Gas Industry*. June. Prepared for the Joint Industry Programme on E&P Sound & Marine Life.

Kipple, B., and C. Gabriele. 2003. *Glacier Bay Watercraft Noise: Underwater acoustic noise levels of watercraft operated by Glacier Bay National Park and Preserve as measured in 2000 and 2002*. Technical Report NSWCCD-71-TR-2003/522. Prepared by the Naval Surface Warfare Center, Carderock Division - Detachment Bremerton. February.

Kongsberg Maritime AS. 2013. APOS for HiPAP®: *High Precision Acoustic Positioning Instruction Manual*. March.

Küsel, E. T., M. J. Weirathmueller, K. E. Zammit, S. J. Welch, K. E. Limpert, and D. G. Zeddies. 2022. *Underwater acoustic and exposure modeling*. Document 02109, Version 1.0 DRAFT. Technical report by JASCO Applied Sciences for Ocean Wind LLC.

Küsel, E. T., M. J. Weirathmueller, K. E. Zammit, S. J. Welch, K. E. Limpert, and D. G. Zeddies. 2022. Citing Arons, A. B., and D. R. Yennie. 1949. *Long range shock propagation in underwater explosion phenomena I*. U.S. Navy Dept. Bur. Ord. NAVORD Rep 424.

Kyhn, L. A., J. Tougaard, and S. Sveegaard. 2011. *Underwater Noise from the Drillship Stena Forth in Disko West, Baffin Bay, Greenland*. National Environmental Research Institute, Aarhus University, Denmark. NERI Technical Report No. 838. Available: http://www.dmu.dk/Pub/FR838.pdf.

MacGillivray, A. O., Z. Li, D. E. Hannay, K. B. Trounce, and O. M. Robinson. 2019. Slowing deep-sea commercial vessels reduces underwater radiated noise. *J. Acoust. Soc. Am.* 146(1):340–351. DOI: 10.1121/1.5116140.

Martin, S. B., K. Lucke, and D. R. Barclay. 2020. Techniques for distinguishing between impulsive and non-impulsive sound in the context of regulating sound exposure for marine mammals. *J. Acoust. Soc. Am.* 147 (4):2159–2176.

Matuschek, R., and K. Betke. 2009. *Measurements of Construction Noise During Pile Driving of Offshore Research Platforms and Wind Farms*.

McCauley, R. D., J. Fewtrell, A. J. Duncan, C. Jenner, M.-N. Jenner, J. D. Penrose, R. I. T. Prince, A. Adhitya, J. Murdoch, and K. A. McCabe. 2000. "Marine seismic surveys: Analysis and propagation of air-gun signals; and effects of air-gun exposure on humpback whales, sea turtles, fishes and squid." Prepared for Australian Petroleum Production Exploration Association by Centre for Maine Science and Technology, Western Australia, p. 198.

McKenna, M. F., S. M. Wiggins, and J. A. Hildebrand. 2013. Relationship between container ship underwater noise levels and ship design, operational and oceanographic conditions. *Scientific Reports* 3:1760. DOI: 10.1038/srep01760.

McQueen, A. D., B. C. Suedel, J. L. Wilkens, and M. P. Fields. 2018. Evaluating Biological Effects of Dredging-Induced Underwater Sounds. *Dredging Summit & Expo '18 Proceedings*. pp. 202–213.

Mueller-Blenkle, C., P. K. McGregor, A. B. Gill, M. H. Andersson, J. Metcalfe, V. Bendall, P. Sigray, D. T. Wood, and F. Thomsen. 2010. "Effects of pile-driving noise on the behaviour of marine fish." COWRIE Ref: Fish 06-08; Cefas Ref: C3371, p. 62.

National Marine Fisheries Service (NMFS). 2012. Marine mammal acoustic thresholds. Available: https://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html. Accessed: March 14, 2019. (As cited in Ocean Wind Offshore Wind Farm, Application for Marine Mammal Protection Act [MMPA] rulemaking and letter of authorization. February 2022. Prepared for Ocean Wind LLC by HDR, p. 509.)

National Marine Fisheries Service (NMFS). 2018. 2018 Revision to: *Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing (Version 2.0) Underwater thresholds for onset of permanent and temporary threshold shifts*. Silver Spring, MD, p. 178.

National Marine Fisheries Service (NMFS). 2020. *Manual for optional user spreadsheet tool* (Version 2.1) for: 2018 Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing (Version 2.0): Underwater thresholds for onset of permanent and temporary threshold shifts. Silver Spring, Maryland: Office of Protected Resources, National Marine Fisheries Service.

National Marine Fisheries Service (NMFS). 2021. Draft U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2021. Available: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports.

National Marine Fisheries Service (NMFS). 2022. National Marine Fisheries Service: Summary of Marine Mammal Protection Act Acoustic Thresholds. May.

National Oceanic and Atmospheric Administration (NOAA). 2005. "Endangered fish and wildlife: Notice of intent to prepare an environmental impact statement." *Federal Register* 70, 1871–1875.

Nedwell, J. R., and B. Edwards. 2004. *A review of measurements of underwater man-made noise carried out by Subacoustech Ltd, 1993 – 2003*. Subacoustech Report ref: 534R0109. September.

Nedwell, J., J. Langworthy, and D. Howell. 2003. *Assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife; initial measurements of underwater noise during construction of offshore wind farms, and comparison with background noise*. Report No. 544 R 0424. Prepared by Subacoustech Ltd. May.

Nedwell, J. R., S. J. Parvin, A. G. Brooker, and D. R. Lambert. 2008. *Modeling and measurement of underwater noise associated with the proposed Port of Southampton capital dredge and redevelopment of berths 201/202 and assessment of the disturbance to salmon*. Subacoustech Report No. 805R0444.

Normandeau Associates, Inc. and APEM Inc. 2018a. *Digital aerial baseline survey of marine wildlife in support of offshore wind energy: Summer 2018 taxonomic analysis summary report*. Prepared for New York State Energy Research and Development Authority. Available: https://remote.normandeau.com/docs/NYSERDA_Summer_2018_Taxonomic_Analysis_Summary_Report.pdf.

Normandeau Associates, Inc. and APEM Inc. 2018b. *Digital aerial baseline survey of marine wildlife in support of Offshore Wind Energy: Spring 2018 taxonomic analysis summary report*. Prepared for New York State Energy Research and Development Authority. Available: https://remote.normandeau.com/docs/NYSERDA_Spring_2018_Taxonomic_Analysis_Summary_Report.pdf.

Normandeau Associates, Inc. and APEM Inc. 2019a. *Digital aerial baseline survey of marine wildlife in support of offshore wind energy: Spring 2019 taxonomic analysis summary report*. Prepared for New York State Energy Research and Development Authority. Available: https://remote.normandeau.com/docs/NYSERDA_Spring_2019_Taxonomic_Analysis_Summary_Report.pdf.

Normandeau Associates, Inc. and APEM Inc. 2019b. *Digital aerial baseline survey of marine wildlife in support of offshore wind energy: Fall 2018 taxonomic analysis summary report*. Prepared for New York State Energy Research and Development Authority. Available: https://remote.normandeau.com/docs/NYSERDA_Fall_2018_Taxonomic_Analysis_Summary_Report.pdf.

Normandeau Associates, Inc. and APEM Inc. 2020. *Digital aerial baseline survey of marine wildlife in support of offshore wind energy: Winter 2018-2019 taxonomic analysis summary report*. Prepared for New York State Energy Research and Development Authority. Available: https://remote.normandeau.com/docs/NYSERDA_Winter_2018_19_Taxonomic_Analysis_Summary_Report.pdf.

Ocean Wind LLC (Ocean Wind). 2022. *Application for Marine Mammal Protection Act (MMPA) Rulemaking and Letter of Authorization.* February.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Pijanowski, B. C., L. J. Villanueva-Rivera, S. L. Dumyahn, A. Farina, B. L. Krause, B. M. Napoletano, S. H. Gage, and N. Pieretti. 2011. Soundscape Ecology: The Science of Sound in the Landscape. *Bio Science* 61:203–216.

Pile Dynamics, Inc. 2010. GRLWEAP: Wave Equation Analysis software.

Popper, A. N., and A. D. Hawkins. 2018. The importance of particle motion to fishes and invertebrates. *J. Acoust. Soc. Am.* 143:470–488. Available: https://doi.org/10.1121/1.5021594.

Popper, A. N., A. D. Hawkins, O. Sand, and J. A. Sisneros. 2019. Examining the hearing ability of fishes. *J. Acoust. Soc. Am.* 146 (2):948–955. DOI: 10.1121/1.5120185.

Popper, A. N., A. D. Hawkins, R. R. Fay, D. A. Mann, S. Bartol, T. J. Carlson, S. Coombs, W. T. Ellison, R. L. Gentry, M. B. Halvorsen, S. Løkkeborg, P. H. Rogers, B. L. Southall, D. G. Zeddies, and W. N. Tavolga. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.* ASA Press and Springer.

Popper, A. N., M. E. Smith, P. A. Cott, B. W. Hanna, A. O. MacGillivray, M. E. Austin, and D. A. Mann. 2005. Effects of exposure to seismic airgun use on hearing of three fish species. *J. Acoust. Soc. Am.* 117 (6):3958–3971. DOI: 10.1121/1.1904386.

Purser, J., and A. N. Radford. 2011. "Acoustic Noise Induces Attention Shifts and Reduces Foraging Performance in Three-Spined Sticklebacks (*Gasterosteus aculeatus*)." PLOS One 6, e17478.

Reine, K., D. Clarke, and C. Dickerson. 2012a. *Characterization of Underwater Sounds Produced by a Backhoe Dredge Excavating Rock and Gravel*. ERDC TN-DOER-E36.

Reine, K. J., D. Clarke, and C. Dickerson. 2012b. *Characterization of Underwater Sounds Produced by a Hydraulic Cutterhead Dredge Fracturing Limestone Rock*. ERDC TN-DOER-E34. September.

Reine, K., D. Clarke, C. Dickerson, and G. Wikel. 2014a. *Characterization of Underwater Sounds Produced by Trailing Suction Hopper Dredges during Sand Mining and Pump-out Operations*. U.S. Department of the Interior, Bureau of Ocean Energy Management and U.S. Army Corps of Engineers. ERDC/EL TR 14-3, BOEM 2014-055. Herndon, VA, March 2014.

Reine, K. J., D. Clarke, and C. Dickerson. 2014b. Characterization of underwater sounds produced by hydraulic and mechanical dredging operations. *J. Acoust. Soc. Am.* 135(6):3280–3294. Available: http://dx.doi.org/10.1121/1.4875712.

Richardson, W. J., C. R. Greene, C. Malme, and D. H. Thompson. 1995. *Marine mammals and noise*. San Diego (CA): Academic Press.

Roberts, J. J., B. D. Best, L. Mannocci, E. Fujioka, P. N. Halpin, D. L. Palka, L. P. Garrison, K. D. Mullin, T. V. N. Cole, C. B. Khan, W. A. McLellan, D. A. Pabst, and G. G. Lockhart. 2016a. "Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico." *Scientific Reports* 6.

Roberts, J. J., L. Mannocci, and P. N. Halpin. 2016b. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2015-2016 (Base Year)*. Document Version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC, USA.

Roberts, J. J., L. Mannocci, and P. N. Halpin. 2017. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1)*. Version 1.4. Report by Duke University Marine Geospatial Ecology Lab for Naval Facilities Engineering Command, Atlantic, Durham, NC, USA.

Roberts, J. J., L. Mannocci, R. S. Schick, and P. N. Halpin. 2018. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2)*. Version 1.2. Report by the Duke University Marine Geospatial Ecology Lab for Naval Facilities Engineering Command, Atlantic Durham, NC, USA.

Roberts, J. J., R. S. Schick, and P. N. Halpin. 2021a. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2020 (Opt. Year 4)*. Version 1.0. Report by the Duke University Marine Geospatial Ecology Lab for Naval Facilities Engineering Command, Atlantic Durham, NC, USA.

Roberts, J. J., R. S. Schick, and P. N. Halpin. 2021b. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2020 (Option Year 4)*. Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC, USA.

Roberts, J. J., and P. N. Halpin. 2022. *Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico*. Available: https://seamap.env.duke.edu/models/Duke/EC/ in HDR Inc. 2022. *Ocean Wind 1 Offshore Wind Farm Updates to the Application for Marine Mammal Protection Act (MMPA) Rulemaking and Letter of Authorization*.

Roberts, L., S. Cheesman, and A. D. Hawkins. 2016. Chapter 113: Effects of Sound on the Behavior of Wild, Unrestrained Fish Schools. In A. N. Popper, A. Hawkins (eds.), *The Effects of Noise on Aquatic Life II, Advances in Experimental Medicine and Biology* 875. DOI 10.1007/978-1-4939-2981-8_113.

Robinson, S. P., P. D. Theobald, G. Hayman, L. S. Wang, P. A. Lepper, V. Humphrey, and S. Mumford. 2011. *Measurement of underwater noise arising from marine aggregate dredging operations*. Final Report. Marine Aggregate Levy Sustainability Fund Report. MEPF Ref No: MEPF 09/P108. February.

Robinson, S. P., L. Wang, S. Cheong, P. A. Lepper, F. Marubini, and J. P. Hartley. 2020. Underwater acoustic characterization of unexploded ordnance disposal using deflagration. *Marine Pollution Bulletin* 160. Available: https://doi.org/10.1016/j.marpolbul.2020.111646.

Rogers, P. H. 1977. “Weak-shock solution for underwater explosive shock waves.” *The Journal of the Acoustical Society of America* 62(6): 1412–1419.

Ross, D. 1976. *Mechanics of underwater noise*. Pasadena (CA): Pergamon Press, Inc.

Ruppel, C. D., T. C. Weber, E. R. Staaterman, S. J. Labak, and P. E. Hart. 2022. Categorizing Active Marine Acoustic Sources Based on Their Potential to Affect Marine Animals. *J. Mar. Sci. Eng*. 2022(10):1278. Available: https://doi.org/10.3390/jmse10091278.

Song, J., D. A. Mann, P. A. Cott, B. W. Hanna, and A. N. Popper. 2008. The inner ears of Northern Canadian freshwater fishes following exposure to seismic air gun sounds. *J. Acoust. Soc. Am.* 124(2). DOI: 10.1121/1.2946702.

Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene, D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L. Tyack. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals* Volume 33 (4).

Stadler, J. H., and D. P. Woodbury. 2009. “Assessing the effects to fishes from pile driving: Application of new hydroacoustic criteria,” in *Inter-Noise 2009: Innovations in Practical Noise Control*, Ottawa, Canada.

U.S. Department of the Navy (Navy). 2007. *Navy OPAREA Density Estimates (NODE) for the Southeast OPAREAS: VACAPES, CHPT, JAX/CHASN, and Southeastern Florida & AUTEC-Andros.* August. Naval Facilities Engineering Command, Atlantic: Norfolk, Virginia. Prepared by Geo-Marine, Inc., Hampton, Virginia. Available: https://seamap.env.duke.edu/downloads/resources/serdp/Southeast%20NODE%20Final%20Report.pdf.

Stöber, U., and F. Thomsen. 2021. How could operational underwater sound from future offshore wind turbines impact marine life? *J. Acoust. Soc. Am.* 149(3):1791–1795. Available: https://doi.org/10.1121/10.0003760.

Tougaard, J., O. D. Henriksen, and L. A. Miller. 2020. Underwater noise from three types of offshore wind turbines: Estimation of impact zones for harbor porpoises and harbor seals. *J. Acoust. Soc. Am.* 125(6):3766–3773. DOI: 10.1121/1.3117444.

Urick, R. J. 1983. *Principles of underwater sound* (3rd ed.). Los Altos Hills (CA): Peninsula Publishing.

von Benda-Beckmann, A. M., G. Aarts, H. O. Sertlek, K. Lucke, W. C. Verboom, R. A. Kastelein, D. R. Ketten, R. van Bemmelen, F. A. Lam, R. J. Kirkwood, and M. A. Ainslie. 2015. Assessing the Impact of Underwater Clearance of Unexploded Ordnance on Harbour Porpoises *(Phocoena phocoena)* in the Southern North Sea. *Aquatic Mammals* 41(4):503–523. DOI: 10.1578/AM.41.4.2015.503.

Warner, G., and A. McCrodan. 2011. "Chapter 3: Underwater Sound Measurements." In: Hartin K. G., L. N. Bisson, S. A. Case, D. S. Ireland, and D. Hannay (eds.). *Marine mammal monitoring and mitigation during site clearance and geotechnical surveys by Statoil USA E&P Inc. in the Chukchi Sea, August–October 2011: 90-day report*. LGL Rep. P1193. Rep. from LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Research Ltd. for Statoil USA E&P Inc., National Marine Fisheries Service, and U.S. Fish and Wildlife Service. December.

Wood, J. D., B. L. Southall, and D. J. Tollit. 2012. *PG&E offshore 3-D Seismic Survey Project Environmental Impact Report–Marine Mammal Technical Draft Report*. Report by SMRU Ltd, p. 121.

Wysocki, L. E., S. Amoser, and F. Ladich. 2007. "Diversity in ambient noise in European freshwater habitats: Noise levels, spectral profiles, and impact on fishes." *The Journal of the Acoustical Society of America* 121:2559–2566.

Yelverton, J. T., D. R. Richmond, W. Hicks, K. Saunders, and E. R. Fletcher. 1975. *The relationship between fish size and their response to underwater blast*. DNA 3677T. Prepared by Lovelace Foundation for Medical Education and Research. Prepared for Defense Nuclear Agency. June.

Zhang, Z. Y., and C. T. Tindle. 1995. "Improved equivalent fluid approximations for a low shear speed ocean bottom." *The Journal of the Acoustical Society of America* 96:3391–3396.

ATTACHMENT J-1
UPDATES TO THE APPLICATION FOR MARINE MAMMAL PROTECTION ACT RULEMAKING AND LETTER OF AUTHORIZATION

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Ocean Wind 1
An Ørsted & PSEG project

Ocean Wind 1 Offshore Wind Farm

Updates to the Application for Marine Mammal Protection Act (MMPA) Rulemaking and Letter of Authorization

Submitted to:
National Marine Fisheries Service
Office of Protected Resources

Prepared for:
Ocean Wind LLC

Prepared by:
HDR, Inc.

August 2022

Purpose and Need

Ocean Wind LLC (Ocean Wind), a subsidiary of Orsted Wind Power North America LLC (Orsted) (Applicant), and joint venture partner Public Service Enterprise Group Renewable Generation LLC (PSEG), is proposing to install up to 98 wind turbine generators (WTGs) and three associated offshore substations (OSSs), each supported by a steel pipe monopile (OSSs may have jacket pile (pin pile) foundations); install and remove cofferdams at landfall sites; detonate unexploded ordnances (UXO); and conduct high-resolution site characterization surveys during construction and operation, all to support the construction of an offshore wind farm. The Ocean Wind Offshore Wind Farm Project (OCW01, Offshore Wind Farm, or Project) is being developed pursuant to the Bureau of Ocean Energy Management (BOEM) requirements for the Ocean Wind BOEM Lease Area Outer Continental Shelf (OCS)-A-0498 Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf.

Ocean Wind submitted a request for a rulemaking and Letter of Authorization (LOA) pursuant to Section 101(a)(5) of the Marine Mammal Protection Act (MMPA) and 50 Code of Federal Regulations (CFR) § 216 Subpart I to allow for the incidental harassment of small numbers of marine mammals resulting from the installation of WTGs and OSSs; installation and removal of cofferdams at locations of export cable route (ECR) to landfall transitions; potential detonations of UXO; and performance of high-resolution geophysical (HRG) site characterization surveys operating at less than 180 kHz which was deemed complete on February 11, 2022. A Notice of Receipt of the LOA application was published in the Federal Register on March 7, 2022 (87 FR 12666).

The take requests included in Section 6 of the OCW01 LOA application, submitted to NMFS in February 2022, were based primarily on a collection of Roberts et al. (2016a, 2016b, 2017, 2018, 2020, 2021a, 2021b) density estimates. On June 20, 2022, the Duke Marine Geospatial Ecology Lab released a comprehensive new set of marine mammal density models for the U.S. east coast, available at https://seamap.env.duke.edu/models/-Duke/EC/. **The new models result in updated density estimates for all taxa for which OCW01 is requesting take** and serve as a complete replacement for the Roberts et al. (2016) models and subsequent updates. Although our LOA application was deemed complete in February 2022, OCW01 voluntarily agreed to provide NMFS and the Public with updated take estimates resulting from this update in the density models.

Additionally, OCW01 has committed to mitigating all potential unexploded ordnance (pUXO) detonations since the submittal of the LOA application. Therefore, we are presenting an updated take request for that activity based on a mitigated scenario of up to 10 pUXO detonations assuming 10 dB of mitigation.

The tables presented in this document have been updated and are intended to replace the corresponding tables contained within the LOA application. Only tables that have been updated due to the new Roberts et al. (2022) models or the mitigated pUXO detonation scenarios are included herein, otherwise tables within the LOA application remain valid.

Updates to Methodology

- Each proposed activity resulting in potential marine mammal take (WTG/OSS installation, cofferdam installation, HRG surveys, and UXO detonation) is associated with unique animal density estimates defined by the anticipated extent of that activity's "footprint", which includes the activity location plus a perimeter that corresponds to maximum extent of the Level B isopleth, rounded up to the nearest 5-km increment (Figure 1 through Figure 4).
- All density grid cells which overlapped with the activity footprint were included in the analysis (Figure 1).

- For all activities, coastal migratory and offshore stocks of bottlenose dolphins were delineated using the 20-m isobath. For WTG/OSS installation (i.e., impact piling), coastal and offshore bottlenose dolphins were rerun using animal movement modeling in order to have coastal bottlenose dolphins seeded only in less than 20 m water depth and offshore bottlenose dolphins seeded only in greater than 20 m water depth.
- Harbor seal, gray seal, short-finned pilot whale, and long-finned pilot whale densities have now been scaled based on relative abundance in the project area, vs. in the LOA application where densities were applied equally to both species present and not adjusted by abundance.
- The 2022 updates to the North Atlantic right whale (NARW) and humpback whale density models resulted in datasets with three different time spans for each species. We have selected the most recent of these for this analysis: 2009-2019 for humpbacks, and 2010-2019 for NARW.
- As stated above, OCW01 has committed to mitigating every potential unexploded ordnance (pUXO) detonation with a minimum 10 dB noise reduction. We have therefore revised all take estimates to reflect the 10 dB-mitigated scenario. Potential exposures for all marine mammal taxa were modeled using frequency-weighted sound exposure level (SEL) values. In the LOA application, SPL_{pk} values were used to model exposures for high-frequency cetaceans because these distances were larger than SEL distances for the unmitigated scenario.
- Because cofferdam installation may take place at any time between October and May (no cofferdams will be installed from June through September), requested take is based on the average density for the months October through May (vs. using the maximum monthly density to estimate take)[1]. This averaging approach avoids potential overestimation of take and aligns with the take estimation approach for HRG surveys, which assumes density averaged across all months in which activities may take place.
- Estimated takes resulting from HRG surveys have been better aligned with the proposed schedule as outlined in the COP; namely, an annual total of 88 survey days for years 1, 4, and 5 with approximately 47.5 survey days in the wind farm area (WFA) and 40.5 survey days in the export cable route (ECR) area, and 180 survey days for years 2 and 3 with approximately 101.5 survey days in the WFA and 78.5 survey days in the ECR. Likewise the activity footprint and associated animal densities have been parsed to separate the ECR cable route from the WFA in order to more accurately represent the spatial resolution of proposed survey effort (Fig. 3; Tables 6-3 and 6-X).

All other methods outlined within the LOA application remain unchanged.

[1] Note that the mean density values were selected during the density extraction process, consistent with what was done in the LOA application.

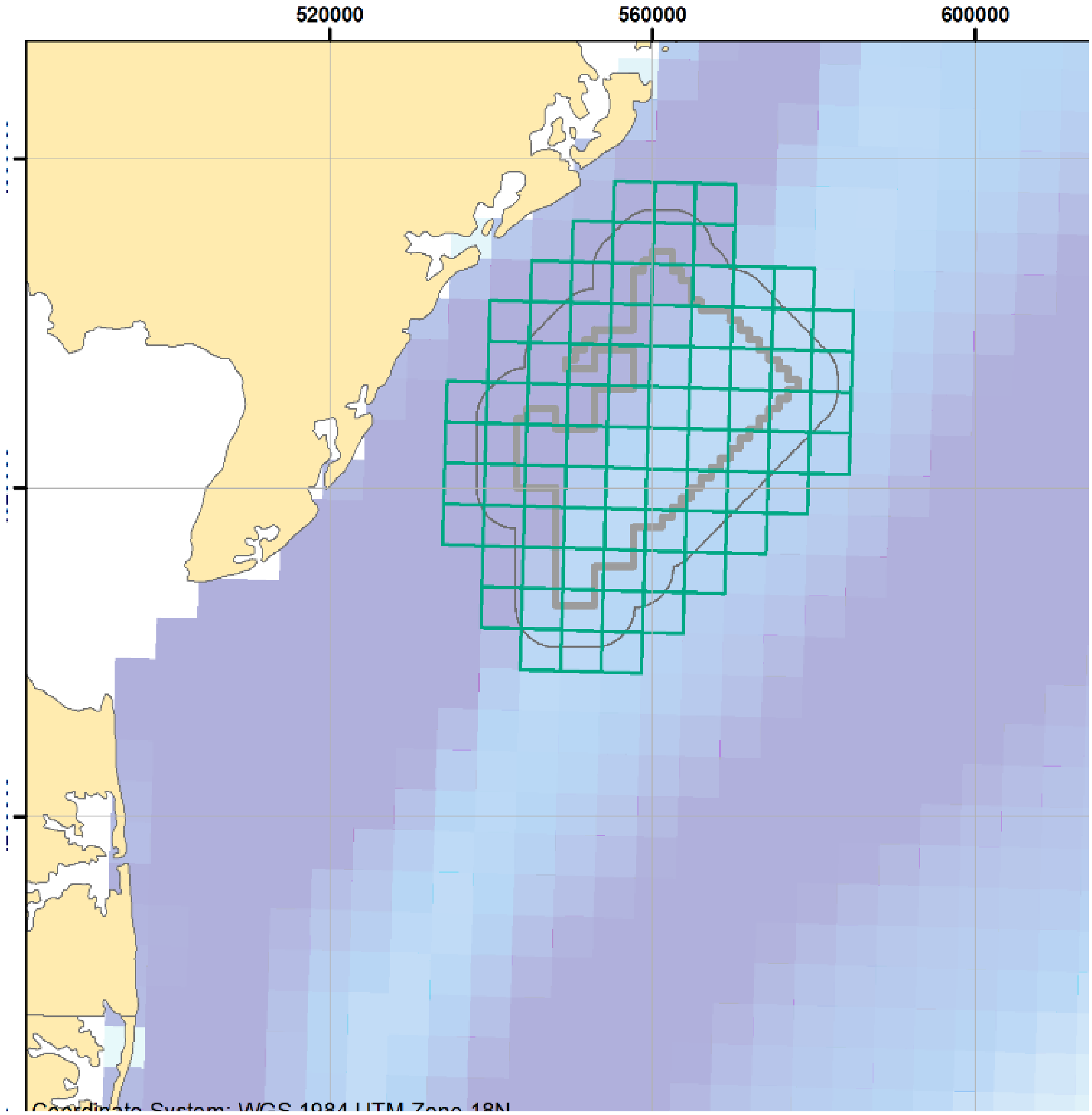

Figure 1. Marine mammal (e.g., NARW) density map showing highlighted grid cells used to calculate mean monthly species exposure estimates for WTG and OSS installation within a 5 km perimeter around the full OCS-A 0498 lease area (Roberts et al. 2016, 2022)

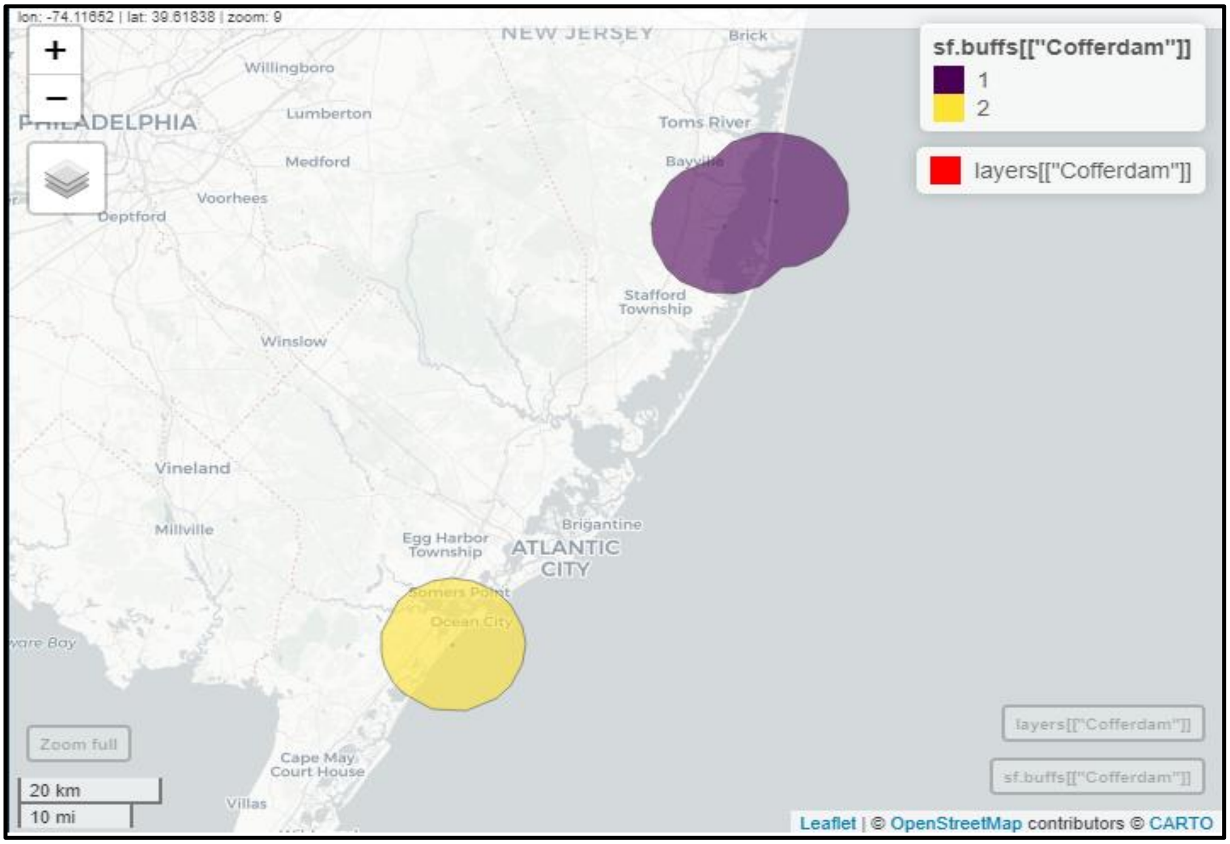

Figure 2. Activity footprint associated with cofferdam Installation (10 km perimeter)

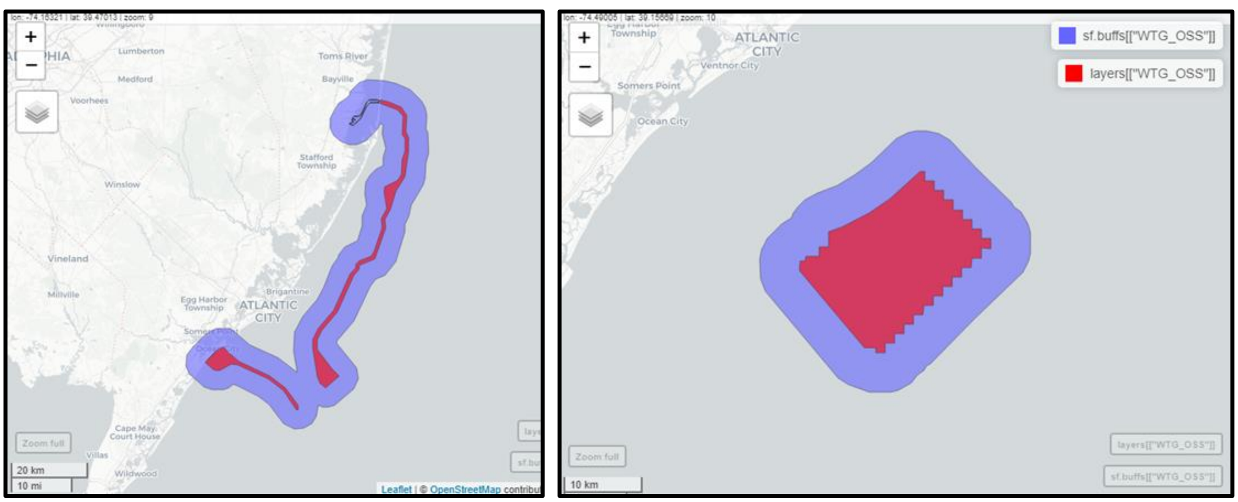

Figure 3. Activity footprint associated with HRG Surveys (5 km perimeter; ECR survey area shown in L panel; WFA surveys shown in R panel)

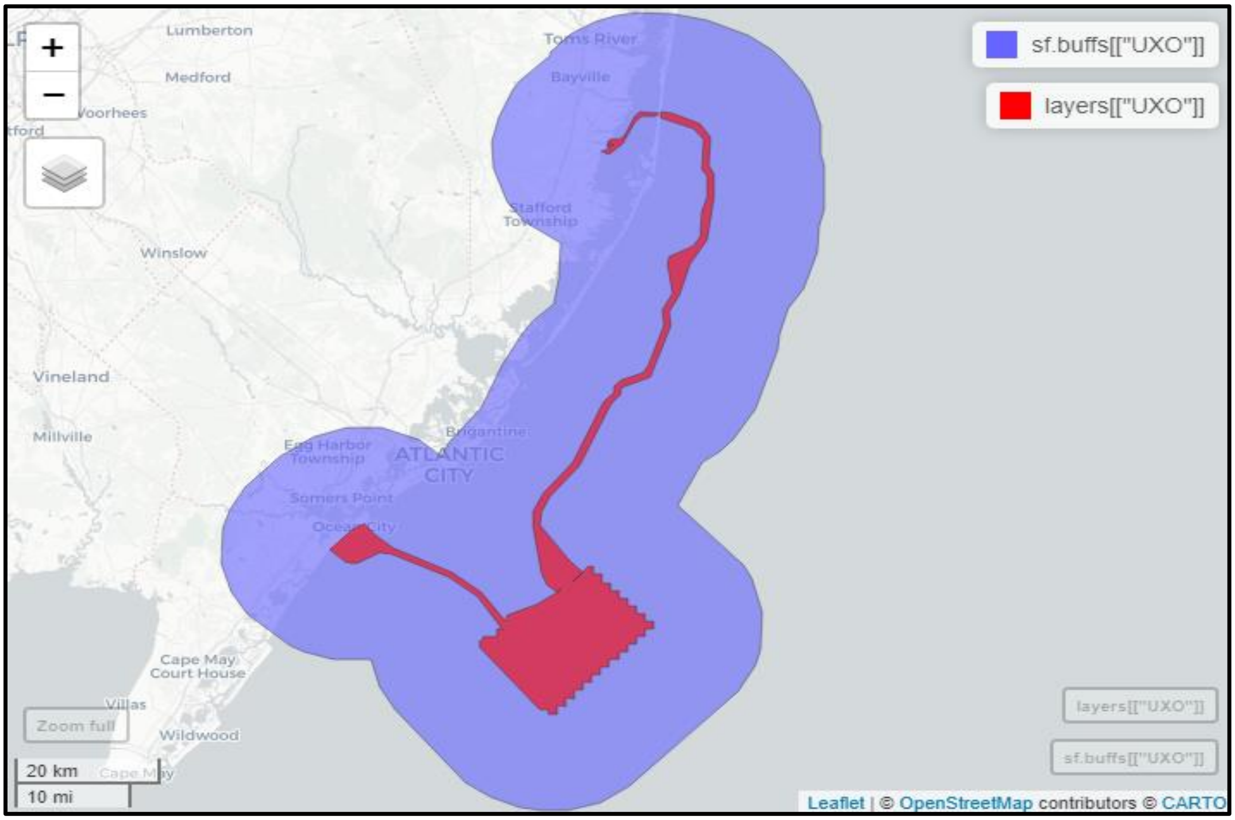

Figure 4. Activity footprint associated with pUXO Detonations (15 km perimeter)

Updated Tables

Table 6-1. Estimated Densities (Animals/km^2) Used for Modeling Marine Mammal Exposures to WTG and OSS Installation Within a 5 km Buffer Around Ocean Wind Farm OCS-A 0498 Lease Area for All Months within the Planned Construction Schedule.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Density
North Atlantic right whale [a]					0.00010	0.00003	0.00001	0.00001	0.00002	0.00004	0.00012	**0.00045**	
Fin whale [a]			--	--	0.00080	0.00067	0.00041	0.00023	0.00027	0.00030	0.00038	**0.00141**	--
Sei whale [a]		--	--	--	0.00021	0.00005	0.00001	0.00001	0.00002	0.00007	0.00021	**0.00042**	--
Minke whale		--	--	--	**0.00674**	0.00154	0.00044	0.00020	0.00012	0.00061	0.00014	0.00041	--
Humpback whale	--	--	--	--	0.00085	0.00051	0.00010	0.00005	0.00018	0.00062	0.00081	**0.00126**	--
Sperm whale [a]	--	--	--	--	**0.00008**	0.00003	0.00001	0.00000	0.00000	0.00000	0.00003	0.00004	--
Atlantic white-sided dolphin	--	--	--	--	**0.00643**	0.00475	0.00018	0.00003	0.00043	0.00474	0.00539	0.00488	--
Bottlenose dolphin, offshore [b]	--	--	--	--	0.07555	0.09293	0.11089	**0.11352**	0.10079	0.09563	0.11146	0.06987	--
Bottlenose dolphin, coastal [b]	--	--	--	--	0.33333	0.39124	0.42611	0.47620	**0.51100**	0.45149	0.44875	0.23091	--
Short-finned pilot whale [b]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00011**
Long-finned pilot whale [b]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00015**
Risso's dolphin	--	--	--	--	0.00024	0.00006	0.00006	0.00007	0.00006	0.00012	0.00063	**0.00096**	--
Common dolphin	--	--	--	--	0.02902	0.01382	0.00831	0.00355	0.00059	0.00862	0.04682	**0.05157**	--
Harbor porpoise	--	--	--	--	0.00801	0.00010	0.00006	0.00005	0.00001	0.00003	0.00010	**0.02456**	--
Harbor seal	--	--	--	--	0.08433	0.01299	0.00319	0.00194	0.00391	0.01947	0.05067	**0.09830**	--
Gray seal	--	--	--	--	0.03017	0.00465	0.00114	0.00069	0.00140	0.00697	0.01813	**0.03517**	--

[a] Listed as Endangered under the ESA.

[b] Density adjusted by their relative abundance (see Section 3.1 of Appendix A for more information).

Note: Exposure modeling for the Atlantic spotted dolphin and the blue whale was not conducted because impacts on these species approach zero due to their low predicted densities in the Project; therefore, these species were excluded from all quantitative analyses and tables based on modeling results.

Note: Gray cells with **Bold** values indicate highest monthly density May – December. Gray cells with Underlined values represent the second highest monthly density May – December. No pile installation is planned for January – April. Density estimates are from habitat-based density modeling of the entire Atlantic Exclusive Economic Zone (EEZ) (Roberts *et al.* 2022).

Table 6-2. Estimated Densities (Animals/km^2) of Marine Mammals Within a 10 km Buffer of the Affected Area of the Cofferdam Installation for All Months within the Planned Construction Schedule.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Density	Oct – May Average
North Atlantic right whale [a]	0.00066	0.00054	0.00030	0.00017	0.00004	--	--	--	--	0.00003	0.00013	0.00038	--	**0.00028**
Blue whale [a]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00075**	--
Fin whale [a]	0.00070	0.00021	0.00041	0.00052	0.00018	--	--	--	--	0.00017	0.00017	0.00081	--	**0.00039**
Sei whale [a]	0.00013	0.00008	0.00015	0.00019	0.00009	--	--	--	--	0.00003	0.00014	0.00029	--	**0.00014**
Minke whale	0.00013	0.00015	0.00021	0.00296	0.00234		--	--	--	0.00030	0.00004	0.00009	--	**0.00078**
Humpback whale	0.00071	0.00048	0.00072	0.00049	0.00026	--	--	--	--	0.00028	0.00067	0.00134	--	**0.00062**
Sperm whale [a]	0.00001	0.00001	0.00001	0.00002	0.00002	--	--	--	--	0.00000	0.00005	0.00003	--	**0.00002**
Atlantic white-sided dolphin	0.00047	0.00030	0.00046	0.00121	0.00067	--	--	--	--	0.00060	0.00128	0.00118	--	**0.00077**
Common bottlenose dolphin - Offshore [b]	0.03783	0.01201	0.01922	0.08214	0.20581	--	--	--	--	0.32131	0.29980	0.21115	--	**0.14866**
Common bottlenose dolphin - Coastal [b]	0.05088	0.01936	0.04322	0.21940	0.54984	--	--	--	--	0.74941	0.62651	0.33903	--	**0.32471**
Short-finned pilot whale [b]	--	--	--	--	--	--	-	--	--	--	--	--	**0.00001**	--
Long-finned pilot whale [b]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00001**	--
Risso's dolphin	0.00000	0.00000	0.00000	0.00001	0.00001	--	--	--	--	0.00001	0.00004	0.00007	--	**0.00002**
Common dolphin	0.00222	0.00096	0.00171	0.00411	0.00281	--	--	--	--	0.00197	0.01140	0.00757	--	**0.00409**
Harbor porpoise	0.01230	0.01081	0.01234	0.01637	0.00324	--	--	--	--	0.00006	0.00022	0.01297	--	**0.00854**
Harbor seal	0.09066	0.06456	0.07150	0.11609	0.07464	--	--	--	--	0.11182	0.16049	0.11575	--	**0.10069**
Gray seal	0.03244	0.02310	0.02558	0.04153	0.02670	--	--	--	--	0.04001	0.05742	0.04141	--	**0.03602**

[a] Listed as Endangered under the ESA.

[b] Density adjusted by their relative abundance (short-finned pilot whale = 0.00000133395 animals/km^2; long-finned pilot whale = 0.00000181 animals/km^2) (see Section 3.1 of **Appendix A** for more information).

Note: Grey cells with **Bold** values indicate density used in Cofferdam exposure estimates.

Table 6-3. Estimated Densities (Animals/km^2) of Marine Mammals Within a 5 km Buffer Around the Affected Area of the High-Resolution Geophysical Surveys (Export Cable Route) for All Months.

Species	January	February	March	April	May	June	July	August	September	October	November	December	Annual Density	Annual Average
North Atlantic right whale [a]	0.00088	0.00076	0.00047	0.00029	0.00007	0.00002	0.00001	0.00001	0.00001	0.00004	0.00014	0.00047	--	**0.00026**
Blue whale [a]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00001**	--
Fin whale [a]	0.00134	0.00053	0.00069	0.00082	0.00040	0.00042	0.00019	0.00011	0.00014	0.00027	0.00032	0.00122	--	**0.00054**
Sei whale [a]	0.00022	0.00013	0.00026	0.00038	0.00014	0.00005	0.00001	0.00001	0.00001	0.00004	0.00020	0.00043	--	**0.00016**
Minke whale	0.00027	0.00029	0.00036	0.00495	0.00432	0.00070	0.00013	0.00005	0.00007	0.00047	0.00008	0.00021	--	**0.00099**
Humpback whale	0.00084	0.00057	0.00080	0.00081	0.00045	0.00031	0.00009	0.00006	0.00014	0.00046	0.00091	0.00145	--	**0.00057**
Sperm whale [a]	0.00002	0.00002	0.00001	0.00004	0.00007	0.00000	0.00000	0.00000	0.00000	0.00000	0.00006	0.00004	--	**0.00002**
Atlantic white-sided dolphin	0.00111	0.00069	0.00087	0.00266	0.00184	0.00124	0.00006	0.00001	0.00013	0.00164	0.00286	0.00247	--	**0.00130**
Common bottlenose dolphin – Offshore [b]	0.02538	0.00856	0.01571	0.06199	0.15746	0.21175	0.21513	0.22393	0.23224	0.22416	0.22789	0.13564	--	**0.14499**
Common bottlenose dolphin - Coastal [b]	0.04469	0.01658	0.03581	0.16624	0.41650	0.54059	0.53568	0.57866	0.65609	0.59458	0.53167	0.28456	--	**0.36680**
Short-finned pilot whale [b]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00001**	--
Long-finned pilot whale [b]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00002**	--
Risso's dolphin	0.00001	0.00000	0.00000	0.00005	0.00004	0.00001	0.00001	0.00001	0.00001	0.00003	0.00018	0.00023	--	**0.00005**
Common dolphin	0.00628	0.00277	0.00453	0.01061	0.00995	0.00203	0.00053	0.00014	0.00004	0.00409	0.02396	0.01937	--	**0.00702**
Harbor porpoise	0.02199	0.01958	0.01839	0.02454	0.00526	0.00014	0.00007	0.00002	0.00001	0.00005	0.00022	0.02073	--	**0.00925**
Harbor seal	0.09088	0.06190	0.05808	0.09051	0.08105	0.05305	0.00872	0.00522	0.01027	0.05957	0.10025	0.10656	--	**0.06051**
Gray seal	0.03252	0.02215	0.02078	0.03238	0.02900	0.01898	0.00312	0.00187	0.00367	0.02131	0.03587	0.03812	--	**0.02165**

[a] Listed as Endangered under the ESA.

[b] Density adjusted by their relative abundance (see Section 3.1 of Appendix A for more information).

Note: **Bold** values indicate densities used in HRG ECR exposure estimates.

Table 6-X NEW. Estimated Densities (Animals/km^2) of Marine Mammals Within a 5 km Buffer Around the Affected Area of the High-Resolution Geophysical Surveys (Wind Farm Area) for All Months.

Species	January	February	March	April	May	June	July	August	September	October	November	December	Annual Density	Annual Average
North Atlantic right whale [a]	0.00066	0.00073	0.00061	0.00049	0.00011	0.00003	0.00001	0.00001	0.00002	0.00004	0.00009	0.00037	--	**0.00026**
Blue whale [a]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00001**	--
Fin whale [a]	0.00187	0.00142	0.00106	0.00102	0.00093	0.00076	0.00051	0.00029	0.00031	0.00031	0.00038	0.00144	--	**0.00086**
Sei whale [a]	0.00026	0.00016	0.00034	0.00075	0.00025	0.00006	0.00001	0.00001	0.00002	0.00008	0.00025	0.00042	--	**0.00022**
Minke whale	0.00058	0.00059	0.00061	0.00673	0.00788	0.00187	0.00054	0.00025	0.00014	0.00066	0.00017	0.00050	--	**0.00171**
Humpback whale	0.00095	0.00066	0.00084	0.00103	0.00102	0.00061	0.00012	0.00006	0.00021	0.00071	0.00088	0.00113	--	**0.00069**
Sperm whale [a]	0.00004	0.00002	0.00001	0.00007	0.00010	0.00003	0.00001	0.00000	0.00000	0.00000	0.00003	0.00003	--	**0.00003**
Atlantic white-sided dolphin	0.00360	0.00231	0.00210	0.00674	0.00806	0.00607	0.00022	0.00004	0.00058	0.00585	0.00642	0.00589	--	**0.00399**
Common bottlenose dolphin – Offshore [b]	0.01615	0.00555	0.00786	0.02497	0.06586	0.08314	0.09932	0.09994	0.08669	0.08358	0.09841	0.06283	--	**0.06119**
Common bottlenose dolphin - Coastal [b]	0.03145	0.01108	0.02114	0.07735	0.20004	0.23634	0.27770	0.29394	0.29119	0.27197	0.29371	0.16292	--	**0.18073**
Short-finned pilot whale [b]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00014**	--
Long-finned pilot whale [b]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00018**	--
Risso's dolphin	0.00019	0.00003	0.00003	0.00032	0.00030	0.00008	0.00007	0.00008	0.00007	0.00015	0.00083	0.00127	--	**0.00029**
Common dolphin	0.02980	0.01260	0.01481	0.03048	0.03751	0.01786	0.01024	0.00416	0.00066	0.01046	0.05685	0.06472	--	**0.02418**
Harbor porpoise	0.03940	0.03782	0.02871	0.03842	0.00970	0.00015	0.00009	0.00007	0.00001	0.00003	0.00014	0.02757	--	**0.01518**
Harbor seal	0.11132	0.08232	0.05158	0.05694	0.09691	0.00776	0.00170	0.00107	0.00224	0.01127	0.03705	0.10569	--	**0.04715**
Gray seal	0.03983	0.02945	0.01846	0.02037	0.03467	0.00278	0.00061	0.00038	0.00080	0.00403	0.01325	0.03781	--	**0.01687**

[a] Listed as Endangered under the ESA.

[b] Density adjusted by their relative abundance (see Section 3.1 of Appendix A for more information).

Note: **Bold** values indicate densities used in HRG WFA exposure estimates

Table 6-Y (NEW). Estimated Densities (Animals/km^2) of Marine Mammals Within a 15 km Buffer Around the Affected Area of pUXO Detonations for All Months in which Detonations are Allowed (May through October).

Species	January	February	March	April	May	June	July	August	September	October	November	December	Annual Density
North Atlantic right whale [a]	--	--	--	--	**0.00008**	0.00002	0.00001	0.00001	0.00002	0.00004	--	--	--
Blue whale [a]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00001**
Fin whale [a]	--	--	--	--	**0.00068**	0.00061	0.00034	0.00019	0.00023	0.00029	--	--	--
Sei whale [a]	--	--	--	--	**0.00021**	0.00006	0.00001	0.00001	0.00002	0.00006	--	--	--
Minke whale	--	--	--	--	**0.00627**	0.00146	0.00037	0.00019	0.00012	0.00056	--	--	--
Humpback whale	--	--	--	--	**0.00081**	0.00056	0.00011	0.00007	0.00019	0.00063	--	--	--
Sperm whale [a]	--	--	--	--	**0.00008**	0.00003	0.00003	0.00001	0.00000	0.00000	--	--	--
Atlantic white-sided dolphin	--	--	--	--	**0.00545**	0.00415	0.00013	0.00003	0.00041	0.00392	--	--	--
Common bottlenose dolphin – Offshore [b]	--	--	--	--	0.09128	0.12148	0.12465	**0.12615**	0.12612	0.12511	--	--	--
Common bottlenose dolphin - Coastal [b]	--	--	--	--	0.45605	0.58021	0.56497	0.61742	**0.71100**	0.64462	--	--	--
Short-finned pilot whale [b]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00010**
Long-finned pilot whale [b]	--	--	--	--	--	--	--	--	--	--	--	--	**0.00013**
Risso's dolphin	--	--	--	--	**0.00021**	0.00007	0.00006	0.00006	0.00005	0.00009	--	--	--
Common dolphin	--	--	--	--	**0.02407**	0.01261	0.00759	0.00417	0.00095	0.00754	--	--	--
Harbor porpoise	--	--	--	--	**0.00789**	0.00024	0.00016	0.00008	0.00002	0.00007	--	--	--
Harbor seal	--	--	--	--	**0.09467**	0.04068	0.00659	0.00392	0.00774	0.04540	--	--	--
Gray seal	--	--	--	--	**0.03387**	0.01456	0.00236	0.00140	0.00277	0.01624	--	--	--

[a] Listed as Endangered under the ESA.

[b] Density adjusted by their relative abundance (see Section 3.1 of Appendix A for more information).
Note: **Bold** values indicate densities used in pUXO exposure estimates.

Table 6-7. Estimated Maximum Level A Exposures of Marine Mammals Resulting from WTG Foundation Monopile Impact Installation. Results indicate total potential exposures per stock modeled over the effective period of the LOA assuming 2 piles are installed per day.

Species	Estimated Level A Exposures (SEL_{cum})
North Atlantic right whale [a]	0.9 [b]
Fin whale [a]	3.69
Sei whale [a]	0.89
Minke whale	18.42
Humpback whale	4.24
Sperm whale [a]	0
Atlantic white-sided dolphin	0
Common bottlenose dolphins:	
Offshore	0
Coastal	0
Pilot whales:	
Short-finned pilot whale	0
Long-finned pilot whale	0
Risso's dolphin	0
Common dolphin	0
Harbor porpoise	51.31 [C]
Seals:	
Gray seal	3.04
Harbor seal	12.16

Note: Values taken from JASCO's density and exposure modeling update memo (August 2022). Exposure modeling for the blue whale and Atlantic spotted dolphin was not conducted because impacts on the species approach zero due to their low predicted densities in the Project area. These species are therefore excluded from quantitative analyses and tables.

[a] Listed as Endangered under the ESA.

[b] Level A exposures were estimated for this species, but due to mitigation measures in **Section 11**, no Level A takes are expected or requested. Level A exposure estimates are added to Level B take requests in **Section 6.2.3**.

[C] The calculated Level A exposures are likely an overestimate; the modeled 10 dB reduction due to NMS is assumed across all frequencies and does not take into account that the reduction is greater at higher frequencies, which are those heard best by harbor porpoise.

Table 6-8. Estimated Maximum Level A Exposures of Marine Mammals Resulting from OSS Foundation Monopile or Pin Pile Impact Pile Driving. Results indicate total potential exposures per stock modeled over the effective period of the LOA assuming 2 monopiles or 3 pin piles are installed per day.

Species	Estimated Level A Exposures (SEL_{cum}) 11-m Monopiles (3)	Estimated Level A Exposures (SEL_{cum}) 2.44-m Pin Piles (48)
North Atlantic right whale [a]	0.04 [b]	0.10 [b]
Fin whale [a]	0.15	0.48
Sei whale [a]	0.04	0.14
Minke whale	0.76	2.29
Humpback whale	0.18	0.54
Sperm whale [a]	0	0
Atlantic white-sided dolphin	0	0
Common bottlenose dolphins:		
Offshore	0	0
Coastal	0	0
Pilot whales:		
Short-finned pilot whale	0	0
Long-finned pilot whale	0	0
Risso's dolphin	0	0
Common dolphin	0	0
Harbor porpoise [c]	2.38	16.60
Seals:		
Gray seal	0.08	0.32
Harbor seal	0.37	0.43

Note: Values taken from JASCO's density and exposure modeling update memo (August 2022). Exposure modeling for the blue whale and Atlantic spotted dolphin was not conducted because impacts on the species approach zero due to their low predicted densities in the Project area. These species are therefore excluded from quantitative analyses and tables.

[a] Listed as Endangered under the ESA.

[b] Level A exposures were estimated for this species, but due to mitigation measures outlined in **Section 11**, no Level A takes are expected or requested. See **Section 6.2.3** for more information.

[C] The calculated Level A exposures are likely an overestimate; the modeled 10 dB reduction due to NMS is assumed across all frequencies and does not take into account that the reduction is greater at higher frequencies, which are those heard best by harbor porpoise.

Table 6-9. Estimated Level A Exposures by Month to Marine Mammal Species Resulting from Vibratory Pile Installation and Removal of Cofferdams.

Species	Jan	Feb	Mar	Apr	May	Oct	Nov	Dec	Average Exposures [a]
North Atlantic right whale [b]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Blue whale [b]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Fin whale [b]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Sei whale [b]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Minke whale	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Humpback whale	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Sperm whale [b]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Atlantic white-sided dolphin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Common bottlenose dolphins:									
Offshore	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Coastal	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Pilot whales:									
Short-finned pilot whale	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Long-finned pilot whale	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Risso's dolphin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Common dolphin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**<0.01**
Harbor porpoise	0.02	0.02	0.02	0.02	<0.01	<0.01	<0.01	0.02	**0.01**
Seals:									
Gray seal	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	0.01	**0.01**
Harbor seal	0.02	0.02	0.02	0.03	0.02	0.03	0.04	0.03	**0.02**

Note: **Bolded** values indicate estimates used in final take request.

[a] Average Exposure values were calculated using the October – May average density column from Table 6-2; all other monthly exposure methods remained the same.

[b] Listed as Endangered under the ESA.

Table 6-10. Estimated Potential Maximum Level A Exposures of Marine Mammals Resulting from the Possible Detonations of up to 10 UXOs assuming both 10 dB of Attenuation

Species	Estimated Level A Exposures (PTS SEL)
	10 dB Attenuation
North Atlantic right whale [a,b]	0.03
Blue whale [a]	<0.01
Fin whale [a]	0.28
Sei whale [a]	0.08
Minke whale	2.53
Humpback whale	0.33
Sperm whale [a]	<0.01
Atlantic white-sided dolphin	0.03
Common bottlenose dolphins:	
Offshore	0.68
Coastal	3.84
Pilot whales:	
Short-finned pilot whale	<0.01
Long-finned pilot whale	<0.01
Risso's dolphin	<0.01
Common dolphin	0.13
Harbor porpoise	9.49
Seals:	
Gray seal	2.28
Harbor seal	6.39

[a] Listed as Endangered under the ESA.

[b] Level A exposures were estimated for this species, but due to mitigation measures outlined in **Section 11**, no Level A takes are expected or requested. See **Section 6.2.3** for more information.

Table 6-11. Estimated Annual Level A Exposures of Marine Mammals Resulting from HRG Surveys.

Species	Estimated Level A Exposures [b]	
	Years 1, 4, and 5 (88 days each of HRG surveys)	Years 2 and 3 (180 days each of HRG surveys)
North Atlantic right whale [a]	<0.01	0.01
Blue whale [a]	<0.01	<0.01
Fin whale [a]	0.01	0.02
Sei whale [a]	<0.01	<0.01
Minke whale	0.02	0.04
Humpback whale	0.01	0.02
Sperm whale [a]	<0.01	<0.01
Atlantic white-sided dolphin	0.03	0.05
Common bottlenose dolphins:		
Offshore	1.23	2.46
Coastal	3.28	6.60
Pilot whales:		
Short-finned pilot whale	<0.01	<0.01
Long-finned pilot whale	<0.01	<0.01
Risso's dolphin	<0.01	<0.01
Common dolphin	0.20	0.42
Harbor porpoise	5.60	11.59
Seals:		
Gray seal	0.23	0.48
Harbor seal	0.66	1.34

[a] Listed as Endangered under the ESA.

[b] Although Level A exposures were estimated for HRG surveys, due to mitigation measures outlined in **Section 11**, no Level A takes are expected or requested. See **Section 6.2** for more information.

Table 6-12. Estimated Level B Maximum Exposures of Marine Mammals Resulting from WTG Monopile Impact Installation based on the 160 dB rms Threshold.

Species	Estimated Level B Exposures
North Atlantic right whale [a]	3.11
Fin whale [a]	7.05
Sei whale [a]	2.00
Minke whale	52.25
Humpback whale	13.82
Sperm whale [a]	0
Atlantic white-sided dolphin	71.5
Common bottlenose dolphins:	
Offshore	935.91
Coastal	0
Pilot whales:	
Short-finned pilot whale	0.04
Long-finned pilot whale	0
Risso's dolphin	7.06
Common dolphin	1,229.37
Harbor porpoise	233.89
Seals:	
Gray seal	197.56
Harbor seal	554.22

Notes: Values taken from JASCO's density and exposure modeling update memo (August 2022). Exposure modeling for the blue whale and Atlantic spotted dolphin was not conducted because impacts on the species approach zero due to their low predicted densities in the Project area. These species are therefore excluded from quantitative analyses and tables.

[a] Listed as Endangered under the ESA.

Table 6-13. Estimated Maximum Level B Exposures of Marine Mammals Resulting from OSS Foundation Monopile or Pin Pile Impact Pile Driving.

Species	Estimated Level B Exposures 8/11-m Monopiles (3)	Estimated Level B Exposures 2.44-m Pin Piles (48)
North Atlantic right whale [a]	0.14	0.75
Fin whale [a]	0.27	1.20
Sei whale [a]	0.08	0.45
Minke whale	2.32	15.81
Humpback whale	0.51	3.63
Sperm whale [a]	0	0
Atlantic white-sided dolphin	2.37	16.20
Common bottlenose dolphins:		
Offshore	30.44	168.23
Coastal	0	0
Pilot whales:		
Short-finned pilot whale	<0.01	0
Long-finned pilot whale	0	0
Risso's dolphin	0.26	1.79
Common dolphin	40.51	293.89
Harbor porpoise	10.004	70.97
Seals:		
Gray seal	6.98	38.59
Harbor seal	19.76	99.14

Notes: Values taken from JASCO's density and exposure modeling update memo (August 2022). Exposure modeling for the blue whale and Atlantic spotted dolphin was not conducted because impacts on the species approach zero due to their low predicted densities in the Project area. These species are therefore excluded from quantitative analyses and tables.

[a] Listed as Endangered under the ESA.

Table 6-14. Estimated Level B Exposures by Month to Marine Mammal Species Resulting from Vibratory Pile Installation and Removal of Cofferdams.

Species	Jan	Feb	Mar	Apr	May	Oct	Nov	Dec	Average Exposures
North Atlantic right whale [a]	2.08	1.71	0.97	0.55	0.13	0.09	0.41	1.20	**0.89**
Blue whale [a]	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	**0.02**
Fin whale [a]	2.21	0.65	1.30	1.64	0.57	0.54	0.55	2.56	**1.25**
Sei whale [a]	0.40	0.26	0.48	0.61	0.29	0.09	0.44	0.91	**0.44**
Minke whale	0.42	0.48	0.68	9.40	7.42	0.94	0.12	0.28	**2.47**
Humpback whale	2.25	1.51	2.28	1.56	0.83	0.90	2.13	4.26	**1.96**
Sperm whale [a]	0.03	0.04	0.02	0.06	0.08	0.00	0.15	0.09	**0.06**
Atlantic white-sided dolphin	1.49	0.96	1.47	3.84	2.11	1.91	4.06	3.76	**2.45**
Common bottlenose dolphins:									
Offshore	120.06	38.12	60.99	260.70	653.27	1019.85	951.596	670.22	**471.85**
Coastal	161.51	61.44	137.20	696.39	1745.23	2378.69	1988.58	1076.10	**1030.64**
Pilot whales:									
Short-finned pilot whale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Long-finned pilot whale	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	**0.01**
Risso's dolphin	0.01	0.00	0.00	0.03	0.02	0.02	0.11	0.21	**0.05**
Common dolphin	7.05	3.05	5.43	13.05	8.91	6.24	36.20	24.03	**12.99**
Harbor porpoise	39.03	34.32	39.17	51.95	10.28	0.18	0.69	41.18	**27.10**
Seals:									
Gray seal	102.96	73.31	81.20	131.83	84.76	126.98	182.25	131.44	**114.34**
Harbor seal	287.77	204.92	226.96	368.48	236.92	354.92	509.40	367.39	**319.59**

Note: **Bolded** values indicate estimates used in final take request.

[a] Average Exposure values were calculated using the October – May average density column from Table 6-2; all other monthly exposure methods remained the same.

[b] Listed as Endangered under the ESA.

Table 6-15. Estimated Maximum Level B Exposures of Marine Mammals Resulting from the Possible Detonations of up to 10 UXOs assuming both 10 dB of Attenuation

Species	Estimated Level B Exposures (TTS SEL)
	10 dB Attenuation
North Atlantic right whale [a]	0.35
Blue whale [a]	0.04
Fin whale [a]	2.87
Sei whale [a]	0.87
Minke whale	26.42
Humpback whale	3.41
Sperm whale [a]	0.01
Atlantic white-sided dolphin	1.05
Common bottlenose dolphins:	
Offshore	24.36
Coastal	137.31
Pilot whales:	
Short-finned pilot whale	0.02
Long-finned pilot whale	0.02
Risso's dolphin	0.04
Common dolphin	4.65
Harbor porpoise	46.50
Seals:	
Gray seal	50.98
Harbor seal	142.49

[a] Listed as Endangered under the ESA.

Table 6-16. Estimated Annual Maximum Level B Exposures of Marine Mammals Resulting from HRG Surveys.

Species	Estimated Annual Level B Exposures Per Year	
	Years 1, 4 and 5 (88 days each of HRG surveys)	Years 2 and 3 (180 days each of HRG surveys)
North Atlantic right whale [a]	0.46	0.94
Blue whale [a]	0.02	0.03
Fin whale [a]	1.24	2.56
Sei whale [a]	0.33	0.68
Minke whale	2.40	4.98
Humpback whale	1.10	2.27
Sperm whale [a]	0.04	0.09
Atlantic white-sided dolphin	4.79	10.04
Common bottlenose dolphins:		
Offshore	173.84	348.37
Coastal	464.18	933.46
Pilot whales:		
Short-finned pilot whale	0.14	0.29
Long-finned pilot whale	0.19	0.40
Risso's dolphin	0.31	0.65
Common dolphin	28.38	59.52
Harbor porpoise	21.69	44.88
Seals:		
Gray seal	33.23	67.56
Harbor seal	92.88	188.83

[a] Listed as Endangered under the ESA.

Table 6-17. Requested Level A and Level B Takes for Marine Mammals During Impact Pile Driving of WTG 8/11-m Monopiles for the Effective Period of the LOA (5-year total).

Species	Population Size	Level A Harassment Takes	Level B Harassment Takes	Max Percent Population
North Atlantic right whale [a]	368	0 [b]	4	1.09
Blue whale [a]	unknown	0	4 [c]	unknown
Fin whale [a]	6,802	4	8	0.18
Sei whale [a]	6,292	1	2 [d]	0.05
Minke whale	21,968	19	53	0.33
Humpback whale	1,396	5	14	1.36
Sperm whale [a]	4,349	0	3 [d]	0.07
Atlantic white-sided dolphin	93,233	0	72	0.08
Atlantic spotted dolphin	39,921	0	45 [d]	0.11
Common bottlenose dolphins:				
Offshore	62,851	0	936	1.49
Coastal	6,639	0	0	0.00
Pilot whales:				
Short-finned pilot whale	28,924	0	10 [d]	0.03
Long-finned pilot whale	39,215	0	10 [d]	0.03
Risso's dolphin	35,215	0	30 [d]	0.09
Common dolphin	172,974	0	1,230	0.71
Harbor porpoise	95,543	52	234	0.30
Seals:				
Gray seal	27,300	4	198	0.74
Harbor seal	61,336	13	555	0.93

Note: Values ≥0.5 from **Table 6-7** and **Table 6-12** have been rounded up to the nearest integer, values <0.5 rounded down to 0.

[a] Listed as Endangered under the ESA.

[b] 0.90 Level A exposures were estimated for North Atlantic right whale, but due to mitigation measures outlined in **Section** Error! Reference source not found., no Level A takes are expected or requested.

[c] No Level B exposures were estimated for blue whale, but up to 4 Level B takes not calculated through density estimates are requested in the unlikely event that 4 individuals, or two cow and calf pairs, approach monopile installation.

[d] The requested take for these species was adjusted based on mean group size:

- Sei whale: Kenney and Vigness-Raposa, 2010.
- Sperm whale: Barkaszi and Kelly, 2019.
- Atlantic spotted dolphin: Kenney and Vigness-Raposa, 2010.
- Pilot whales: Kenney and Vigness-Raposa, 2010.
- Risso's dolphin: Barkaszi and Kelly, 2019.

Table 6-18. Requested Level A and Level B Takes for Marine Mammals During Impact Pile Driving for Either OSS Scenario: 3 8/11-m Monopiles or 3 Jacket Foundations Composed of 16 2.44-m Pin Piles Each.

Species	Population Size	3 8/11-m Monopile Scenario			48 2.44-m Pin Pile Scenario		
		Level A Harassment Takes	Level B Harassment Takes	Max Percent Population	Level A Harassment Takes	Level B Harassment Takes	Max Percent Population
North Atlantic right whale [a]	368	0	0	0.00	0	1	0.27
Blue whale [a]	unknown	0	0	0.00	0	0	0.00
Fin whale [a]	6,802	0	0	0.00	0	2	0.03
Sei whale [a]	6,292	0	0	0.00	0	0	0.01
Minke whale	21,968	1	3	0.02	3	16	0.09
Humpback whale	1,396	0	1	0.07	1	4	0.36
Sperm whale [a]	4,349	0	0	0.00	0	3 [b]	0.07
Atlantic white-sided dolphin	93,233	0	3	0.01	0	17	0.02
Atlantic spotted dolphin	39,921	0	0	0.00	0	45 [b]	0.11
Common bottlenose dolphins:							
Offshore	62,851	0	31	0.05	0	169	0.27
Coastal	6,639	0	0	0.06	0	0	0.00
Pilot whales:							
Short-finned pilot whale	28,924	0	0	0.00	0	10 [b]	0.03
Long-finned pilot whale	39,215	0	0	0.00	0	10 [b]	0.03
Risso's dolphin	35,215	0	0	0.00	0	30 [b]	0.09
Common dolphin	172,974	0	41	0.02	0	294	0.17
Harbor porpoise	95,543	3	11	0.01	17	71	0.09
Seals:							
Gray seal	27,300	0	7	0.03	0	39	0.14
Harbor seal	61,336	0	20	0.03	0	100	0.16

Note: Values ≥0.5 from **Table 6-8** and **Table 6-13** have been rounded up to the nearest integer, values <0.5 rounded down to 0.

[a] Listed as Endangered under the ESA.

[b] The requested take for these species was adjusted based on mean group size:

- Sei whale: Kenney and Vigness-Raposa, 2010.
- Sperm whale: Barkaszi and Kelly, 2019.
- Atlantic spotted dolphin: Kenney and Vigness-Raposa, 2010.
- Pilot whales: Kenney and Vigness-Raposa, 2010.
- Risso's dolphin: Barkaszi and Kelly, 2019.

Table 6-19. Requested Level A and Level B Takes Resulting from Vibratory Installation and Removal of Cofferdams and the Percentage of Each Population or Stock Taken for the Effective Period of the LOA (5-year total).

Species	Population Size	Level A Harassment Takes	Level B Harassment Takes	Max Percent Population
North Atlantic right whale [a]	368	0	1	0.27
Blue whale [a]	unknown	0	0	0.00
Fin whale [a]	6,802	0	2	0.03
Sei whale [a]	6,292	0	1	0.02
Minke whale	21,968	0	3	0.01
Humpback whale	1,396	0	3	0.21
Sperm whale [a]	4,349	0	0	0.00
Atlantic white-sided dolphin	93,233	0	5	0.01
Atlantic spotted dolphin	39,921	0	45 [b]	0.11
Common bottlenose dolphins:				
Offshore	62,851	0	472	0.75
Coastal [f]	6,639	11 [c]	1,031	15.70
Pilot whales:				
Short-finned pilot whale	28,924	0	10 [d]	0.03
Long-finned pilot whale	39,215	0	10 [d]	0.03
Risso's dolphin	35,215	0	30 [d]	0.09
Common dolphin	172,974	0	13	0.01
Harbor porpoise	95,543	0	28	0.03
Seals:				
Gray seal	27,300	28 [e]	115	0.52
Harbor seal	61,336	28 [e]	320	0.57

[a] Listed as Endangered under the ESA.

[b] No Level B exposures were estimated for Atlantic spotted dolphin, but up to 45 Level B takes are requested in the unlikely event a pod of up to 45 individuals approaches cofferdam installation or removal (based on Kenney and Vigness-Raposa, 2010).

[c] No Level A exposures were estimated for coastal bottlenose dolphin, but up to 11 Level A takes are requested in the unlikely event a pod of dolphins approaches cofferdam installation or removal (based on Toth *et al.* 2011).

[d] Level B take of these species were adjusted to account for mean group size:

- Pilot whales: Kenney and Vigness-Raposa, 2010.
- Risso's dolphins: Barkaszi and Kelly, 2019.

[e] No Level B exposures were estimated for gray and harbor seals, but up to 28 Level A takes are requested in the event that up to 2 animals per day approach cofferdam installation or removal.

[f] Coastal bottlenose dolphin take for bayside (vs. Atlantic-facing) cofferdams is likely overestimated, as this stock has been shown to prefer coastal to estuarine environments (Toth et al. 2011).

Table 6-20. Requested Level A and Level B Takes Resulting from the Detonation of up to 10 UXOs and the Percentage of Each Population or Stock Taken for the Effective Period of the LOA (5-year total).

Species	Population Size	10 dB of Attenuation		
		Level A Harassment Takes	Level B Harassment Takes	Max Percent Population
North Atlantic right whale [a]	368	0	1	0.00
Blue whale [a]	unknown	0	0	0.00
Fin whale [a]	6,802	0	3	0.04
Sei whale [a]	6,292	0	1	0.02
Minke whale	21,968	0 [b]	27	0.12
Humpback whale	1,396	0	4	0.29
Sperm whale [a]	4,349	0	3 [c]	0.07
Atlantic white-sided dolphin	93,233	0	2	0.01
Atlantic spotted dolphin	39,921	0	45 [c]	0.11
Common bottlenose dolphins:				
Offshore	62,851	0 [b]	25	0.04
Coastal	6,639	0 [b]	138	2.08
Pilot whales:				
Short-finned pilot whale	28,924	0	10 [c]	0.03
Long-finned pilot whale	39,215	0	10 [c]	0.03
Risso's dolphin	35,215	0	30 [c]	0.09
Common dolphin	172,974	0	5	<0.01
Harbor porpoise	95,543	10	47	0.06
Seals:				
Gray seal	27,300	3	51	0.20
Harbor seal	61,336	7	143	0.24

Note: Calculated exposures that were ≥0.5 were rounded up to the nearest whole number.

[a] Listed as Endangered under the ESA.

[b] A small number of Level A exposures were estimated based on density calculations; however, no Level A take in these instances is requested due to mitigation measures outlined in **Section 11**.

[c] The requested take for these species was adjusted based on mean group size:

- Sperm whale: Barkaszi and Kelly, 2019.
- Atlantic spotted dolphin: Kenney and Vigness-Raposa, 2010.
- Pilot whales: Kenney and Vigness-Raposa, 2010.
- Risso's dolphin: Barkaszi and Kelly, 2019.

Table 6-21. Requested Level A and Level B Takes Per Year for High-resolution Geophysical Surveys Conducted during Ocean Wind Construction.

Species	Population Size	Years 1, 4, and 5 (88 days of HRG surveys per year)			Years 2 and 3 (180 days of HRG surveys per year)		
		Annual Level A Harassment Takes	Annual Level B Harassment Takes	Annual Max Percent Population	Annual Level A Harassment Takes	Annual Level B Harassment Takes	Annual Max Percent Population
North Atlantic right whale [a]	368	0	1 [d]	0.27	0	2 [d]	0.54
Blue whale [a]	unknown	0	0	0.00	0	0	0.00
Fin whale [a]	6,802	0	2	0.03	0	3	0.04
Sei whale [a]	6,292	0	0	0.00	0	1 [b]	0.02
Minke whale	21,968	0	3	<0.01	0	5 [b]	0.02
Humpback whale	1,396	0	2	0.14	0	3 [b]	0.21
Sperm whale [a]	4,349	0	3 [b]	0.07	0	3 [b]	0.07
Atlantic white-sided dolphin	93,233	0	5	<0.01	0	11	0.01
Atlantic spotted dolphin	39,921	0	45 [b]	0.11	0	45 [b]	0.11
Common bottlenose dolphins:							
Offshore	62,851	0 [c]	174	0.28	0 [c]	349	0.62
Coastal	6,639	0 [c]	465	7.00	0 [c]	934	19.70
Pilot whales:							
Short-finned pilot whale	28,924	0	10 [b]	0.03	0	10 [b]	0.03
Long-finned pilot whale	39,215	0	10 [b]	0.03	0	10 [b]	0.03
Risso's dolphin	35,215	0	30 [b]	0.09	0	30 [b]	0.09
Common dolphin	172,974	0	29	0.01	0	60	0.03
Harbor porpoise	95,543	0 [c]	22	0.02	0 [c]	45	0.05
Seals:							
Gray seal	27,300	0	34	0.12	0 [c]	68	0.25
Harbor seal	61,336	0 [c]	93	0.15	0 [c]	189	0.31

[a] Listed as Endangered under the ESA.

[b] The requested take for these species was adjusted based on mean group size:

- Sei whale: Kenney and Vigness-Raposa, 2010.
- Minke whale: Kenney and Vigness-Raposa, 2010.
- Humpback whale: CeTAP, 1982.
- Sperm whale: Barkaszi and Kelly, 2019
- Atlantic spotted dolphin: Kenney and Vigness-Raposa, 2010.
- Pilot whales: Kenney and Vigness-Raposa, 2010.
- Risso's dolphin: Barkaszi and Kelly, 2019.

[c] A small number of Level A exposures were estimated based on density calculations; however, no Level A take is requested due to mitigation measures outlined in **Section 11**.

[d] For all species other than NARW, estimated take values greater than 0.5 were rounded up to 1. Take values for NARW were set manually for conservatism: 0.45 was rounded to 1, and .93 was rounded to 2.

Table 6-22. Requested Level A and Level B Takes for All Activities Conducted During Ocean Wind Construction.

Species	Population Size	Year 1			Year 2			Year 3			Year 4			Year 5		
		Level A	Level B	Max %	Level A	Level B	Max %	Level A	Level B	Max %	Level A	Level B	Max %	Level A	Level B	Max %
North Atlantic right whale [a]	368	0	3	0.82	0	7	1.90	0	2	0.54	0	1	0.27	0	1	0.27
Blue whale [a]	unknown	0	0	N/A	0	4	N/A	0	0	N/A	0	0	N/A	0	0	N/A
Fin whale [a]	6,802	0	7	0.10	4	13	0.25	0	3	0.04	0	2	0.03	0	2	0.03
Sei whale [a]	6,292	0	2	0.03	1	3	0.06	0	1	0.02	0	0	0.00	0	0	0.00
Minke whale	21,968	0	33	0.15	22	74	0.44	0	5	0.02	0	3	0.01	0	3	0.01
Humpback whale	1,396	0	9	0.64	6	21	1.93	0	3	0.21	0	2	0.14	0	2	0.14
Sperm whale [a]	4,349	0	6	0.14	0	6	0.14	0	3	0.07	0	3	0.07	0	3	0.07
Atlantic white-sided dolphin	93,233	0	12	0.01	0	100	0.11	0	11	0.01	0	5	0.01	0	5	0.01
Atlantic spotted dolphin	39,921	0	135	0.34	0	135	0.34	0	45	0.11	0	45	0.11	0	45	0.11
Common bottlenose dolphins:																
Offshore	62,851	0	671	1.07	0	1,454	2.31	0	349	0.56	0	174	0.28	0	174	0.28
Coastal [b]	6,639	11	1,634	24.78	0	934	14.07	0	934	14.07	0	465	7.00	0	465	7.00
Pilot Whales:																
Short-finned pilot whale	28,924	0	30	0.10	0	30	0.10	0	10	0.03	0	10	0.03	0	10	0.03
Long-finned pilot whale	39,215	0	30	0.08	0	30	0.08	0	10	0.03	0	10	0.03	0	10	0.03
Risso's dolphin	35,215	0	90	0.26	0	90	0.26	0	30	0.09	0	30	0.09	0	30	0.09
Common dolphin	172,974	0	47	0.03	0	1,584	0.92	0	60	0.03	0	29	0.02	0	29	0.02
Harbor porpoise	95,543	10	97	0.11	69	350	0.44	0	45	0.56	0	22	0.02	0	22	0.02
Seals:																
Gray seal	27,300	31	200	0.85	4	305	1.13	0	68	0.25	0	34	0.12	0	34	0.12
Harbor seal	61,336	35	556	0.96	13	844	1.40	0	189	0.31	0	93	0.15	0	93	0.15

[a] Listed as Endangered under the ESA.

[b] Coastal bottlenose dolphin take for bayside (vs. Atlantic-facing) cofferdams is likely overestimated, as this stock has been shown to prefer coastal to estuarine environments (Toth et al. 2011).

Table 6-23. Summary of Level A and Level B Takes for All Activities Conducted During Ocean Wind Construction.

Species	Population Size	5 Year Total		
		Level A	Level B	Max Percent
North Atlantic right whale [a]	368	0	14	3.80
Blue whale [a]	unknown	0	4	N/A
Fin whale [a]	6,802	4	27	0.46
Sei whale [a]	6,292	1	6	0.11
Minke whale	21,968	22	118	0.64
Humpback whale	1,396	6	37	3.08
Sperm whale [a]	4,349	0	24	0.55
Atlantic white-sided dolphin	93,233	0	133	0.14
Atlantic spotted dolphin	39,921	0	405	1.01
Common bottlenose dolphins:				
Offshore	62,851	0	2,822	4.49
Coastal [b]	6,639	11	4,432	66.92
Pilot Whales:				
Short-finned pilot whale	28,924	0	90	0.31
Long-finned pilot whale	39,215	0	90	0.23
Risso's dolphin	35,215	0	270	0.77
Common dolphin	172,974	0	1,749	1.01
Harbor porpoise	95,543	79	536	0.64
Seals:				
Gray seal	27,300	35	641	2.48
Harbor seal	61,336	48	1,775	2.97

[a] Listed as Endangered under the ESA.

[b] Coastal bottlenose dolphin take for bayside (vs. Atlantic-facing) cofferdams is likely overestimated, as this stock has been shown to prefer coastal to estuarine environments (Toth et al. 2011).

References

Toth, J.L., Hohn, A.A., Able, K.W. and Gorgone, A.M., 2011. Patterns of seasonal occurrence, distribution, and site fidelity of coastal bottlenose dolphins (*Tursiops truncatus*) in southern New Jersey, USA. Marine Mammal Science, 27(1), pp.94-110.

Appendix K. List of Agencies, Organizations, and Persons to Whom Copies of the Statement Are Sent

This EIS is available in electronic form for public viewing at https://www.boem.gov/renewable-energy/state-activities/ocean-wind-1. Hard copies and digital versatile disks (DVDs) of the EIS can be requested by contacting the Program Manager, Office of Renewable Energy in Sterling, Virginia. Publication of the Draft EIS initiated a 45-day comment period where government agencies, members of the public, and interested stakeholders could provide comments and input. BOEM accepted comments received or postmarked no later than August 8, 2022, in any of the following ways:

- In hard copy form, delivered by hand or by mail, enclosed in an envelope labeled "Ocean Wind 1 COP EIS" and addressed to Program Manager, Office of Renewable Energy, Bureau of Ocean Energy Management, 45600 Woodland Road, Sterling, Virginia 20166.
- Through the regulations.gov web portal by navigating to http://www.regulations.gov and searching for docket number "BOEM-2022-0021."
- By attending one of the EIS public meetings at the locations and dates listed in the notice of availability and providing written or verbal comments. BOEM used comments received during the public comment period to inform its preparation of the final EIS, as appropriate. EIS notification lists for the Project are provided in Table K-1 through Table K-4.

K.1. Notification List

Table K-1 Federal Agencies

Agency	Contact
Cooperating Federal Agencies	
USEPA	Mark Austin, NEPA Lead, USEPA Region 2
NOAA, NMFS	Sue Tuxbury, Fishery Biologist/Wind Coordinator, Greater Atlantic Regional Fisheries Office, Habitat and Ecosystems Services Division
USCG	Matt Creelman, District 5
U.S. Department of the Interior, BSEE	Juliette Giordano, Lead Environmental Protection Specialist
USACE	Naomi Handell, Regulatory Program Manager, USACE North Atlantic Division Brian Anthony, Biologist, USACE Philadelphia District, Regulatory Branch
USFWS	Eric Schrading, Field Supervisor, New Jersey Field Office
National Park Service	Mary Krueger, Energy Specialist, Project Lead
DOD	Steven Sample, Executive Director, DoD Siting Clearinghouse

Table K-2 State and Local Agencies or Other Interested Parties

Agency	Contact
Cooperating State Agencies	
NJDEP	Megan Brunatti, Director, Office of Permitting & Project Navigation
New York State Department of State	Laura McLean, Coastal Energy Review Specialist
New Jersey Board of Public Utilities	Jim Ferris, P.E., CEM, Deputy Director, Division of Clean Energy
Libraries (Draft EIS only)	
Ocean County Library, Waretown	112 Main Street, Waretown, New Jersey, 08758
Atlantic City Free Public Library (Main)	1 North Tennessee Avenue, Atlantic City, New Jersey, 08401
Ocean City Free Public Library	1735 Simpson Avenue, Ocean City, New Jersey, 08226
Cape May County Library, Wildwood	6300 Atlantic Avenue, Wildwood Crest, New Jersey, 08260

Table K-3 Tribes and Native Organizations

Agency	Contact
Stockbridge-Munsee Community, Band of Mohican Indians	Jeff Bendremer, Tribal Historic Preservation Officer
Delaware Nation	Carissa Speck, Historic Preservation Director
Delaware Tribe of Indians	Susan Bachor, Archaeologist, Delaware Tribe Historic Preservation Office Representative
The Shinnecock Indian Nation	Jeremy Dennis, Junior Tribal Historic Preservation Officer
Wampanoag Tribe of Gay Head (Aquinnah)	Cheryl Andrews-Maltais, Chairwoman Bettina Washington, Tribal Historic Preservation Officer Lael Echo-Hawk, General Counsel

Table K-4 Section 106 Consulting Parties

Government or Organization	Participating Consulting Parties	Contact
SHPOs and State Agencies	NJDEP, Historic Preservation Office	Katherine Marcopul, Administrator and Deputy Historic Preservation Officer
	NJDEP, Office of Historic Sites & Parks	Mark Texel, Administrator
	New Jersey Historic Trust	Dorothy Guzzo, Executive Director
Federal Agencies	ACHP	Christopher Daniel, Federal Property Management Section, Program Analyst Chris Koeppel, Federal Property Management Section, Assistant Director

Government or Organization	Participating Consulting Parties	Contact
	USACE	Naomi Handell, Regulatory Program Manager, USACE North Atlantic Division Brian Anthony, Biologist, Regulatory Branch, USACE Philadelphia District Ann Marie Dilorenzo, Division Section 408 Coordinator, USACE North Atlantic Division Juan Carlos Corona, Philadelphia District Section 408 Coordinator
	USCG	Matt Creelman, District 5 Agency Point of Contact Robb Webb, District 5 George Detweiler, Headquarters Jodi Min, Sector Delaware Bay Elizabeth Marshall, Sector Delaware Bay
	USEPA	Abbey States, Human Health Risk Assessor Mark Austin, Team Leader, Environmental Reviews
	National Park Service	Mary Krueger, Energy Specialist for the Northeast Region Kathy Schlegel, Historical Landscape Architect
	U.S. Naval History and Heritage Command	Dr. Alexis Catsambis, Underwater Archaeology Branch
Federally Recognized Tribes	Delaware Nation	Carissa Speck, Historic Preservation Director
	Delaware Tribe of Indians	Susan Bachor, Archaeologist, Delaware Tribe Historic Preservation Office Representative
	Stockbridge-Munsee Community Band of Mohican Indians	Jeff Bendremer, Tribal Historic Preservation Officer
	The Shinnecock Indian Nation	Jeremy Dennis, Junior Tribal Historic Preservation Officer
	Wampanoag Tribe of Gay Head (Aquinnah)	Cheryl Andrews-Maltais, Chairwoman Bettina Washington, Tribal Historic Preservation Officer Lael Echo-Hawk, General Counsel
Local Government	Atlantic County	Gerald DelRosso, County Administrator Frances Brown, Senior Planner
	Cape May City	Warren Coupland, Historic Preservation Commission Chairperson
	Cape May County	William Cook, Special Council, Cultural Heritage Partners
	City of North Wildwood	Michael J. Donohue, Blaney Donohue & Weinberg, P.C. Nicholas Long, City Administrator
	Harvey Cedars Borough	Daina Dale, Municipal Clerk Jonathan Oldham, Mayor Paul Rice, Commissioner

Government or Organization	Participating Consulting Parties	Contact
	Linwood City	Mary Cole, Deputy Municipal Clerk Leigh Ann, Napoli Municipal Clerk, Registrar of Vital Statistics
	Margate City	Roger McLarnon, Planner, Zoning Officer
	Ocean City	George Savastano, Business Administrator Doug Bergen, Public Information Officer Dottie McCrosson, City Solicitor
	Sea Isle City	George Savastano, Business Administrator Shannon Romano, Municipal Clerk
	Somers Point City	Jason Frost, City Administrator
	Stafford Township	Mathew von der Hayden, Township Administrator Justin Riggs, Assistant to the Administrator
Nongovernmental Organizations or Groups	Absecon Lighthouse	Jean Muchanic, Executive Director
	Flanders Condominium Association	Peter Voudouris, President
	Garden State Seafood Association	Scot Mackey, Trenton Representative
	House at 114 South Harvard Avenue	Donald Feith, Property Owner
	Long Beach Island Historical Association	Ronald Marr, President
	The Noyes Museum of Art	Michael Cagno, Executive Director
	Ritz Condominium Association	Gordon Pherribo, President Board of Trustees
	Rutgers University, Department of Marine and Coastal Sciences	Oscar Schofield, Distinguished Professor and Department Chair
	Save Lucy Committee, Inc.	James M. Rutala, Rutala Associates, LLC
	Vassar Square Condominiums	Paul Snyderman, President, Board of Trustees

Appendix L. Other Impacts

L.1. Unavoidable Adverse Impacts of the Proposed Action

CEQ's NEPA-implementing regulations (40 CFR 1502.16(a)(2)) require that an EIS evaluate the potential unavoidable adverse impacts associated with a Proposed Action. Adverse impacts that can be reduced by mitigation measures but not eliminated are considered unavoidable. Table L-1 provides a listing of such impacts. Most potential unavoidable adverse impacts associated with the Proposed Action would occur during the construction phase and would be temporary. Chapter 3 provides additional information on the potential impacts listed below.

All impacts from planned activities are still expected to occur as described in the No Action Alternative analysis in this EIS, regardless of whether the Proposed Action is approved.

Table L-1 Potential Unavoidable Adverse Impacts of the Proposed Action

Resource Area	Potential Unavoidable Adverse Impact of the Proposed Action
Air Quality	• Air quality impacts from emissions from engines associated with vessel traffic, construction activities, and equipment operation
Bats	• Displacement and avoidance behavior due to habitat loss/alteration, equipment noise, and vessel traffic
Benthic Resources	• Suspension and re-settling of sediments due to seafloor disturbance • Conversion of soft-bottom habitat to new hard-bottom habitat • Habitat quality impacts, including reduction in certain habitat types as a result of seafloor alterations • Disturbance, displacement, and avoidance behavior due to habitat loss/ alteration, equipment activity and noise, and vessel traffic • Individual mortality due to construction activities • Temporary loss of SAV within Barnegat Bay due to cable emplacement
Birds	• Displacement and avoidance behavior due to habitat loss/alteration, equipment noise, and vessel traffic
Coastal Habitat and Fauna	• Habitat alteration and removal of vegetation, including trees • Temporary avoidance behavior by fauna during construction activity and noise-producing activities • Individual fauna mortality due to collision with vehicles or equipment during clearing and grading activities, particularly species with limited mobility
Commercial Fisheries and For-Hire Recreational Fishing	• Disruption of access or temporary restriction in harvesting activities due to construction of offshore Project elements • Disruption of harvesting activities during operations of offshore wind facility • Changes in vessel transit and fishing operation patterns • Changes in risk of gear entanglement or availability of target species
Cultural Resources	• Impacts on viewsheds of historic properties

Resource Area	Potential Unavoidable Adverse Impact of the Proposed Action
Demographics, Employment, and Economics	• Disruption of commercial fishing, for-hire recreational fishing, and marine recreational businesses during offshore construction and cable installation • Hindrances to ocean economy sectors due to the presence of the offshore wind facility, including commercial fishing, recreational fishing, sailing, sightseeing, and supporting businesses
Environmental Justice	• Compounded health issues of local environmental justice communities near ports as a result of air quality impacts from emissions from engines associated with vessel traffic, construction activities, and equipment operation • Loss of employment or income due to disruption to commercial fishing, for-hire recreational fishing, or marine recreation businesses • Hindrances to subsistence fishing due to offshore construction and operation of the offshore wind facility
Finfish, Invertebrates, and Essential Fish Habitat	• Temporary loss of SAV within Barnegat Bay due to cable emplacement • Suspension and re-settling of sediments due to seafloor disturbance • Displacement, disturbance, and avoidance behavior due to construction-related impacts, including noise, vessel traffic, increased turbidity, sediment deposition, and EMF • Individual mortality due to construction activities • Habitat quality impacts, including reduction in certain habitat types as a result of seafloor surface alterations • Conversion of soft-bottom habitat to new hard-bottom habitat
Land Use and Coastal Infrastructure	• Conversion of undeveloped areas to utility right-of-way or easement or cable maintenance or replacement • Land use disturbance due to construction as well as effects due to noise, vibration, and travel delays • Potential for accidental releases during construction
Marine Mammals	• Increased risk of injury (TTS or PTS) to individuals due to underwater noise from pile-driving activities during construction • Disturbance (behavioral effects) and acoustic masking due to underwater noise from pile driving, shipping and other vessel traffic, aircraft, geophysical surveys (HRG surveys and geotechnical drilling surveys), WTG operation, and dredging during construction and operations • Increased risk of individual injury and mortality due to vessel strikes • Increased risk of individual injury and mortality associated with fisheries gear
Navigation and Vessel Traffic	• Congestion in port channels • Increased navigational complexity, vessel congestion, and allision risk within the offshore Wind Farm Area • Potential for disruption to marine radar on smaller vessels operating within or in the vicinity of the Project, increasing navigational complexity • Hindrances to SAR missions within the offshore Wind Farm Area
Other Uses	• Disruption to offshore scientific research and surveys and species monitoring and assessment • Increased navigational complexity for military or national security vessels operating within the Wind Farm Area • Changes to aviation and air traffic navigational patterns

Resource Area	Potential Unavoidable Adverse Impact of the Proposed Action
Recreation and Tourism	• Disruption of coastal recreation activities during onshore construction, such as beach access • Viewshed effects from the WTGs altering enjoyment of marine and coastal recreation and tourism activities • Disruption to access or temporary restriction of in-water recreational activities from construction of offshore Project elements • Temporary disruption to the marine environment and marine species important to fishing and sightseeing due to turbidity and noise • Hindrances to some types of recreational fishing, sailing, and boating within the area occupied by WTGs during operation
Sea Turtles	• Increased risk of for individual injury and mortality due to vessel strikes during construction, O&M, and decommissioning • Disturbance, displacement, and avoidance behavior due to habitat disturbance and underwater noise during construction
Scenic and Visual Resources	• Alterations to the ocean, seascape, landscape character units' character, and effects on viewer experience, by the wind farm, vessel traffic, onshore landing sites, onshore export cable routes, onshore substations, and electrical connections with the power grid
Water Quality	• Increase in suspended sediments due to seafloor disturbance during construction, O&M, and decommissioning
Wetlands and Waters of the US	• Wetland and surface water alterations, including increased sedimentation deposition and removal of vegetation

L.2. Irreversible and Irretrievable Commitment of Resources

CEQ's NEPA-implementing regulations (40 CFR 1502.16(a)(4)) require that an EIS review the potential impacts on irreversible or irretrievable commitments of resources resulting from implementation of a Proposed Action. CEQ considers a commitment of a resource irreversible when the primary or secondary impacts from its use limit the future options for its use. Irreversible commitment of resources typically applies to impacts on nonrenewable resources such as marine minerals or cultural resources. The irreversible commitment of resources occurs due to the use or destruction of a specific resource. An irretrievable commitment refers to the use, loss, or consumption of a resource, particularly a renewable resource, for a period of time.

Table L-2 provides a listing of potential irreversible and irretrievable impacts by resource area. EIS Chapter 3 provides additional information on the impacts summarized below.

Table L-2 Irreversible and Irretrievable Commitment of Resources by Resource Area for the Proposed Action

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Air Quality	No	No	BOEM expects air pollutant emissions to comply with permits regulating compliance with air quality standards. Emissions would be temporary during construction activities. To the extent that the Proposed Action displaces fossil-fuel energy generation, overall improvement of air quality would be expected.

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Bats	Yes	No	Irreversible impacts on bats could occur if one or more individuals were injured or killed; however, implementation of mitigation measures developed in consultation with USFWS would reduce or eliminate the potential for such impacts. Decommissioning of the Project would reverse the impacts of bat displacement from foraging habitat.
Benthic Resources	No	No	Although local mortality of benthic fauna, habitat alteration, and SAV losses is likely to occur, BOEM does not anticipate population-level impacts on benthic organisms; habitat could recover after decommissioning activities.
Birds	Yes	No	Irreversible impacts on birds could occur if one or more individuals were injured or killed; however, implementation of mitigation measures developed in consultation with USFWS would reduce or eliminate the potential for such impacts. Decommissioning of the Project would reverse the impacts of bird displacement from foraging habitat.
Coastal Habitat and Fauna	No	No	Although limited removal of habitat associated with clearing and grading for construction of the onshore export cable and substation are likely to occur, BOEM does not anticipate population-level impacts on flora or fauna; coastal habitat could recover after construction in some areas, and after decommissioning activities in other areas.
Commercial Fisheries and For-Hire Recreational Fishing	No	Yes	Based on the anticipated duration of construction and O&M activities, BOEM does not anticipate irreversible impacts on commercial fisheries. The Project could alter habitat during construction and operations, limit access to fishing areas during construction, or reduce vessel maneuverability during operations. However, the conceptual decommissioning of the Project would reverse those impacts. Irretrievable impacts (lost revenue) could occur due to the loss of use of fishing areas at an individual level.
Cultural Resources	Yes	Yes	Although unlikely, unanticipated removal or disturbance of previously unidentified cultural resources onshore and offshore could result in irreversible and irretrievable impacts.
Demographics, Employment, and Economics	No	Yes	Construction activities could temporarily increase contractor needs, housing needs, supply requirements, and demand for local businesses, leading to an irretrievable loss of workers for other projects. These factors could lead to increased housing and supply costs.

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Environmental Justice	No	Yes	Impacts on environmental justice communities could occur due to loss of income or employment for low-income workers in marine industries; this could be reversed by Project decommissioning or by other employment, but income lost during Project operations would be irretrievable.
Finfish, Invertebrates, and Essential Fish Habitat	No	No	Although local mortality of finfish and invertebrates and habitat alteration and loss of SAV habitat could occur, BOEM does not anticipate population-level impacts on finfish, invertebrates, and essential fish habitat. It is expected that the aquatic habitat for finfish and invertebrates would recover following decommissioning activities.
Land Use and Coastal Infrastructure	Yes	Yes	Land use required for construction and operational activities could result in a minor irreversible impact. Construction activities could result in a minor irretrievable impact due to the temporary loss of use of the land for otherwise typical activities. Onshore facilities may or may not be decommissioned.
Marine Mammals	No	Yes	Irreversible impacts on marine mammal populations could occur if one or more individuals of an ESA-listed species were injured or killed or if those populations experienced behavioral effects of high severity. With implementation of mitigation measures, developed in consultation with NMFS (e.g., timing windows, vessel speed restrictions, safety zones), the potential for an ESA-listed species to experience high-severity behavioral effects or be injured or killed would be reduced or eliminated. No irreversible high-severity behavioral effects from Project activities are anticipated, as described in Section 3.15; however, due to the uncertainties from lack of information that are outlined in Appendix D, these effects are still possible. Irretrievable impacts could occur if individuals or populations grow more slowly as a result of displacement from the Project area.
Navigation and Vessel Traffic	No	Yes	Based on the anticipated duration of construction and operations, BOEM does not anticipate impacts on vessel traffic to result in irreversible impacts. Irretrievable impacts could occur due to changes in transit routes, which could be less efficient during the life of the Project.
Other Uses	No	Yes	Disruption of offshore scientific research and surveys would occur during proposed Project construction, operations, and decommissioning activities.
Recreation and Tourism	No	No	Construction activities near the shore could result in a minor, temporary loss of use of the land for recreation and tourism purposes.

Resource Area	Irreversible Impacts	Irretrievable Impacts	Explanation
Sea Turtles	No	Yes	Irreversible impacts on sea turtles could occur if one or more individuals of species listed under the ESA were injured or killed; however, the implementation of mitigation measures, developed in consultation with NMFS, would reduce or eliminate the potential for impacts on listed species. Irreversible impacts could occur if individuals or populations grow more slowly as a result of injury or mortality due to vessel strikes or entanglement with fisheries gear caught on the structures, or due to displacement from the Project area.
Scenic and Visual Resources	No	No	Long-term (until post-decommissioning) seascape unit, open ocean unit, and landscape units' character alterations, and effects on viewer experience, by the wind farm, vessel traffic, onshore landing sites, onshore export cable routes, onshore substations, and electrical connections with the power grid would occur.
Water Quality	No	No	BOEM does not expect activities to cause loss of, or major impacts on, existing inland waterbodies or wetlands. Turbidity impacts in marine and coastal environments would be short term.
Wetlands	No	No	BOEM does not expect activities to cause loss of, or major impacts on, existing inland waterbodies or wetlands.

L.3. Relationship Between the Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

CEQ's NEPA-implementing regulations (40 CFR 502.16(a)(3)) require that an EIS address the relationship between short-term use of the environment and the potential impacts of such use on the maintenance and enhancement of long-term productivity. Such impacts could occur as a result of a reduction in the flexibility to pursue other options in the future, or assignment of a specific area (land or marine) or resource to a certain use that would not allow other uses, particularly beneficial uses, to occur at a later date. An important consideration when analyzing such effects is whether the short-term environmental effects of the action will result in detrimental effects on long-term productivity of the affected areas or resources.

As assessed in EIS Chapter 3, BOEM anticipates that the majority of the potential adverse effects associated with the Proposed Action would occur during construction activities and would be short term in nature and minor to moderate in severity/intensity. These effects would cease after decommissioning activities. In assessing the relationships between short-term use of the environment and the maintenance and enhancement of long-term productivity, it is important to consider the long-term benefits of the Proposed Action, which include:

- Promotion of clean and safe development of domestic energy sources and clean energy job creation;
- Promotion of renewable energy to help ensure geopolitical security, combat climate change, and provide electricity that is affordable, reliable, safe, secure, and clean;

- Delivery of power to the New Jersey energy grid to contribute to the state's renewable energy requirements; and
- Increased habitat for certain fish species.

Based on the anticipated potential impacts evaluated in this document and the Final EIS that could occur during Proposed Action construction, O&M, and decommissioning, and with the exception of some potential impacts associated with onshore components, BOEM anticipates that the Proposed Action would not result in impacts that would significantly narrow the range of future uses of the environment. Removal or disturbance of habitat associated with onshore activities could create long-term irreversible impacts. For purposes of this analysis, BOEM assumes that the irreversible impacts presented in Table L-2 would be long term. After completion of the Proposed Action's operations and decommissioning phases, however, BOEM expects the majority of marine and onshore environments to return to normal long-term productivity levels.

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Appendix M. Seascape, Landscape, and Visual Impact Assessment

M.1. Introduction

This appendix describes the SLVIA methodology and key findings that BOEM used to identify the potential impacts of offshore wind structures (WTGs and OSS) on scenic and visual resources within the geographic analysis area. This SLVIA methodology applies to any offshore wind energy development proposed for the OCS and incorporates by reference the detailed description of the methodology described in the *Assessment of Seascape, Landscape, and Visual Impacts of Offshore Wind Energy Developments on the Outer Continental Shelf of the United States* (BOEM 2021). Section M.2, *Method of Analysis*, describes the specific methodology used to apply the SLVIA methodology to the Ocean Wind 1 COP and Section M.3, *Results,* summarizes the wind farm distances, FOVs, noticeable elements, visual contrasts, scale of change, and prominence that contributed to the determination of impact levels for each KOP under the Proposed Action and each of the action alternatives that include modifications to WTG array layouts (Alternatives B-1, B-2, C-1, C-2, and D). The Project's incremental contribution to cumulative impacts of the action alternatives in combination with other planned offshore wind projects is also assessed. An overview map of scenic resources present in the geographic analysis area is included as Attachment M-1, *Scenic Resources Overview Map*. Visual simulations of the Proposed Action alone, other planned offshore wind projects without the Proposed Action, and other offshore wind projects in combination with the Proposed Action are included in Attachment M-2, *Cumulative Visual Simulations*. Visual simulations of Alternatives B-1, B-2, and C-1 are included in Attachment M-3, *Visual Simulations of Action Alternatives*. Nighttime visual simulations are included as Attachment M-4, *Nighttime Visual Simulations*.

M.2. Method of Analysis

The SLVIA has two separate but linked parts: seascape, open ocean, and landscape impact assessment (SLIA) and VIA. SLIA analyzes and evaluates impacts on both the physical elements and features that make up a landscape, seascape, or open ocean; and the aesthetic, perceptual, and experiential aspects of the landscape, seascape, or open ocean that make it distinctive. These impacts affect the "feel," "character," or "sense of place" of an area of landscape, seascape, or open ocean, rather than the composition of a view from a particular place. In SLIA, the impact receptors (the entities that are potentially affected by the proposed Project) are the seascape/open ocean/landscape itself and its components, both its physical features and its distinctive character.

VIA analyzes and evaluates the impacts on people of adding the proposed development to views from selected viewpoints. VIA evaluates the change to the composition of the view itself and assesses how the people who are likely to be at that viewpoint may be affected by the change to the view. Enjoyment of a particular view is dependent on the viewer and, in VIA, the impact receptors are people. The inclusion of both SLIA and VIA in the BOEM SLVIA methodology is consistent with NEPA's objective of providing Americans with aesthetically and culturally pleasing surroundings and its requirement to consider all potentially significant impacts of development.

The magnitude of effect in a seascape, open ocean, landscape, or view depends on the nature, scale, prominence, and visual contrast of the change and its experiential duration. The SLVIA offshore geographic analysis area consists of the extent of the zone of theoretical visibility and zones of visual influence (COP Volume III, Appendix L; Ocean Wind 2023), as follows:

- Offshore turbine array area where the WTGs and OSS would be located plus a 40-mile (64.4-kilometer) radius area. This distance is the maximum extent within which a seascape, landscape, or visual effect could occur, given visibility of the maximum height of the WTG rotor (906 feet [276.1 meters]).

The OSS (maximum height of 296 feet [90.2 meters]) would potentially be visible to a distance of 23.8 miles (38.3 kilometers).

WTG visibility would be variable through the day depending on many factors. View angle, sun angle, and atmospheric conditions would affect the WTG visibility. Visual contrast of WTGs would vary throughout the day depending on the visual character of the horizon's backdrop and whether the WTGs are backlit, side-lit, or front-lit. If less visual contrast is apparent in the morning hours, then it is likely that the visual contrast may be more pronounced in the afternoon. The inverse is possible, as well. These effects are also influenced by varying atmospheric conditions, direction of view, distance between the viewer and the WTGs, and elevation of the viewer.

At closer distances, approximately 12 miles or closer, the form of the WTG may be the dominant visual element creating the visual contrast regardless of color. At greater distances, color may become the dominant visual element creating visual contrast under certain visual conditions that gives visual definition to the WTG's form and line.

As the elevation of the viewer increases, the lesser the effect EC has on the visible height of individual WTGs.

While the East Coast shoreline has a prevailing eastward viewing direction, localized views may vary from southwest to north-northeast. All cardinal directions are conceivable when viewing from a water vessel while at sea. When viewing from onshore toward a northerly direction and scanning to the south, the color of the horizon backdrop will often vary. Variation will continue as the sun arcs across the sky from sunrise to sunset. Depending on sun angle, the backdrop sky color may have various intensities of white to gray and sky blue to pale blue to dark blue-gray. Partly cloudy to overcast conditions will also influence the color make-up of the horizon's backdrop. The sunrise and sunset have varying degrees of light blue to dark blue, light and dark purples intermixed with oranges, yellows, and reds. Partly cloudy skies may increase the remarkable color effects during the sunset and sunrise periods of the day.

When placing WTGs offshore, the visual interplay and contrasting elements in form, line, color, and texture may vary with the ever-changing character of the backdrop. Front-lit WTGs may have strong color contrast against a darker gray sky, giving definition to the WTG vertical form and line contrast to the ocean's horizontal character and the line where the sea meets sky, or visually dissipate against a whiter backdrop created by high levels of evaporative atmospheric moisture during clear sunny days. Partly cloudy skies may create varying degrees of sunlight reflecting off the white color wind turbines, placing some WTGs in the shadow and making them appear darker gray and less conspicuous while highlighting others with a bright white color contrast. The level of noticeability would be directly proportional to the degree of visual contrast and scale of change between the WTGs and the corresponding backdrop.

These variations through the course of the day may result in periods of moderate to major visual effect while at other times of day would have minor or negligible effect.

The onshore geographic analysis area includes landfalls, buried onshore export cables, onshore substations, and transmission connections to the electric grid. The visual impacts of onshore components are assessed in Section 3.20, *Scenic and Visual Resources*.

The SLVIA methodology and parameters assessed consider local stakeholders' identity, culture, values, and issues and the understanding of baseline maritime conditions. Project activities for all stages of the Project life cycle (construction and installation, O&M, and decommissioning) are assessed against the environmental baseline to identify the potential interactions between the Project and the seascape, landscape, and viewers. Potential impacts are assessed to determine an impact level consistent with the definitions in Table M-1.

Table M-1 Definitions of Potential Adverse Impact Levels

Impact Level	Historic Properties under Section 106 of the NHPA	Visual Resources
Negligible	No historic properties affected, as defined at 36 CFR 800.4(d)(1).	SLIA: Very little or no effect on seascape/landscape unit character, features, elements, or key qualities either because unit lacks distinctive character, features, elements, or key qualities; values for these are low; or Project visibility would be minimal. VIA: Very little or no effect on viewer experiences because Project visibility/contrast/magnitude of change are minimal, or view receptor sensitivity/susceptibility/value is minimal.
Minor	No adverse effects on historic properties could occur, as defined at 36 CFR 800.5(b).	SLIA: The Project would introduce features that may have low to medium levels of visual prominence within the geographic area of an ocean/seascape/landscape character unit. The Project features may introduce a visual character that is somewhat inconsistent with the character of the unit, which may have minor to medium negative effects on the unit's features, elements, or key qualities, but the unit's features, elements, or key qualities have low susceptibility or value. SLIA: The Project would introduce features that may have low to medium levels of visual prominence within the geographic area of an ocean/seascape/landscape character unit. The Project features may introduce a visual character that is somewhat inconsistent with the character of the unit, which may have minor to medium negative effects on the unit's features, elements, or key qualities, but the unit's features, elements, or key qualities have low susceptibility or value. VIA: The visibility of the Project would introduce a small but noticeable to medium level of change to the view's character, have a low to medium level of visual prominence that attracts but may or may not hold the viewer's attention, and have a small to medium effect on the viewer's experience. The viewer receptor sensitivity/susceptibility/value is low. If the value, susceptibility, and viewer concern for change are medium or high, the nature of the sensitivity is evaluated to determine if elevating the impact to the next level is justified. For instance, a KOP with a low magnitude of change but a high level of viewer concern (combination of susceptibility/value) may justify adjusting to a moderate level of impact.

Impact Level	Historic Properties under Section 106 of the NHPA	Visual Resources
Moderate	Adverse effects on historic properties as defined at 36 CFR 800.5(a)(1) could occur but would be avoided or minimized using a less-impactful scenario contemplated under the PDE.	SLIA: The Project would introduce features that would have medium to large levels of visual prominence within the geographic area of an ocean/seascape/landscape character unit. The Project would introduce a visual character that is inconsistent with the character of the unit, which may have a moderate negative effect on the unit's features, elements, or the key qualities. In areas affected by large magnitudes of change, the unit's features, elements, or key qualities have low susceptibility or value. VIA: The visibility of the Project would introduce a moderate to large level of change to the view's character, may have a moderate to large levels of visual prominence that attracts and holds but may or may not dominate the viewer's attention, and has a moderate effect on the viewer's visual experience. The viewer receptor sensitivity/susceptibility/value is medium to low. Moderate impacts are typically associated with medium viewer receptor sensitivity (combination of susceptibility/value) in areas where the view's character has medium levels of change, or low viewer receptor sensitivity (combination of susceptibility/value) in areas where the view's character has large changes. If the value, susceptibility, and viewer concern for change is high, the nature of the sensitivity is evaluated to determine if elevating the impact to the next level is justified.
Major	Adverse effects on historic properties as defined at 36 CFR 800.5(a)(1) could occur; at least some would require mitigation to resolve.	SLIA: The Project would introduce features that would have dominant levels of visual prominence within the geographic area of an ocean/seascape/landscape character unit. The Project would introduce a visual character that is inconsistent with the character of the unit, which may have a major negative effect on the unit's features, elements, or key qualities. The concern for change (combination of susceptibility/value) to the character unit is high. VIA: The visibility of the Project would introduce a major level of character change to the view; attract, hold, and dominate the viewer's attention; and have a moderate to major effect on the viewer's visual experience. The viewer receptor sensitivity/susceptibility/value is medium to high. If the magnitude of change to the view's character is medium but the susceptibility or value at the KOP is high, the nature of the sensitivity is evaluated to determine if elevating the impact to major is justified. If the sensitivity (combination of susceptibility/value) at the KOP is low in an area where the magnitude of change is large, the nature of the sensitivity is evaluated to determine if lowering the impact to moderate is justified.

M.3. Results

M.3.1 Proposed Action

Atmospheric conditions offshore and near the shoreline limit views more than the typically drier-air conditions in inland areas. Visual simulations from representative viewpoints included as Appendix D to the *Ocean Wind Visual Impact Assessment Report* (COP Volume III, Appendix L; Ocean Wind 2023) indicate that daytime and nighttime visibility of WTGs and OSS would be noticeable to the casual observer from beach viewpoints. Distances to the Proposed Action WTG and OSS array would range from:

- 28.1 miles (45.2 kilometers) from KOP-3 (Bay View Park) on the northern extent of the geographic analysis area;
- 15.3 miles (24.6 kilometers) from KOP-12 and KOP-13 (Atlantic City Beachfront), which is the closest KOP to the front edge of the WTG array; and
- 25.9 miles (41.7 kilometers) from KOP-26 (Wildwood Crest Fishing Pier) on the southern extent of the geographic analysis area.

The noticeable daytime and nighttime elements of the Project's WTGs and substations and their viewshed distances are listed in Table M-2. Each WTG would have two L-864 flashing red obstruction lights on the top of the nacelle, one of which is required to be lit (BOEM 2021). WTGs would have additional intermediate lighting on the tower utilizing low-intensity red flashing (L-810) obstruction lighting (see Section 2.1.1.2, *Offshore Activities and Facilities*). Line-of-sight calculations for onshore viewers (5-foot [1.5-meter] eye level) are based on intervening EC screening (7.98 inches [20.3 centimeters] height per mile). Heights of WTG and substation components are stated relative to MLLW and highest astronomical tide.

Table M-3 and Table M-4 indicate the Proposed Action's effects based on horizontal FOV and vertical FOV, respectively, defined as the extent of the observable landscape seen at any given moment, usually measured in degrees (BOEM 2021). The horizontal FOV for each KOP is listed in Appendix D to COP Volume III, Appendix L (Ocean Wind 2023). FOVs are valid and reliable indicators of the magnitude of view occupation by Proposed Action facilities. Typical human perception extends to 124° in the horizontal axis and 55° in the vertical axis. The nearest shoreline viewers would be 15.3 miles (25.9 kilometers) from the Wind Farm Area. EC, at this distance, reduces the observable height above the horizon of the nearest WTG from 906 feet (276.1 meters) MLLW to 801 feet (244 meters), resulting in occupation of 0.6° and 1 percent of the vertical view. WTGs would further diminish in perceived size with distance and EC.

Table M-2 Heights of Noticeable[1] 12-MW WTG Elements and Substations and Visible Distances[2]

Noticeable Element	Height in Feet (meters)	Visible Distance[2] in Miles (kilometers)
Rotor Blade Tip	906 (276) MLLW	0–39.6 (63.7)
Navigation Light	531 (162) MLLW	0–31.0 (49.9)
Nacelle	521 (159) MLLW	0–30.7 (49.4)
Hub	512 (156) MLLW	0–30.5 (49.1)
OSS	296 (90) MLLW	0–23.8 (38.3)
Mid-tower Light	256 (78) MLLW	0–22.4 (36.0)
Yellow Tower Base Color	50 (15) HAT	0–11.4 (18.3)

[1] Perception of Project elements, from 5.5 feet (1.7 meters) human eye level while standing at mean sea level, involves static distance-related sizes, forms, lines, colors, and textures; variable daytime lighting conditions; variable nighttime light conditions; and variable meteorological conditions.
[2] Based on intervening EC and clear-day conditions.
HAT = highest astronomical tide

Table M-3 Horizontal FOV Occupied by the Proposed Action

Noticeable Element	Width miles (kilometers)	Distance miles (kilometers)	Horizontal FOV	Human FOV	Percent of FOV
Wind Farm	11.8 (19.0)	15.3 (25.9)	37.6°	124°	30%

Table M-4 Vertical FOV Occupied by the Proposed Action

Noticeable Element	Height feet (meters)	Distance miles (kilometers)	Height Above Horizon[1] feet (meters)	Vertical FOV	Human FOV	Percent of FOV
Rotor Blade Tip	906 feet (276.1) MLLW	15.3 (25.9)	801 (244)	0.6°	55°	1%

[1] Based on intervening EC and clear-day conditions.

Table M-5 lists the wind farm's distances, horizontal FOVs, noticeable features based on their heights and EC, and visual contrasts. The analysis considers the introduction of WTGs and OSS to an open ocean baseline. The scale, size, contrast, and prominence of change focuses on the:

- Arrangement of WTGs and OSS in the view;
- Horizontal FOV and vertical FOV scale of the wind farm array, based on WTG and OSS size and number;
- Position of the array in the open ocean;
- Position of the array in the view; and
- Turbine array's distance from the viewer.

Visibility, character-changing effects, and visual contrasts reduce steadily with distance from the observation point. Visibility, character-changing effects, scale, prominence, and visual contrasts increase with elevated observer position in comparison with the wind farm. Distance and observer elevation considerations are informed by the VIA simulations (Appendix D to COP Volume III, Appendix L; Ocean Wind 2023), EC calculations, horizontal FOV, and vertical FOV in undeveloped open ocean. The wind farm and nearest WTGs would be:

- Unavoidably dominant features in the view between 0 and 5 miles (0–8 kilometers) distance;
- Strongly pervasive features between 5 and 12 miles (8–19.3 kilometers) distance;
- Clearly visible features between 12 and 28 miles (19.3–45.1 kilometers) distance;
- Low on the horizon, but persistent features in the view between 28 and 31 miles (45.1–49.9 kilometers) distance;
- Intermittently noticed features between 31 and 39.6 miles (49.9–63.7 kilometers) distance; and
- Below the horizon beyond 39.6 miles (63.7 kilometers) distance.

Visual contrast determinations involve comparisons of characteristics of the seascape, open ocean, and landscape before and after Project implementation. The range of potential contrasts includes strong, moderate, weak, and none (BOEM 2021). The strongest daytime contrasts would result from tranquil and flat seas combined with sunlit WTG towers, nacelles, flickering rotors, and a yellow tower base color against a dark background sky and an undifferentiated foreground. There would be daily variation in WTG color contrast as sun angles change from backlit to front-lit (sunrise to sunset) and the backdrop would vary under different lighting and atmospheric conditions. The weakest daytime contrasts would result from turbulent seas combined with overcast daylight conditions on WTG towers, nacelles, and rotors against an overcast background sky and a foreground modulated by varied landscape elements. The strongest nighttime contrasts would result from dark skies (absent moonlight) combined with navigation lights, activated lighting on the OSS, mid-tower lights, and Project lighting reflections on low clouds and active (non-reflective) surf, and the dark-sky light dome. The weakest nighttime contrasts would result from moonlit, cloudless skies; tranquil (reflective) seas; ADLS activation; and only mid-tower lights.

The seascape character units, landscape character units, and viewer experiences would be affected by the Proposed Action’s noticeable features, applicable distances and FOV extents, open views versus view framing and intervening foregrounds, and form, line, color, and texture contrasts, scale of change, and prominence in the characteristic seascape and landscape. Higher impact levels would stem from unique, extensive, and long-term appearance of strongly contrasting, large, and prominent vertical structures in the otherwise horizontal seascape environment; where structures are an unexpected element and viewer experience is of formerly open views of high-sensitivity seascape and landscape; and from high sensitivity view receptors.

Construction involving moving and stationary visual feature contrasts to forms, lines, colors, and textures, scale, and prominence in formerly open seascape may have more effect on viewers than operational and decommissioning impacts, where the viewing context is existing WTGs and substations. Construction impacts would be temporary and include:

- Daytime and nighttime movement of installation vessels, cranes, and other equipment visible in the seascape in and around the Lease Area;
- Dawn, dusk, and nighttime construction lighting on WTGs and OSS;
- Beach, other sensitive land-based, and boat and cruise ship views of WTGs and OSS under construction;
- Laying of the offshore and onshore buried export cables and the connections between offshore and onshore export cables at high-sensitivity Island Beach State Park and Ocean City beach landing sites; and
- Activities along the onshore landfalls, export cable routes, and BL England and Oyster Creek onshore substations.

Operational effects would be similar to those of end-stage construction and would be long term and fully reversible.

Proposed Action impacts on high-sensitivity seascape character would be **major**. The daytime and nighttime (lighting) presence of the WTGs, OSS, and construction and O&M vessel traffic would change perception of this area from natural, undeveloped seascape to a developed wind energy environment characterized by visually dominant WTGs and OSS.

Maintenance activities would cause **minor** effects on seascape character by increased O&M vessel traffic to and from the Wind Farm Area. Increases in these vessel movements would be noticeable to offshore viewers but are unlikely to have a significant effect.

Decommissioning would involve the removal of all offshore structures and is expected to follow the reverse of the construction activity. Decommissioning activities would cause effects similar to those of construction activities.

Viewshed analyses (Appendix A to COP Volume III, Appendix L; Ocean Wind 2023) determined that clear-weather visibility of the WTGs and OSS would occur from 12.5 percent of the land area within the Proposed Action's zone of visual influence. The Proposed Action would be visible along the barrier islands' eastern beaches. The majority of landward visibility (155 square miles) would occur within 15–20 miles of the Proposed Action over inland bays. Visibility would diminish significantly between 30 and 40 miles, contributing 44 square miles to the zone of visual influence. Due to coastal meteorological conditions, Proposed Action visibility in these areas would be noticeably reduced on approximately 3 days out of 4 to 5 days.

Daytime lighting of WTGs is not required. ADLS would reduce nighttime impact levels from **major** to **moderate** or **moderate** to **minor**, due to substantially limited hours of lighting. Residual impacts would result from the presence of continuously flashing lights, sky light dome, and reflections on clouds during those limited hours. Lights of the three OSS, when lit for maintenance, potentially would be visible from beaches and adjoining land and built environment during hours of darkness. The nighttime sky light dome and cloud lighting caused by reflections from the water surface may be seen from distances beyond the 40-mile (64.4-kilometer) geographic analysis area, depending on variable ocean surface and meteorological reflectivity. Onshore substations' nighttime lighting would be visible in their immediate neighborhoods during hours of darkness and similar in magnitude and extent to existing conditions.

Table M-5 Wind Farm Distances, FOVs, Noticeable Elements, Visual Contrasts, Scale of Change, and Prominence

KOP[1]	Distance in miles (kilometers)						Proposed Action FOV Degrees (% of 124°)	Noticeable Elements[2] & Impact Level	Contrast, Scale of Change, and Prominence							
	Proposed Action	Alternative B-1	Alternative B-2	Alternative C-1	Alternative C-2	Alternative D			Proposed Action Form	Proposed Action Line	Proposed Action Color	Proposed Action Texture	Proposed Action Scale	Proposed Action Prominence[3]	Alternatives B-1, B-2	Alternatives C-1, C-2, D
KOP-1	38.6 (62.1)	38.7 (62.3)	39.9 (64.2)	38.4 (61.8)	39.6 (63.7)	38.6 (62.1)	17° (14%)	R **Minor**	Weak	Weak	Weak	Weak	Small	2	Same as Proposed Action	Same as Proposed Action
KOP-2	33.4 (53.7)	33.4 (53.7)	34.7 (55.8)	33 (53.1)	34.3 (55.2)	34.3 (55.2)	20° (16%)	R **Negligible**	Weak	Weak	Weak	Weak	Small	2	Same as Proposed Action	Same as Proposed Action
KOP-3	28.1 (45.2)	28.1 (45.2)	29.5 (47.5)	27.6 (44.4)	28.9 (46.5)	28.9 (46.5)	23° (18%)	R, NL, N, and H **Minor**	Weak	Weak	Weak	Weak	Small	2	Same as Proposed Action	Same as Proposed Action
KOP-4	28.0 (45.1)	28 (45.1)	29.8 (47.9)	26.5 (42.6)	28.3 (45.5)	28.3 (45.5)	19° (15%)	R, NL, N, and H **Minor**	Weak	Weak	Weak	Weak	Small	1	Same as Proposed Action	Same as Proposed Action
KOP-5	22.6 (36.4)	22.6 (36.4)	24.2 (38.9)	21.7 (34.9)	23.2 (37.3)	23.2 (37.3)	28° (22%)	R, NL, N, H, and O[1] **Minor**	Weak	Weak	Weak	Weak	Small	2	Same as Proposed Action	Same as Proposed Action
KOP-6	21.8 (35.1)	21.9 (35.2)	23.2 (37.3)	20.7 (33.3)	22.4 (36)	22.4 (36)	30° (24%)	R, NL, N, H, O, and M[1] **Minor**	Weak	Weak	Weak	Weak	Small	2	Same as Proposed Action	Same as Proposed Action
KOP-7	20.4 (32.8)	20.1 (32.3)	21.2 (34.1)	18.4 (29.6)	20.1 (32.3)	20.2 (32.5)	33° (27%)	R, NL, N, H, O, and M[1] **Minor**	Weak	Weak	Weak	Weak	Small	3	Same as Proposed Action	Same as Proposed Action
KOP-8	21.0 (33.8)	21.1 (33.9)	22.7 (36.5)	19.8 (31.9)	21 (33.8)	21 (33.8)	31° (25%)	R, NL, N, H, O, and M[1] **Minor**	Weak	Weak	Weak	Weak	Small	1	Same as Proposed Action	Same as Proposed Action
KOP-9	16.8 (27.0)	16.8 (27.0)	17.9 (28.8)	15.3 (24.6)	17.5 (28.2)	17 (27.4)	37° (30%)	R, NL, N, H, O, and M[1] **Moderate**	Weak	Moderate	Moderate	Weak	Medium	4	Same as Proposed Action	Same as Proposed Action
KOP-10	16.2 (26.1)	16.3 (26.2)	17.3 (27.8)	14.6 (23.5)	16.5 (26.5)	16.3 (26.2)	39° (31%)	R, NL, N, H, O, and M[1] **Moderate**	Weak	Moderate	Moderate	Weak	Medium	4	Same as Proposed Action	Same as Proposed Action
KOP-11	19.7 (31.7)	19.8 (31.9)	21.6 (34.8)	18.9 (30.4)	19.8 (31.9)	19.8 (31.9)	23° (18%)	R, NL, N, H, O, and M[1] **Minor**	Weak	Weak	Weak	Weak	Small	2	Same as Proposed Action	Same as Proposed Action
KOP-12	16.0 (25.7)	16 (25.7)	16.8 (27)	14 (22.5)	15.1 (24.3)	15.1 (24.3)	41° (33%)	R, NL, N, H, O, and M[1] **Moderate**	Weak	Moderate	Moderate	Weak	Medium	4	Same as Proposed Action	Same as Proposed Action
KOP-13	16.0 (25.7)	16 (25.7)	16.8 (27)	14 (22.5)	15.1 (24.3)	15.1 (24.3)	41° (33%)	R, NL, N, H, O, and M[1] **Minor**	Weak	Weak	Weak	Weak	Medium	6	Same as Proposed Action	Same as Proposed Action
KOP-14	15.3 (25.6)	16 (25.7)	16.9 (27.2)	14.1 (22.7)	15.2 (24.5)	15.2 (24.5)	41° (33%)	R, NL, N, H, O, and M[1] **Moderate**	Moderate	Moderate	Moderate	Weak	Medium	4	Same as Proposed Action	Same as Proposed Action
KOP-15	15.8 (25.4)	16.7 (26.9)	17.7 (28.5)	14.9 (24.0)	15.8 (25.4)	15.8 (25.4)	1° (.8%)	Unseen **Negligible**	None	None	None	None	None	0	Same as Proposed Action	Same as Proposed Action
KOP-16	16.0 (25.7)	17 (27.4)	17.9 (28.8)	15.3 (24.6)	16 (25.7)	16 (25.7)	39° (31%)	R, NL, N, H, O, and M[1] **Moderate**	Moderate	Moderate	Moderate	Weak	Medium	4	Same as Proposed Action	Same as Proposed Action
KOP-17	18.3 (29.4)	19.3 (31.1)	20.2 (32.5)	18.4 (29.6)	18.3 (29.4)	18.4 (29.6)	31° (25%)	R, NL, N, H, O, and M[1] **Minor**	Weak	Weak	Weak	Weak	Medium	3	Same as Proposed Action	Same as Proposed Action
KOP-18	15.4 (24.8)	16.5 (26.5)	17.4 (28.0)	15.4 (24.8)	15.4 (24.8)	15.6 (25.1)	36° (29%)	R, NL, N, H, O, and M[1] **Moderate**	Moderate	Weak	Moderate	Weak	Medium	4	Same as Proposed Action	Same as Proposed Action
KOP-19	16.2 (26.1)	17.1 (27.5)	18 (29.0)	16.2 (26.1)	16.2 (26.1)	16.3 (26.2)	34° (27%)	R, NL, N, H, O, and M[1] **Moderate**	Moderate	Moderate	Moderate	Weak	Medium	4	Same as Proposed Action	Same as Proposed Action
KOP-20	17.4 (28.0)	18.1 (29.1)	18.9 (30.4)	17.4 (28.0)	17.4 (28.0)	17.4 (28.0)	19° (15%)	R, NL, N, H, O, and M[1] **Negligible**	Weak	Weak	Weak	Weak	Small	2	Same as Proposed Action	Same as Proposed Action
KOP-21	17.8 (28.6)	18.5 (29.8)	19.1 (30.7)	17.8 (28.6)	17.8 (28.6)	17.9 (28.8)	29° (23%)	R, NL, N, H, O, and M[1] **Moderate**	Moderate	Weak	Moderate	Weak	Medium	4	Same as Proposed Action	Same as Proposed Action
KOP-22	20.9 (33.6)	21.5 (34.6)	22 (35.4)	20.9 (33.6)	20.9 (33.6)	21 (33.8)	25° (20%)	R, NL, N, H, O, and M[1] **Minor**	Weak	Weak	Weak	Weak	Small	3	Same as Proposed Action	Same as Proposed Action

KOP[1]	Distance in miles (kilometers)						Proposed Action FOV Degrees (% of 124°)	Noticeable Elements[2] & Impact Level	Contrast, Scale of Change, and Prominence							
	Proposed Action	Alternative B-1	Alternative B-2	Alternative C-1	Alternative C-2	Alternative D			Proposed Action Form	Proposed Action Line	Proposed Action Color	Proposed Action Texture	Proposed Action Scale	Proposed Action Prominence[3]	Alternatives B-1, B-2	Alternatives C-1, C-2, D
KOP-23	20.9 (33.6)	21.5 (34.6)	22 (35.4)	20.9 (33.6)	20.9 (33.6)	21 (33.8)	25° (20%)	R, NL, N, H, O, and M[1] **Minor**	Weak	Weak	Weak	Weak	Small	3	Same as Proposed Action	Same as Proposed Action
KOP-24	24.3 (39.1)	24.8 (39.9)	25.2 (40.5)	24.3 (39.1)	24.3 (39.1)	24.4 (39.3)	22° (18%)	R, NL, N, H, and O[1] **Minor**	Weak	Weak	Weak	Weak	Small	3	Same as Proposed Action	Same as Proposed Action
KOP-25	23.6 (38.0)	24.1 (38.8)	24.5 (39.4)	23.6 (38.0)	23.6 (38.0)	23.7 (38.1)	9° (7%)	R, NL, N, H, and O[1] **Minor**	Weak	Weak	Weak	Weak	Small	3	Same as Proposed Action	Same as Proposed Action
KOP-26	25.9 (41.7)	26.4 (42.5)	26.7 (43.0)	25.9 (41.7)	25.9 (41.7)	26 (41.8)	20° (16%)	R, NL, N, and H **Minor**	Weak	Weak	Weak	Weak	Small	3	Same as Proposed Action	Same as Proposed Action
KOP-27	28.4 (45.7)	28.8 (46.3)	29.1 (46.8)	28.4 (45.7)	28.4 (45.7)	28.5 (45.8)	18° (14%)	R, NL, N, and H **Minor**	Weak	Weak	Weak	Weak	Small	2	Same as Proposed Action	Same as Proposed Action
KOP-28	33.9 (54.5)	34.3 (55.2)	34.6 (55.7)	33.9 (54.5)	33.9 (54.5)	34 (54.7)	23° (18%)	R **Minor**	Weak	Weak	Weak	Weak	Small	1	Same as Proposed Action	Same as Proposed Action
KOP-29	Sub-station	NA	NA	NA	NA	NA	NA	**Minor**	Weak	Weak	Weak	Weak	Small	3	Same as Proposed Action	Same as Proposed Action
KOP-30	Sub-station	NA	NA	NA	NA	NA	NA	**Minor**	Weak	Weak	Weak	Weak	Small	3	Same as Proposed Action	Same as Proposed Action
KOP-31	0–40 (0–64)	0–40 (0–64)	0–40 (0–64)	0–40 (0–64)	0–40 (0–64)	0–40 (0–64)	124° (100%)	R, NL, N, H, O, M, and Y **Major**	Strong	Strong	Strong	Strong	Large	6	Same as Proposed Action	Same as Proposed Action
KOP-32	0–40 (0–64)	0–40 (0–64)	0–40 (0–64)	0–40 (0–64)	0–40 (0–64)	0–40 (0–64)	124° (100%)	R, NL, N, H, O, M, and Y **Major**	Strong	Strong	Strong	Strong	Large	6	Same as Proposed Action	Same as Proposed Action

[1] KOP-1 Barnegat Lighthouse; KOP-2 Harvey Cedars Beach Access; KOP-3 Bayview Park; KOP-4 Garden State Parkway; KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit; KOP-6 Great Bay Boulevard Wildlife Management Area; KOP-7 Edwin B. Forsythe National Wildlife Refuge; KOP-8 Absecon Creek Boat Ramp; KOP-9 North Brigantine Natural Area Wildlife Observation Deck; KOP-10 16th Street Park Beachfront; KOP-11 Atlantic City Country Club; KOP-12 Atlantic City Beachfront; KOP-13 Atlantic City Beachfront (Nighttime); KOP-14 Atlantic City Playground Pier; KOP-15 Ventor City, City Hall; KOP-16 Lucy the Elephant National Historic Landmark; KOP-17 Bay Front Historic District, Municipal Beach Park; KOP-18 Ocean City Boardwalk; KOP-19 Corson's Inlet State Park; KOP-20 Sea Isle City Promenade; KOP-21 Avalon Beach Jetty; KOP-22 Stone Harbor Beach; KOP-23 Stone Harbor Beach (nighttime); KOP-24 North Wildwood Boulevard Bridge; KOP-25 Hereford Inlet Lighthouse; KOP-26 Wildwood Crest Fishing Pier; KOP-27 Cape May National Wildlife Refuge; KOP-28 Cape May Lighthouse; KOP-29 BL England Substation Area; KOP-30 Oyster Creek Substation Area; KOP-31 Commercial and Recreational Fishing and Tour Boat Area; KOP-32 Commercial and Cruise Ship Shipping Lanes

[2] Noticeable elements: R = rotor, NL = navigation light, N = nacelle, H = hub, O = OSS, M = mid-tower light, Y = yellow tower base color

[3] WTGs and OSS (onshore) visibility: 0 = Not visible. 1 = Visible only after extended study; otherwise not visible. 2 = Visible when viewing in general direction of the wind farm; otherwise likely to be missed by casual observer. 3 = Visible after brief glance in general direction of the wind farm; unlikely to be missed by casual observer. 4 = Plainly visible; could not be missed by casual observer, but does not strongly attract visual attention or dominate view. 5 = Strongly attracts viewers' attention to the wind farm; moderate to strong contrasts in form, line, color, or texture, luminance, or motion. 6 = Dominates view; strong contrasts in form, line, color, texture, luminance, or motion fill most of the horizontal FOV or vertical FOV (NAEP 2012).

Table M-6 lists the Proposed Action's noticeable features based on their heights, distances, and EC.

Table M-6 Noticeable Elements and Impacts by Seascape Character Unit, Open Ocean Character Unit, Landscape Character Unit, and KOP for the Proposed Action

Noticeable Elements[1] Impacts	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
R, NL, N, H, O, M, and Y **Major**	Open Ocean Character Unit KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area KOP-32 Cruise Ship Shipping Lanes
R, NL, N, H, O, and M **Moderate**	Seascape and Landscape Character Units: Beachfront and Jetty/Seawall, Boardwalk, Coastal Dune, and Island Community KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-14 Atlantic City Playground Pier KOP-16 Lucy the Elephant National Historic Landmark KOP-18 Ocean City Boardwalk KOP-19 Corson's Inlet State Park KOP-20 Sea Isle City Promenade KOP-21 Avalon Beach Jetty
R, NL, N, H, O, and M **Minor**	KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp KOP-11 Atlantic City Country Club KOP-13 Atlantic City Beachfront—Nighttime KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime
R, NL, N, H, and O **Minor**	Landscape Character Units: Marshland, and Bay/Shoreline KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-17 Bay Front Historic District, Municipal Beach Park KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse
R, NL, N, and H **Minor**	KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-26 Wildwood Crest Fishing Pier KOP-28 Cape May Lighthouse
R, NL, and N **Minor**	Landscape Character Units: Mainland and Ridges
R **Minor**	KOP-1 Barnegat Lighthouse
R **Negligible**	KOP-2 Harvey Cedars Beach Access KOP-15 Ventor City, City Hall (obscured, not distant) KOP-20 Sea Isle City Promenade KOP-27 Cape May National Wildlife Refuge

[1] R = rotor, NL = navigation light, N = nacelle, H = hub, O = OSS, M = mid-tower light, Y = yellow tower base color
WMA = Wildlife Management Area

Table M-7 summarizes the Proposed Action's wind farm distance, percent of FOV occupied by the wind farm, and effects on the seascape units, open ocean unit, landscape units, and KOPs.

Table M-7 Wind Farm Distance Effects by Seascape Character Unit, Open Ocean Character Unit, Landscape Character Unit, and KOP for the Proposed Action

Distance miles (kilometers) Effects	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
0–40.0 (0–64.4) Dominant/Major to Minor Noticeability	Open Ocean Character Unit KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area
5.0–40.0 (8.0–64.4) Dominant/Major to Minor Noticeability	Open Ocean Character Unit KOP-32 Cruise Ship Shipping Lanes
15.3–18.0 (24.6–29.0) Moderate Noticeability	Seascape Character Units: Beachfront and Jetty/Seawall, Boardwalk, Coastal Dune, and Island Community KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-13 Atlantic City Beachfront—Nighttime KOP-14 Atlantic City Playground Pier KOP-18 Ocean City Boardwalk KOP-19 Corson's Inlet State Park KOP-21 Avalon Beach Jetty
18.0–31.0 (29.0–49.9) Minor Noticeability	Landscape Character Units: Marshland, and Bay/Shoreline KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp KOP-11 Atlantic City Country Club KOP-16 Lucy the Elephant National Historic Landmark KOP-17 Bay Front Historic District, Municipal Beach Park KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-26 Wildwood Crest Fishing Pier KOP-27 Cape May National Wildlife Refuge
31.1–40.0 (50.1–64.4) Minor Noticeability	KOP-1 Barnegat Lighthouse (elevated viewpoint) KOP-28 Cape May Lighthouse (elevated viewpoint)

Distance miles (kilometers) Effects	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
31.1–40.0 (50.1–64.4) Minor to Negligible Noticeability	Landscape Character Units: Mainland and Ridges KOP-2 Harvey Cedars Beach Access KOP-15 Ventor City, City Hall (obscured, not distant) KOP-20 Sea Isle City Promenade (obscured, not distant)

WMA = Wildlife Management Area

Table M-8 summarizes the Proposed Action's wind farm distance, percent of FOV occupied by the wind farm, and effects on the seascape units, landscape units, and KOPs.

Table M-8 Wind Farm Percent of FOV and Effects by Seascape Character Unit, Open Ocean Character Unit, Landscape Character Unit, and KOP for the Proposed Action

Percent (°) of 124° FOV POV[1] Effects	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
100% (124°) to 16% (20°) Dominant/Major to Minor	Open Ocean Character Unit KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area
41% (51°) to 16% (20°) Dominant/Major to Minor	Open Ocean Character Unit KOP-32 Cruise Ship Shipping Lanes
33% (37.6°) to 29% (36°) Moderate	Seascape Character Units: Beachfront and Jetty/Seawall, Boardwalk, Coastal Dune, and Island Community KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-11 Atlantic City Country Club KOP-12 Atlantic City Beachfront—Daytime KOP-14 Atlantic City Playground Pier KOP-15 Ventor City, City Hall KOP-16 Lucy the Elephant National Historic Landmark KOP-17 Bay Front Historic District, Municipal Beach Park KOP-18 Ocean City Boardwalk KOP-19 Corson's Inlet State Park KOP-20 Sea Isle City Promenade KOP-21 Avalon Beach Jetty
20% (25°) Minor to Moderate	KOP-13 Atlantic City Beachfront—Nighttime KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime
28% (35°) to 20% (25°) Minor	Landscape Character Units: Marshland, and Bay/Shoreline KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp

Percent (°) of 124° FOV POV[1] Effects	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
	KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-26 Wildwood Crest Fishing Pier KOP-27 Cape May National Wildlife Refuge
20% (25°) to 16% (20°) Minor to Negligible	Landscape Character Units: Mainland and Ridges KOP-1 Barnegat Lighthouse KOP-2 Harvey Cedars Beach Access KOP-28 Cape May Lighthouse KOP-29 BL England Substation Area KOP-30 Oyster Creek Substation Area

[1] Percent of view
WMA = Wildlife Management Area

Foreground influence assessments, involving the presence of intervening or framing elements and their influence on effects of Project characteristics, are based on each KOP's locale photography and visual simulations (Appendix D to COP Volume III, Appendix L; Ocean Wind 2023) and summarized in Table M-9.

Table M-9 Foreground View Framing and Intervening Elements for the Proposed Action

Foreground Element(s) Influence	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
Open Ocean Negligible Influence	Open Ocean Character Unit KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area KOP-32 Cruise Ship Shipping Lanes
Beach, Dunes, and Ocean Minor Influence	Seascape Character Units: Beachfront and Jetty/Seawall, Boardwalk, and Coastal Dune KOP-2 Harvey Cedars Beach Access KOP-3 Bayview Park KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-13 Atlantic City Beachfront—Nighttime KOP-14 Atlantic City Playground Pier KOP-18 Ocean City Boardwalk KOP-19 Corson's Inlet State Park KOP-21 Avalon Beach Jetty KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime KOP-26 Wildwood Crest Fishing Pier

Foreground Element(s) Influence	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
Buildings, Vegetation, and Topography Moderate to Dominant Influence	Landscape Character Units: Island Community, Marshland, Bay/Shoreline, Mainland, and Ridges KOP-1 Barnegat Lighthouse KOP-2 Harvey Cedars Beach Access KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-11 Atlantic City Country Club KOP-15 Ventor City, City Hall KOP-16 Lucy the Elephant National Historic Landmark KOP-17 Bay Front Historic District, Municipal Beach Park KOP-20 Sea Isle City Promenade KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-27 Cape May National Wildlife Refuge KOP-28 Cape May Lighthouse

WMA = Wildlife Management Area

Proposed Action contrasts in the characteristic seascape and landscape, as perceived in views from each KOP, are based on visual simulations (Appendix D to COP Volume III, Appendix L; Ocean Wind 2023). Seascape unit view contrasts are estimated based on similar open view conditions in ocean environments. Landscape and seascape compatibility and photography conditions for each viewpoint are presented in COP Volume III, Appendix L, Table 9.1 (Ocean Wind 2023). The COP landscape and seascape evaluation scale ranges from faint, apparent, conspicuous, and prominent to dominant. No onshore viewpoints would result in either prominent or dominant conditions. Offshore potential viewpoints' evaluations range from faint to dominant. Visual contrast determinations involve comparisons of characteristics of the seascape and landscape before and after Proposed Action implementation. The range of potential contrasts includes strong, moderate, weak, and none. The strongest daytime contrasts would result from tranquil and flat seas combined with sunlit WTG towers, nacelles, flickering rotors, and the yellow tower 50-foot (15.2-meter) base color against a dark background sky and an undifferentiated foreground. The weakest daytime contrasts would result from turbulent seas combined with overcast daylight conditions on WTG towers, nacelles, and rotors again an overcast background sky and a foreground modulated by varied landscape elements. The strongest nighttime contrasts would result from dark skies (absent moonlight) combined with navigation lights, activated lighting on the OSS, mid-tower lights, and Project lighting reflections on low clouds and active (non-reflective) surf, and the dark-sky light dome. The weakest nighttime contrasts would result from moonlit, cloudless skies, tranquil (reflective) seas, ADLS activation, and only mid-tower lights.

Photographic comparisons of characteristics of the seascape's and landscape's existing conditions and Proposed Action implementation are included in Appendix D to COP Volume III, Appendix L (Ocean

Wind 2023) for each of the KOPs in the following summary tables. Visual contrast determinations are listed in Table M-10.

Table M-10 Visual Contrasts to Seascape, Open Ocean, Landscape, and KOPs for the Proposed Action

Contrast Rating Effects	Seascape, Open Ocean, Landscape, and Offshore and Onshore Key Observation Points
Strong Contrasts **Major**	Open Ocean: KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area KOP-32 Cruise Ship Shipping Lanes
Moderate Contrasts **Moderate**	Seascape KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-14 Atlantic City Playground Pier KOP-18 Ocean City Boardwalk KOP-19 Corson’s Inlet State Park KOP-21 Avalon Beach Jetty KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime KOP-16 Lucy the Elephant National Historic Landmark
Weak Contrasts **Minor**	KOP-1 Barnegat Lighthouse KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp KOP-11 Atlantic City Country Club KOP-13 Atlantic City Beachfront—Nighttime KOP-17 Bay Front Historic District, Municipal Beach Park KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-26 Wildwood Crest Fishing Pier KOP-28 Cape May Lighthouse KOP-29 BL England Substation Area KOP-30 Oyster Creek Substation Area
None to very weak **Negligible**	KOP-2 Harvey Cedars Beach Access KOP-15 Ventor City, City Hall KOP-20 Sea Isle City Promenade KOP-27 Cape May National Wildlife Refuge

WMA = Wildlife Management Area

Table M-11 summarizes Proposed Action impacts on the seascape character units, open ocean character unit, and landscape character units throughout the geographic analysis area. The seascape, open ocean, and landscape criteria listed in Table M-1 and consideration of the preceding assessments would result in impact levels for character units as shown in Table M-11.

Table M-11 Proposed Action Impact on Seascape Character, Open Ocean Character, and Landscape Character

Level of Impact	Seascape Character Units, Open Ocean Character Unit, and Landscape Character Units
Major	SLIA: Open Ocean Character Unit
Moderate	SLIA: Seascape Character Units and Landscape Character Units: Beachfront and Jetty/Seawall, Boardwalk, Coastal Dune, and Island Community
Minor	SLIA: Landscape Character Units: Bay/Shoreline, Island, Mainland, Marshland, and Ridges
Negligible	SLIA: Landscape Character Units: Island, Mainland, and Ridges

Table M-12 summarizes Proposed Action impacts on viewer experience (KOP locations) throughout the geographic analysis area. The viewer experience criteria listed in Table M-1 and consideration of the preceding assessments would result in impact levels for KOPs as shown in Table M-12.

Table M-12 Impact Levels on Viewer Experience for the Proposed Action

Impact Level	Offshore and Onshore Key Observation Points
Major	VIA: KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area KOP-32 Cruise Ship Shipping Lanes
Moderate	VIA: KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-14 Atlantic City Playground Pier KOP-16 Lucy the Elephant National Historic Landmark KOP-18 Ocean City Boardwalk KOP-19 Corson's Inlet State Park KOP-21 Avalon Beach Jetty KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime

Impact Level	Offshore and Onshore Key Observation Points
Minor	VIA: KOP-1 Barnegat Lighthouse KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-6 Great Bay Boulevard WMA KOP-8 Absecon Creek Boat Ramp KOP-11 Atlantic City Country Club KOP-13 Atlantic City Beachfront—Nighttime KOP-17 Bay Front Historic District, Municipal Beach Park KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-26 Wildwood Crest Fishing Pier KOP-28 Cape May Lighthouse KOP-29 BL England Substation Area KOP-30 Oyster Creek Substation Area
Negligible	VIA: KOP-2 Harvey Cedars Beach Access KOP-15 Ventor City, City Hall KOP-20 Sea Isle City Promenade KOP-27 Cape May National Wildlife Refuge

WMA = Wildlife Management Area

NEPA requires consideration of other reasonably foreseeable activities in the Project's viewshed and the Project's incremental effects on seascape character, open ocean character, landscape character, and viewer experience. These effects include direct physical effects on the seascape, open ocean, and landscape or changes to the distinct character of the seascape, open ocean, and landscape.

Effects on seascape character, open ocean character, and landscape character can occur in the following conditions (BOEM 2021, Chapter 8):

- Multi-project WTGs and OSS visible within or from the open ocean character unit as overlapping or adjacent features and elements
- Multi-project WTGs and OSS visible from seascape character units as overlapping or adjacent features and elements
- Multi-project WTGs and OSS visible from landscape character units as overlapping or adjacent features and elements

Effects on viewer experience can occur in the following conditions (BOEM 2021 Chapter 8):

- Multi-project WTGs and OSS visible as overlapping features and elements
- Multi-project WTGs and OSS visible as adjacent features and elements
- Multi-project WTGs and OSS visible as viewers move through the seascape, open ocean, and landscape

Attachment M-2 presents simulations of the incremental effects of the Project in the context of other planned wind farms.

Consideration of effects of other planned wind farms on seascape character, open ocean character, and landscape character is listed in Table M-13.

Consideration of effects on viewer experience of other planned wind farms is listed in Table M-14.

Consideration of effects on seascape character, open ocean character, and landscape character of other planned wind farms in combination with the Proposed Action is listed in Table M-15.

Consideration of effects on viewer experience of other planned wind farms in combination with the Proposed Action is listed in Table M-16.

Table M-13 Other Planned Wind Farms' Seascape, Open Ocean, and Landscape Units Cumulative Wind Farm Distances, FOVs, Noticeable Elements, Visual Contrasts, Scale of Change, and Prominence

	Character Unit		
	Seascape (Beaches)[1]	**Open Ocean**	**Landscape[4]**
Distance in miles (kilometers)			
Atlantic Shores South	8.8 (14.2)	0 to 42.5 (0 to 68.4)	Variable to 42.5 (68.4)
Atlantic Shores North	9.1 (14.6)	0 to 42.5 (0 to 68.4)	Variable to 42.5 (68.4)
Bight Wind Holdings	26.5 (42.6)	0 to 38.6 (0 to 62.1)	Variable to 38.6 (62.1)
Atlantic Shores Offshores Wind Bight	34.4 (55.4)	0 to 38.6 (0 to 62.1)	Variable to 38.6 (62.1)
Invenergy Wind Offshore	37.5 (60.3)	0 to 38.6 (0 to 62.1)	Variable to 38.6 (62.1)
Ocean Wind 2	8.9 (14.3)	0 to 40 (64.4)	Variable to 40 (64.4)
Garden State	12.8 (20.6)	0 to 38.6 (0 to 62.1)	Variable to 38.6 (62.1)
Skipjack	15.5 (24.9)	0 to 38.6 (0 to 62.1)	Variable to 38.6 (62.1)
FOV Degrees (1% of 124°)	158° (127%)	82° to 360° (66 to 290%)	155° (125%)
Noticeable Elements[2] & Impact Level	R, NL, N, H, O, and M **Major**	R, NL, N, H, O, M, and Y **Major**	R, NL, N, H, O, and M **Major**
Contrast, scale of change, and prominence			
Form	Strong to Weak	Strong	Strong to Weak
Line	Moderate to Weak	Strong	Moderate to Weak
Color	Strong to Weak	Strong	Strong to Weak
Texture	Moderate to Weak	Strong	Moderate to Weak
Scale	Large	Large	Large
Prominence[3]	6	6	6

[1] The most conservative onshore case involves the seaward edge of the beach nearest the projects. The seascape unit edge is 3.45 miles (5.6 kilometers) offshore (New Jersey jurisdictional boundary).
[2] Noticeable elements: R = rotor, NL = navigation light, N = nacelle, H = hub, O = OSS, M = mid-tower light, Y = yellow tower base color
[3] WTGs and OSS Prominence (visibility): 0 = Not visible. 1 = Visible only after extended study; otherwise not visible. 2 = Visible when viewing in general direction of the wind farm; otherwise likely to be missed by casual observer. 3 = Visible after brief glance in general direction of the wind farm; unlikely to be missed by casual observer. 4 = Plainly visible; could not be missed by casual observer, but does not strongly attract visual attention or dominate view. 5 = Strongly attracts viewers' attention to the wind farm; moderate to strong contrasts in form, line, color, or texture, luminance, or motion. 6 = Dominates view; strong contrasts in form, line, color, texture, luminance, or motion fill most of the horizontal FOV or vertical FOV (NAEP 2012).
[4] The seaward edge between landscape and seascape varies. The most conservative case is a 1.0-mile (1.6-kilometer) distance from the seaward beach edge.

Table M-14 Other Planned Wind Farms' Cumulative Viewer Experience Wind Farm Distances, FOVs, Noticeable Elements, Visual Contrasts, Scale of Change, and Prominence

	KOP[1]			
	KOP-6	**KOP-14**	**KOP-19**	**KOP-22**
Distance in miles (kilometers)				
Atlantic Shores South	12.1 (19.5)	11.1 (17.7)	21.6 (34.8)	31.4 (50.5)
Atlantic Shores North	11.5 (18.5)	18.2 (29.3)	31.5 (50.7)	42.2 (67.9)
Bight Wind Holdings	37.8 (60.8)	46.4 (74.7)	38.6 (62.1)	68.9 (55.2)
Atlantic Shores Offshores Wind Bight	36.7 (59)	42.2 (67.9)	54.2 (87.2)	61.5 (111)
Invenergy Wind Offshore	44.5 (71.6)	43.8 (70.5)	53.3 (85.8)	60.2 (96.9)
Ocean Wind 2	28.6 (46)	9.2 (14.8)	11.6 (18.7)	13.7 (22)
Garden State	55.7 (89.6)	42.3 (68.1)	32.9 (52.9)	22.1 (35.6)
Skipjack	62.2 (100)	50.4 (81.1)	39.8 (64.1)	28.8 (46.3)
Cumulative FOV Degrees (1% of 124°)	142° (114%)	136° (110%)	136° (110%)	144° (116%)
Noticeable Elements[2] & Impact Level	R, NL, N, H, O, and M to R **Major**	R, NL, N, H, O, and M to R **Major**	R, NL, N, H, O, and M to R **Major**	R, NL, N, H, O, and M to R **Major**
Contrast, scale of change, and prominence				
Form	Strong	Strong	Strong	Strong
Line	Moderate	Moderate	Moderate	Moderate
Color	Strong	Strong	Strong	Strong
Texture	Moderate	Moderate	Moderate	Moderate
Scale	Large	Large	Large	Large
Prominence[3]	6	6	6	6

[1] KOP-6 Great Bay Boulevard Wildlife Management Area, KOP-14 Atlantic City Playground Pier; KOP-19 Corson's Inlet State Park, KOP-22 Stone Harbor Beach
[2] Noticeable elements: R = rotor, NL = navigation light, N = nacelle, H = hub, O = OSS, M = mid-tower light, Y = yellow tower base color
[3] WTGs and OSS (onshore) visibility: 0 = Not visible. 1 = Visible only after extended study; otherwise not visible. 2 = Visible when viewing in general direction of the wind farm; otherwise likely to be missed by casual observer. 3 = Visible after brief glance in general direction of the wind farm; unlikely to be missed by casual observer. 4 = Plainly visible; could not be missed by casual observer, but does not strongly attract visual attention or dominate view. 5 = Strongly attracts viewers' attention to the wind farm; moderate to strong contrasts in form, line, color, or texture, luminance, or motion. 6 = Dominates view; strong contrasts in form, line, color, texture, luminance, or motion fill most of the horizontal FOV or vertical FOV (NAEP 2012).

Table M-15 Ocean Wind 1 and Other Planned Wind Farms' Seascape, Open Ocean, and Landscape Units Cumulative Wind Farm Distances, FOVs, Noticeable Elements, Visual Contrasts, Scale of Change, and Prominence

	Character Unit		
	Seascape (Beaches)[1]	**Open Ocean**	**Landscape[4]**
Distance in miles (kilometers)			
Proposed Action	15.3 (24.6)	0 to 40 (0 to 64.4)	Variable to 40 (64.4)
Alternatives B-1 & B-2	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Alternatives C-1, C-2, & D	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Atlantic Shores South	8.8 (14.2)	0 to 42.5 (0 to 68.4)	Variable to 42.5 (68.4)
Atlantic Shores North	9.1 (14.6)	0 to 42.5 (0 to 68.4)	Variable to 42.5 (68.4)
Bight Wind Holdings	26.5 (42.6)	0 to 38.6 (0 to 62.1)	Variable to 38.6 (62.1)
Atlantic Shores Offshores Wind Bight	34.4 (55.4)	0 to 38.6 (0 to 62.1)	Variable to 38.6 (62.1)
Invenergy Wind Offshore	37.5 (60.3)	0 to 38.6 (0 to 62.1)	Variable to 38.6 (62.1)
Ocean Wind 2	8.9 (14.3)	0 to 40 (0 to 64.4)	Variable to 40 (64.4)
Garden State	12.8 (20.6)	0 to 38.6 (0 to 62.1)	Variable to 38.6 (62.1)
Skipjack	15.5 (24.9)	0 to 38.6 (0 to 62.1)	Variable to 38.6 (62.1)
FOV Degrees (1% of 124°)	158° (127%)	82° to 360° (66 to 290%)	155° (125%)
Noticeable Elements[2] & Impact Level	R, NL, N, H, O, and M to R **Major**	R, NL, N, H, O, M, and Y to R **Major**	R, NL, N, H, O, and M to R **Major**
Contrast, Scale of Change, and Prominence			
Form	Strong to Weak	Strong	Strong to Weak
Line	Moderate to Weak	Strong	Moderate to Weak
Color	Strong to Weak	Strong	Strong to Weak
Texture	Moderate to Weak	Strong	Moderate to Weak
Scale	Large	Large	Large
Prominence[3]	6	6	6

[1] The most conservative onshore case involves the seaward edge of the beach nearest the projects. The seascape unit edge is 3.45 miles (5.6 kilometers) offshore (New Jersey jurisdictional boundary).
[2] Noticeable elements: R = rotor, NL = navigation light, N = nacelle, H = hub, O = OSS, M = mid-tower light, Y = yellow tower base color
[3] WTGs and OSS (onshore) visibility: 0 = Not visible. 1 = Visible only after extended study; otherwise not visible. 2 = Visible when viewing in general direction of the wind farm; otherwise likely to be missed by casual observer. 3 = Visible after brief glance in general direction of the wind farm; unlikely to be missed by casual observer. 4 = Plainly visible; could not be missed by casual observer, but does not strongly attract visual attention or dominate view. 5 = Strongly attracts viewers'

attention to the wind farm; moderate to strong contrasts in form, line, color, or texture, luminance, or motion. 6 = Dominates view; strong contrasts in form, line, color, texture, luminance, or motion fill most of the horizontal FOV or vertical FOV (NAEP 2012).
[4] The seaward edge between landscape and seascape varies.

Table M-16 Ocean Wind 1 and Other Planned Wind Farms' Cumulative Viewer Experience Wind Farm Distances, FOVs, Noticeable Elements, Visual Contrasts, Scale of Change, and Prominence

	KOP			
	KOP-6	**KOP-14**	**KOP-19**	**KOP-22**
Distance in miles (kilometers)				
Proposed Action	21.8 (35.1)	15.3 (25.6)	16.2 (26.1)	20.9 (33.6)
Alternatives B-1 & B-2	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Alternatives C-1, C-2, & D	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Atlantic Shores South	12.1 (19.5)	11.1 (17.7)	21.6 (34.8)	31.4 (50.5)
Atlantic Shores North	11.5 (18.5)	18.2 (29.3)	31.5 (50.7)	42.2 (67.9)
Bight Wind Holdings	37.8 (60.8)	46.4 (74.7)	38.6 (62.1)	68.9 (55.2)
Atlantic Shores Offshores Wind Bight	36.7 (59)	42.2 (67.9)	54.2 (87.2)	61.5 (111)
Invenergy Wind Offshore	44.5 (71.6)	43.8 (70.5)	53.3 (85.8)	60.2 (96.9)
Ocean Wind 2	28.6 (46)	9.2 (14.8)	11.6 (18.7)	13.7 (22)
Garden State	55.7 (89.6)	42.3 (68.1)	32.9 (52.9)	22.1 (35.6)
Skipjack	62.2 (100)	50.4 (81.1)	39.8 (64.1)	28.8 (46.3)
Cumulative FOV Degrees (1% of 124°)	142° (114%)	136° (110%)	136° (110%)	144° (116%)
Noticeable Elements[2] & Impact Level	R, NL, N, H, O, and M to R **Major**	R, NL, N, H, O, and M to R **Major**	R, NL, N, H, O, and M to R **Major**	R, NL, N, H, O, and M to R **Major**
Contrast, Scale of Change, and Prominence				
Form	Strong	Strong	Strong	Strong
Line	Moderate	Moderate	Moderate	Moderate
Color	Strong	Strong	Strong	Strong
Texture	Moderate	Moderate	Moderate	Moderate
Scale	Large	Large	Large	Large

	KOP			
	KOP-6	**KOP-14**	**KOP-19**	**KOP-22**
Prominence[3]	6	6	6	6

[1] KOP-6 Great Bay Boulevard Wildlife Management Area, KOP-14 Atlantic City Playground Pier; KOP-19 Corson's Inlet State Park, KOP-22 Stone Harbor Beach
[2] Noticeable elements: R = rotor, NL = navigation light, N = nacelle, H = hub, O = OSS, M = mid-tower light, Y = yellow tower base color
[3] WTGs and OSS (onshore) visibility: 0 = Not visible. 1 = Visible only after extended study; otherwise not visible. 2 = Visible when viewing in general direction of the wind farm; otherwise likely to be missed by casual observer. 3 = Visible after brief glance in general direction of the wind farm; unlikely to be missed by casual observer. 4 = Plainly visible; could not be missed by casual observer, but does not strongly attract visual attention or dominate view. 5 = Strongly attracts viewers' attention to the wind farm; moderate to strong contrasts in form, line, color, or texture, luminance, or motion. 6 = Dominates view; strong contrasts in form, line, color, texture, luminance, or motion fill most of the horizontal FOV or vertical FOV (NAEP 2012).

M.3.2 Alternative B

Table M-17 and Table M-18 compare Alternative B-1 wind farm width-, height-, and distance-related occupation of views from the nearest shoreline area with that of Alternative B-2. Distances vary by 0.8 mile and the horizontal FOVs vary by 1° or less. The vertical FOVs vary by less than 1° of the viewer FOV. These results indicate slight changes to the FOV results compared to the Proposed Action (Table M-3 and Table M-4).

Table M-17 Horizontal FOV Occupied by Alternatives B-1 and B-2

Noticeable Element	Width[1] miles (km)	Distance miles (km)	Horizontal FOV	Human FOV	Percent of FOV
B-1 Wind Farm	11.8 (19.0)	16.1 (25.9)	36.2°	124°	29%
B-2 Wind Farm	12.0 (19.0)	16.9 (27.2)	35.4°	124°	28%

[1] The wind farm width increases from west to east.
km = kilometers

Table M-18 Vertical FOV Occupied by Alternatives B-1 and B-2

Noticeable Element	Height feet (m) MLLW	Distance miles (km)	Height Above Horizon[1] feet (m)	Vertical FOV	Human FOV	Percent of FOV
B-1 Rotor Blade Tip	906 (276.1)	16.1 (25.9)	787 (239.9)	0.5°	55°	0.9%
B-2 Rotor Blade Tip	906 (276.1)	16.9 (27.2)	772 (239.9)	0.5°	55°	0.9%

[1] Based on intervening EC and clear-day conditions.
km = kilometers; m = meters

Table M-19 summarizes the wind farm's noticeable elements and effects on the seascape character unit, landscape character units, and viewer experience under Alternatives B-1 and B-2. Results for Alternatives B-1 and B-2 are similar, and similar to those of the Proposed Action, with slight changes in the visibility of lower portions of towers due to EC and slight changes in the overall horizontal and vertical FOVs.

Table M-19 Wind Farm Noticeable Elements and Effects by Seascape Character Unit, Open Ocean Character Unit, Landscape Character Unit, and KOP for Alternatives B-1 and B-2

Noticeable Elements[1] Effects	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
R, NL, N, H, O, M, and Y **Major**	Open Ocean Character Unit KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area KOP-32 Cruise Ship Shipping Lanes

Noticeable Elements[1] Effects	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
R, NL, N, H, O, and M **Moderate**	Seascape Character Units: Beachfront and Jetty/Seawall, Boardwalk, Coastal Dune, and Island Community KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-14 Atlantic City Playground Pier KOP-16 Lucy the Elephant National Historic Landmark KOP-18 Ocean City Boardwalk KOP-19 Corson's Inlet State Park KOP-20 Sea Isle City Promenade KOP-21 Avalon Beach Jetty
R, NL, N, H, O, and M **Minor**	KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp KOP-11 Atlantic City Country Club KOP-13 Atlantic City Beachfront—Nighttime KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime
R, NL, N, H, and O **Minor**	Landscape Character Units: Marshland, and Bay/Shoreline KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-17 Bay Front Historic District, Municipal Beach Park KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse
R, NL, N, and H **Minor**	Landscape Character Units: KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-26 Wildwood Crest Fishing Pier KOP-27 Cape May National Wildlife Refuge
R, NL, and N **Minor**	Landscape Character Units: Mainland and Ridges
R **Minor**	KOP-1 Barnegat Lighthouse
Unseen **Negligible**	KOP-2 Harvey Cedars Beach Access KOP-15 Ventor City, City Hall (obscured, not distant) KOP-28 Cape May Lighthouse

[1] R = rotor, NL = navigation light, N = nacelle, H = hub, O = OSS, M = mid-tower light, Y = yellow tower base color
WMA = Wildlife Management Area

Table M-20 summarizes the wind farm's distance effects on the seascape unit, landscape units, and KOPs under Alternatives B-1 and B-2.

Table M-20 Wind Farm Distance Effects by Seascape Unit, Open Ocean Unit, Landscape Unit, and KOP for Alternatives B-1 and B-2

Distance miles (kilometers) Effect	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
0–40.0 (0–64.4) Dominant/Major to Minor Noticeability	Open Ocean Character Unit KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area
5.8–40.0 (9.3–64.4) Dominant/Major to Minor Noticeability	Open Ocean Character Unit KOP-32 Cruise Ship Shipping Lanes
B-1: 16.1–18.0 (25.9–29.0) B-2: 16.9–18.0 (27.2–29.0) Moderate Noticeability	Seascape Character Units: Beachfront and Jetty/Seawall, Boardwalk, Coastal Dune, and Island Community KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-14 Atlantic City Playground Pier KOP-18 Ocean City Boardwalk KOP-19 Corson’s Inlet State Park KOP-21 Avalon Beach Jetty
18.0–31.0 (29.0–49.9) Minor Noticeability	Landscape Character Units: Marshland, and Bay/Shoreline KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp KOP-11 Atlantic City Country Club KOP-13 Atlantic City Beachfront—Nighttime KOP-16 Lucy the Elephant National Historic Landmark KOP-17 Bay Front Historic District, Municipal Beach Park KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-26 Wildwood Crest Fishing Pier KOP-27 Cape May National Wildlife Refuge
31.1–40.0 (50.1–64.4) Minor Noticeability	KOP-1 Barnegat Lighthouse (elevated viewpoint) KOP-28 Cape May Lighthouse (elevated viewpoint)
31.1–40.0 (50.1–64.4) Minor to Negligible Noticeable	Landscape Character Units: Mainland and Ridges KOP-2 Harvey Cedars Beach Access KOP-15 Ventor City, City Hall (obscured, not distant) KOP-20 Sea Isle City Promenade (obscured, not distant)

WMA = Wildlife Management Area

Table M-21 summarizes the percent and degrees of FOV occupied by the wind farm and effects on the seascape unit, landscape units, and KOPs under Alternatives B-1 and B-2. There are slight differences in results for Alternatives B-1 and B-2, and slight differences from the FOVs of the Proposed Action.

Table M-21 Wind Farm Percent of FOV and Effects by Seascape Unit, Open Ocean Unit, Landscape Unit, and KOP for Alternatives B-1 and B-2

Percent of 124° FOV Effect	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
100% (124°) to 16% (20°) Dominant/Major to Minor Noticeability	Open Ocean Character Unit KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area
Dominant/Major to Minor Noticeability	Open Ocean Character Unit KOP-32 Cruise Ship Shipping Lanes
B-1: 29% (36.2°) to 29% (36°) B-2: 28% (35.4°) to 29% (36°) Moderate Noticeability	Seascape Character Units: Beachfront and Jetty/Seawall, Boardwalk, Coastal Dune, and Island Community KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-11 Atlantic City Country Club KOP-12 Atlantic City Beachfront—Daytime KOP-14 Atlantic City Playground Pier KOP-15 Ventor City, City Hall KOP-16 Lucy the Elephant National Historic Landmark KOP-17 Bay Front Historic District, Municipal Beach Park KOP-18 Ocean City Boardwalk KOP-19 Corson's Inlet State Park KOP-20 Sea Isle City Promenade KOP-21 Avalon Beach Jetty
20% (25°) Minor to Moderate	KOP-13 Atlantic City Beachfront—Nighttime KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime
28% (35°) to 20% (25°) Minor Noticeability	Landscape Character Units: Marshland, and Bay/Shoreline KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-26 Wildwood Crest Fishing Pier KOP-27 Cape May National Wildlife Refuge

Percent of 124° FOV Effect	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
28% (25°) to 16% (20°) Minor to Negligible Noticeable	Landscape Character Units: Mainland and Ridges KOP-1 Barnegat Lighthouse KOP-2 Harvey Cedars Beach Access KOP-28 Cape May Lighthouse KOP-29 BL England Substation Area KOP-30 Oyster Creek Substation Area

WMA = Wildlife Management Area

Foreground influence assessments, involving the presence of intervening or framing elements and their influence on effects of Project characteristics, are based on the Alternatives B-1 and B-2 visual simulations (Attachment M-3) and locale photography (Appendix D to COP Volume III, Appendix L; Ocean Wind 2023). KOP foreground influences would be similar for Alternatives B-1 and B-2, as summarized in Table M-22.

Table M-22 Foreground View Framing or Intervening Elements for Alternatives B-1 and B-2

Foreground Element(s) Influence	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
Open Ocean Negligible Influence	Open Ocean Character Unit KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area KOP-32 Cruise Ship Shipping Lanes
Beach, Dunes, and Ocean Minor Influence	Seascape Character Units: Beachfront and Jetty/Seawall, Boardwalk, and Coastal Dune KOP-2 Harvey Cedars Beach Access KOP-3 Bayview Park KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-13 Atlantic City Beachfront—Nighttime KOP-14 Atlantic City Playground Pier KOP-18 Ocean City Boardwalk KOP-19 Corson’s Inlet State Park KOP-21 Avalon Beach Jetty KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime KOP-26 Wildwood Crest Fishing Pier

Foreground Element(s) Influence	Seascape Units, Open Ocean Unit, Landscape Units, and Offshore and Onshore Key Observation Points
Buildings, Vegetation, and Topography Moderate to Dominant Influence	Landscape Character Units: Island Community, Marshland, Bay/Shoreline, Mainland, and Ridges KOP-1 Barnegat Lighthouse KOP-2 Harvey Cedars Beach Access KOP-4 Garden State Parkway KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-11 Atlantic City Country Club KOP-15 Ventor City, City Hall KOP-16 Lucy the Elephant National Historic Landmark KOP-17 Bay Front Historic District, Municipal Beach Park KOP-20 Sea Isle City Promenade KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-27 Cape May National Wildlife Refuge KOP-28 Cape May Lighthouse

WMA = Wildlife Management Area

Visual contrast assessments, form, line, color, and texture comparisons of characteristics of the seascape and landscape before and after implementation of Alternative B-1 or B-2 are indicated in Table M-23. There would be a slight difference in contrasts between Alternatives B-1 and B-2, and a slight difference from the Proposed Action. Project contrasts to the characteristic seascape and landscape, as perceived in views from each KOP locale, are based on Alternatives B-1 and B-2 visual simulations (Attachment M-3).

Table M-23 Visual Contrasts to Seascape, Open Ocean, Landscape, and KOPs for Alternatives B-1 and B-2

Contrast Rating Effects	Seascape Units, Open Ocean Unit, and Offshore and Onshore Key Observation Points
Strong Contrasts **Major**	Open Ocean KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area KOP-32 Cruise Ship Shipping Lanes

Contrast Rating Effects	Seascape Units, Open Ocean Unit, and Offshore and Onshore Key Observation Points
Moderate Contrasts **Moderate**	Seascape KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-14 Atlantic City Playground Pier KOP-18 Ocean City Boardwalk KOP-19 Corson's Inlet State Park KOP-21 Avalon Beach Jetty KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime KOP-16 Lucy the Elephant National Historic Landmark
Weak Contrasts **Minor**	Landscape KOP-1 Barnegat Lighthouse KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-6 Great Bay Boulevard WMA KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-8 Absecon Creek Boat Ramp KOP-11 Atlantic City Country Club KOP-13 Atlantic City Beachfront—Nighttime KOP-17 Bay Front Historic District, Municipal Beach Park KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-26 Wildwood Crest Fishing Pier KOP-28 Cape May Lighthouse KOP-29 BL England Substation Area KOP-30 Oyster Creek Substation Area
None to very weak **Negligible**	KOP-2 Harvey Cedars Beach Access KOP-15 Ventor City, City Hall KOP-20 Sea Isle City Promenade KOP-27 Cape May National Wildlife Refuge

WMA = Wildlife Management Area

The seascape, open ocean, and landscape criteria listed in Table M-1, and related consideration of the preceding assessments, would result in impact levels. Table M-24 summarizes the impacts of Alternatives B-1 and B-2 on the seascape character units, open ocean character unit, and landscape character units throughout the geographic analysis area. While there would be slight differences in the extents of visible elements, FOVs, and contrasts, overall impact levels would be similar for Alternative B-1, Alternative B-2, and the Proposed Action.

Table M-24 Alternatives B-1 and B-2 Impact on Seascape Character, Open Ocean Character, and Landscape Character

Level of Impact	Seascape Character Units, Open Ocean Character Unit, and Landscape Character Units
Major	SLIA: Open Ocean Character Unit
Moderate	SLIA: Seascape Character Units and Landscape Character Units: Beachfront and Jetty/Seawall, Boardwalk, Coastal Dune, and Island Community
Minor	SLIA: Landscape Character Units: Bay/Shoreline, Island, Mainland, Marshland, and Ridges
Negligible	SLIA: Landscape Character Units: Island, Mainland, and Ridges

The viewer experience criteria listed in Table M-1, and related consideration of the preceding assessments, would result in impact levels. Table M-25 summarizes the impacts of Alternatives B-1 and B-2 on the viewer experience (KOP locations) throughout the geographic analysis area. While there would be slight differences in the extents of visible elements, FOVs, and contrasts, overall impact levels would be similar for Alternative B-1, Alternative B-2, and the Proposed Action.

Table M-25 Impact of Alternatives B-1 and B-2 on Viewer Experience

Impact Level	Offshore and Onshore Key Observation Points
Major	VIA: KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area KOP-32 Cruise Ship Shipping Lanes SLIA: Seascape Character Units: Beachfront and Jetty/Seawall, Boardwalk, Coastal Dune, and Island Community
Moderate	SLIA: Seascape Character Units: Beachfront and Jetty/Seawall, Boardwalk, Coastal Dune, and Island Community VIA: KOP-7 Edwin B. Forsythe National Wildlife Refuge KOP-9 North Brigantine Natural Area Wildlife Observation Deck KOP-10 16th Street Park Beachfront KOP-12 Atlantic City Beachfront—Daytime KOP-14 Atlantic City Playground Pier KOP-16 Lucy the Elephant National Historic Landmark KOP-18 Ocean City Boardwalk KOP-19 Corson’s Inlet State Park KOP-21 Avalon Beach Jetty KOP-22 Stone Harbor Beach—Daytime KOP-23 Stone Harbor Beach—Nighttime

Impact Level	Offshore and Onshore Key Observation Points
Minor	SLIA: Landscape Character Units: Marshland, and Bay/Shoreline VIA: KOP-1 Barnegat Lighthouse KOP-3 Bayview Park KOP-4 Garden State Parkway KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit KOP-6 Great Bay Boulevard WMA KOP-8 Absecon Creek Boat Ramp KOP-11 Atlantic City Country Club KOP-13 Atlantic City Beachfront—Nighttime KOP-17 Bay Front Historic District, Municipal Beach Park KOP-24 North Wildwood Boulevard Bridge KOP-25 Hereford Inlet Lighthouse KOP-26 Wildwood Crest Fishing Pier KOP-28 Cape May Lighthouse KOP-29 BL England Substation Area KOP-30 Oyster Creek Substation Area
Negligible	SLIA: Landscape Character Units: Mainland and Ridges VIA: KOP-2 Harvey Cedars Beach Access KOP-15 Ventor City, City Hall KOP-20 Sea Isle City Promenade KOP-27 Cape May National Wildlife Refuge

WMA = Wildlife Management Area

M.3.3 Alternatives C-1, C-2, and D

Table M-26 and Table M-27 compare Alternatives C-1, C-2, and D wind farm width-, height-, and distance-related occupation of views from the nearest shoreline area. Distances vary by 1.2 mile and the horizontal FOVs vary by 2.3 degree. The vertical FOV is less than 1°. These results indicate slight changes to the FOV results compared to the Proposed Action (Table M-3 and Table M-4).

Table M-26 Horizontal FOV Occupied by Alternatives C-1, C-2, and D

Noticeable Element	Width miles (km)	Distance miles (km)	Horizontal FOV	Human FOV	Percent of FOV
C-1 Wind Farm	10.6 (17.1)	14.1 (22.7)	36.9°	124°	30%
C-2 Wind Farm	10.7 (17.2)	15.1 (24.3)	35.3°	124°	30%
D Wind Farm	11.8 (19.0)	15.3 (25.9)	37.6°	124°	30%

km = kilometers

Table M-27 Vertical FOV Occupied by Alternatives C-1, C-2, and D

Noticeable Element	Height feet (m) MLLW	Distance miles (km)	Visible Height[1] feet (m)	Vertical FOV	Human FOV	Percent of FOV
C-1 Rotor Blade Tip	906 feet (276.1)	14.1 (22.7)	820 (244)	0.6°	55°	1%
C-2 Rotor Blade Tip	906 feet (276.1)	15.1 (24.3)	804 (244)	0.6°	55°	1%
D Rotor Blade Tip	906 feet (276.1)	15.3 (25.9)	801 (244)	0.6°	55°	1%

[1] Based on intervening EC and clear-day conditions.
km = kilometers; m = meters

M.4. SLIA Summary

SLIA considers the impacts on the physical elements and features that make up a seascape, open ocean, or landscape and the aesthetic, perceptual, and experiential aspects of the seascape, open ocean, or landscape that contribute to its distinctive character. These impacts affect the "feel," "character," or "sense of place" of an area of seascape, open ocean, or landscape. Table M-28 summarizes the effects of the character of the offshore and onshore components of the Project with the aspects that contribute to the distinctive character of the seascape, open ocean, and landscape areas from which the Project would be visible (BOEM 2021).

M.5. VIA Summary

The VIA considers the characteristics of the view receptor, characteristics of the view toward the Project facilities, and experiential impacts of the Project. Table M-29 summarizes the viewer sensitivity, view receptor susceptibility, view value, and summary of the measures of effects from the visible character and magnitude of the offshore and onshore components of the Project (BOEM 2021).

Table M-28 Seascape Character, Open Ocean Character, Landscape Character and Impact Levels

	Affected Environment						Proposed Action													Impact Levels				
	Unit Susceptibility			Unit Value			Project Visibility				Character Key Feature Change			Character Key Element Change			Character Key Quality Change			Proposed Action				Alternatives B-1, B-2, C-1, C-2, and D
Character Unit	High	Medium	Low	High	Medium	Low	Dominant	Substantial	Low	Unseen	High	Medium	Low	High	Medium	Low	High	Medium	Low	Major	Moderate	Minor	Negligible	Impact Level
Open Ocean	X			X			X				X			X			X			X				Same as Proposed Action
Seascape Ocean	X			X			X				X			X			X			X				Same as Proposed Action
Seascape Beachfront	X			X			X				X			X			X			X				Same as Proposed Action
Seascape Boardwalks/Jetties/ Seawalls	X			X			X				X			X			X			X				Same as Proposed Action
Seascape Dunes	X			X			X				X			X			X			X				Same as Proposed Action
Seascape Commerce	X				X		X				X			X			X			X				Same as Proposed Action
Seascape Institutional	X			X			X				X			X			X			X				Same as Proposed Action
Seascape Municipal	X			X			X				X			X			X			X				Same as Proposed Action
Seascape Parks	X			X			X				X			X			X			X				Same as Proposed Action
Seascape Preserves	X			X			X				X			X			X			X				Same as Proposed Action
Seascape Residential	X			X			X				X			X			X			X				Same as Proposed Action
Landscape Bay/ Estuary/Marsh	X			X				X				X			X			X			X			Same as Proposed Action

	Affected Environment						Proposed Action															Impact Levels				
	Unit Susceptibility			Unit Value			Project Visibility				Character Key Feature Change			Character Key Element Change			Character Key Quality Change			Proposed Action				Alternatives B-1, B-2, C-1, C-2, and D
Character Unit	High	Medium	Low	High	Medium	Low	Dominant	Substantial	Low	Unseen	High	Medium	Low	High	Medium	Low	High	Medium	Low	Major	Moderate	Minor	Negligible	Impact Level
Landscape River	X			X				X				X			X			X			X			Same as Proposed Action
Landscape Agriculture			X			X		X				X			X			X			X			Same as Proposed Action
Landscape Commerce			X			X		X				X			X			X			X			Same as Proposed Action
Landscape Forest		X		X					X				X			X			X					Same as Proposed Action
Landscape Institutional	X			X				X				X			X			X			X			Same as Proposed Action
Landscape Park	X			X				X				X			X			X			X			Same as Proposed Action
Landscape Preserve	X			X				X				X			X			X			X			Same as Proposed Action
Landscape Recreation		X			X			X				X			X			X			X			Same as Proposed Action
Landscape Residential	X			X				X				X			X			X			X			Same as Proposed Action

Table M-29 Viewer Sensitivity, Receptor Susceptibility, View Value, Viewer Experience, and Impact Levels

KOP[1]	Affected Environment									Viewer Experience				Impact Levels				
	Viewer Sensitivity			Receptor Susceptibility			View Value			Distance-Noticeable Elements-HFOV-VFOV-Contrast-Scale-Prominence Effects				Proposed Action				Alternatives B-1, B-2, C-1, C-2, and D
	High	Medium	Low	High	Medium	Low	High	Medium	Low	Dominant	Substantial	Low	Unseen	Major	Moderate	Minor	Negligible	Impact Levels
KOP-1[2]	X			X			X					X				X		Same as Proposed Action
KOP-2	X				X		X					X					X	Same as Proposed Action
KOP-3[2]	X			X			X					X				X		Same as Proposed Action
KOP-4	X					X	X						X			X		Same as Proposed Action
KOP-5	X				X		X					X				X		Same as Proposed Action
KOP-6	X				X		X					X				X		Same as Proposed Action
KOP-7	X			X			X					X				X		Same as Proposed Action
KOP-8	X			X			X					X				X		Same as Proposed Action
KOP-9	X					X	X				X				X			Same as Proposed Action
KOP-10	X				X		X				X				X			Same as Proposed Action
KOP-11	X				X		X					X				X		Same as Proposed Action
KOP-12	X				X		X				X				X			Same as Proposed Action
KOP-13	X				X		X					X				X		Same as Proposed Action
KOP-14	X				X		X				X				X			Same as Proposed Action
KOP-15[2]	X			X			X						X				X	Same as Proposed Action
KOP-16	X			X			X				X				X			Same as Proposed Action
KOP-17	X			X			X					X				X		Same as Proposed Action
KOP-18	X				X		X				X				X			Same as Proposed Action
KOP-19	X				X		X				X				X			Same as Proposed Action
KOP-20	X				X		X						X				X	Same as Proposed Action
KOP-21	X				X		X					X			X			Same as Proposed Action
KOP-22	X				X		X					X				X		Same as Proposed Action
KOP-23	X				X		X					X				X		Same as Proposed Action

KOP[1]	Affected Environment									Viewer Experience				Impact Levels				
	Viewer Sensitivity			Receptor Susceptibility			View Value			Distance-Noticeable Elements-HFOV-VFOV-Contrast-Scale-Prominence Effects				Proposed Action				Alternatives B-1, B-2, C-1, C-2, and D
	High	Medium	Low	High	Medium	Low	High	Medium	Low	Dominant	Substantial	Low	Unseen	Major	Moderate	Minor	Negligible	Impact Levels
KOP-24	X				X		X					X				X		Same as Proposed Action
KOP-25	X				X		X					X				X		Same as Proposed Action
KOP-26	X				X		X					X				X		Same as Proposed Action
KOP-27	X				X		X						X				X	Same as Proposed Action
KOP-28	X				X		X					X				X		Same as Proposed Action
KOP-29		X		X				X				X				X		Same as Proposed Action
KOP-30		X		X				X				X				X		Same as Proposed Action
KOP-31	X			X			X			X				X				Same as Proposed Action
KOP-32	X			X			X			X				X				NA

[1] KOP-1 Barnegat Lighthouse; KOP-2 Harvey Cedars Beach Access; KOP-3 Bayview Park; KOP-4 Garden State Parkway; KOP-5 Edwin B. Forsythe National Wildlife Refuge - Holgate Unit; KOP-6 Great Bay Boulevard Wildlife Management Area; KOP-7 Edwin B. Forsythe National Wildlife Refuge; KOP-8 Absecon Creek Boat Ramp; KOP-9 North Brigantine Natural Area Wildlife Observation Deck; KOP-10 16th Street Park Beachfront; KOP-11 Atlantic City Country Club; KOP-12 Atlantic City Beachfront; KOP-13 Atlantic City Beachfront (Nighttime); KOP-14 Atlantic City Playground Pier; KOP-15 Ventor City, City Hall; KOP-16 Lucy the Elephant National Historic Landmark; KOP-17 Bay Front Historic District, Municipal Beach Park; KOP-18 Ocean City Boardwalk; KOP-19 Corson's Inlet State Park; KOP-20 Sea Isle City Promenade; KOP-21 Avalon Beach Jetty; KOP-22 Stone Harbor Beach; KOP-23 Stone Harbor Beach (nighttime); KOP-24 North Wildwood Boulevard Bridge; KOP-25 Hereford Inlet Lighthouse; KOP-26 Wildwood Crest Fishing Pier; KOP-27 Cape May National Wildlife Refuge; KOP-28 Cape May Lighthouse; KOP-29 BL England Substation Area; KOP-30 Oyster Creek Substation Area; KOP-31 Commercial and Recreational Fishing and Tour Boat Area; KOP-32 Commercial and Cruise Ship Shipping Lanes
[2] Elevated observation deck or lighthouse.
HFOV = horizontal field of view; NA = not applicable; VFOV = vertical field of view

M.6. References

Bureau of Ocean Energy Management (BOEM). 2021. *Assessment of Seascape, Landscape, and Visual Impacts of Offshore Wind Energy Developments on the Outer Continental Shelf of the United States*. OCS Study BOEM 2021-032. April.

National Association of Environmental Professionals. (NAEP). 2012. *Offshore Wind Turbine Visibility and Visual Impact Thresholds*.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

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ATTACHMENT M-1
SCENIC RESOURCES OVERVIEW MAP

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SCENIC RESOURCE MAPPING

RESOURCES MAP 1

OVERVIEW MAP

LEGEND

- 40-Mile Study Area Boundary
- C527 Resource Code (see Scenic Resource Table)

Conservation Areas

- National Natural Landmark (NNL)
- National Wildlife Refuge
- State Park/State Forest
- State Wildlife Management Area (WMA)
- State Recreation Area
- Local Park/Conservation/Recreation Area
- Historic or Cultural Conservation Area
- Private Conservation Land

Historic Resources

- National Historic Landmark (NHL)
- NHL District
- Listed NRHP Historic Property
- Listed NRHP Historic District
- Eligible NRHP Historic Property
- Eligible NRHP Historic District
- Local Historic Landmark
- Local NRHP Historic District

Other Resources

- State Scenic Byway
- National Wild & Scenic Rivers
- Waterbodies
- Cemetery

OCEAN WIND

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13 March 2020

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ATTACHMENT M-2
CUMULATIVE VISUAL SIMULATIONS

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VIEWPOINT
Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

VISUALIZATIONS

VISUALIZATIONS INCLUDED	
1A	Northeast view: only Ocean Wind 1
1B	Northeast view: all visible projects
1C	Northeast view: all visible projects except Ocean Wind 1
2A	Southeast view: only Ocean Wind 1
2B	Southeast view: all visible projects
2C	Southeast view: all visible projects except Ocean Wind 1

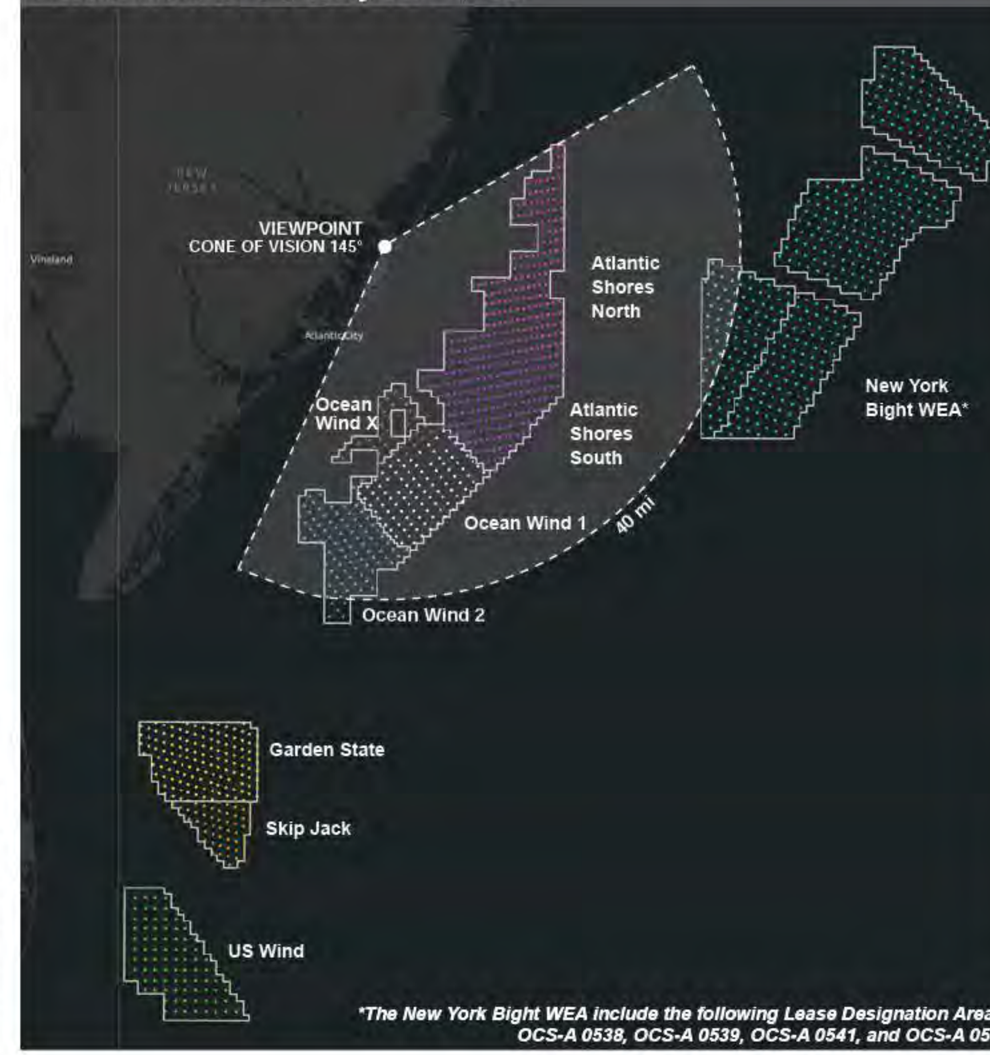
** New York Bight WEA is not visible from this viewpoint due to the land mass in the foreground.

CUMULATIVE PROJECT INFORMATION

OFFSHORE WIND PROJECT	THEORETICALLY VISIBLE FROM VIEWPOINT*	DISTANCE TO NEAREST WTG (mi)	DISTANCE TO FARTHEST WTG (mi)	NUMBER OF THEORETICALLY VISIBLE TURBINES	HORIZONTAL FIELD OF VIEW
New York Bight WEA	Yes	36.6	69.7	0**	0°
Atlantic Shores North	Yes	11.2	23.6	131	56°
Atlantic Shores South	Yes	11.9	28.0	202	43°
Ocean Wind 1	Yes	21.9	34.1	69	30°
Ocean Wind 2	Yes	26.3	41.9	24	14°
Ocean Wind X	Yes	16.4	24.0	33	26°
Garden State	No	55.8	66.1	0	0°
Skip Jack	No	64.2	71.6	0	0°
US Wind	No	76.4	89.2	0	0°

*A distance of 40-miles from each viewpoint has been used to define the limits of theoretical visibility. This 40-mile distance aligns with the visual study area used in the Ocean Wind Visual Impact Assessment. For an observation elevation of 25 feet (typical of views from the boardwalks on the coast of New Jersey), the limit of Ocean Wind turbine hub visibility would be 37.3 miles due to earth curvature. While the blade tips are located above the horizon beyond this range, they are unlikely to be detected by observers at these distances due to the limits of visual acuity.

CUMULATIVE PROJECT MAP



*The New York Bight WEA include the following Lease Designation Areas: OCS-A 0538, OCS-A 0539, OCS-A 0541, and OCS-A 0542

WIND DIRECTION

NORTHWEST

Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

VIEWPOINT INFORMATION

LOCATION	
VIA KOP #	V06
Date / Time	09/20/2018 / 9:40am
Latitude / Longitude	39.508809°/ -74.322008°
Direction of View	Northeast to Southeast

PHOTO	
Camera	NIKON D5500
Resolution	300 dpi
Focal Length	50 mm
Viewer Eye Elevation	7 ft

ENVIRONMENTAL	
Temperature	72°
Humidity	73%
Wind Speed	10 mph
Weather Conditions	Overcast

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 145° (based on Nikon D5500 camera lens, where a Normal Photo is 37.26°)

Ocean Wind tjd&a

1A: Northeast view showing only Ocean Wind 1

Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

Ocean Wind 1 not in view

Panoramic Field of View: 69°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 145°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

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1B: Northeast view showing all visible projects

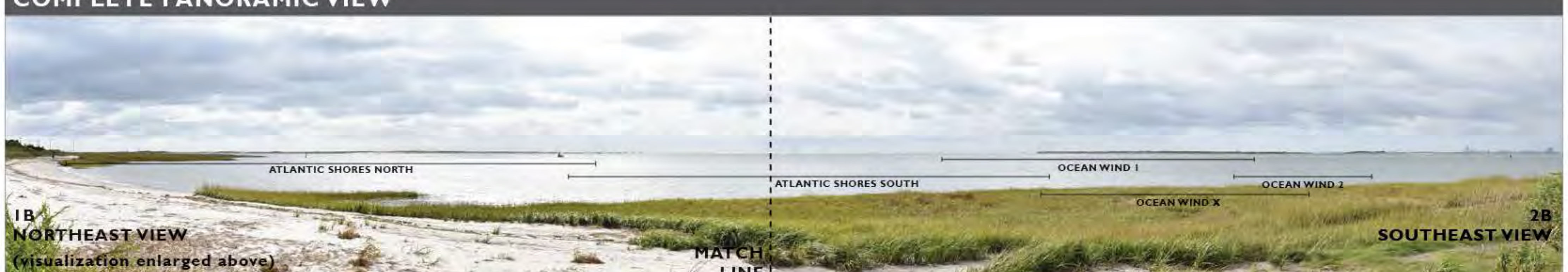
Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

Ocean Wind 1 not in view

Panoramic Field of View: 69°

PROJECT MAP

COMPLETE PANORAMIC VIEW



Panoramic Field of View: 145°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
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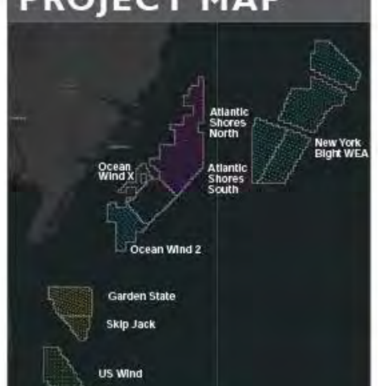
1C: Northeast view showing all projects except Ocean Wind 1

Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

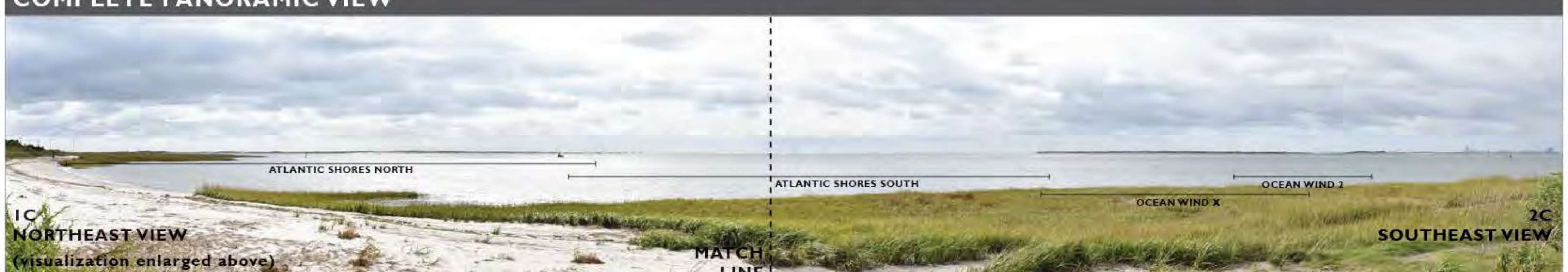
Ocean Wind 1 not in view

Panoramic Field of View: 69°

PROJECT MAP



COMPLETE PANORAMIC VIEW



Panoramic Field of View: 145°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

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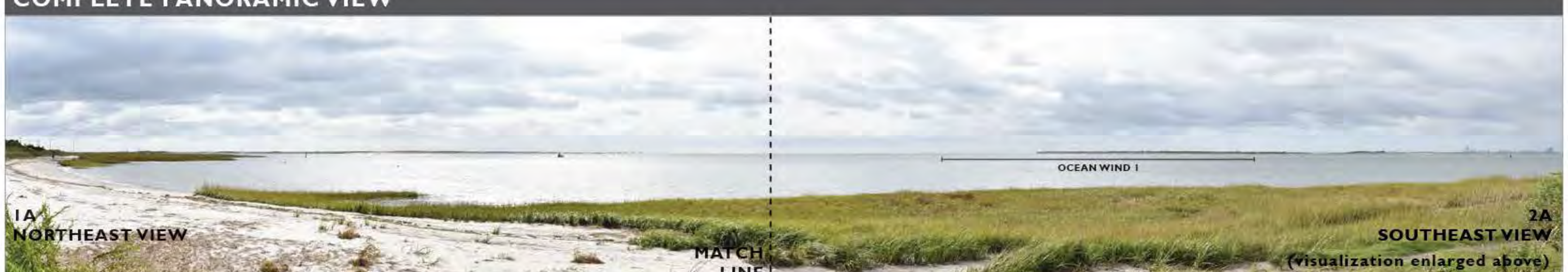
2A: Southeast view showing only Ocean Wind 1

Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

Panoramic Field of View: 69°

PROJECT MAP

COMPLETE PANORAMIC VIEW



Panoramic Field of View: 145°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind An Ørsted initiative

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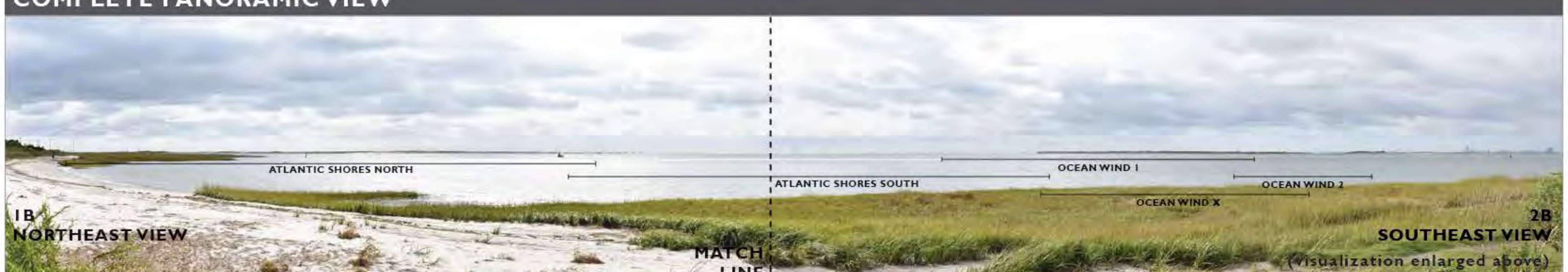
2B: Southeast view showing all visible projects

Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

Panoramic Field of View: 69°

PROJECT MAP

COMPLETE PANORAMIC VIEW



Panoramic Field of View: 145°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
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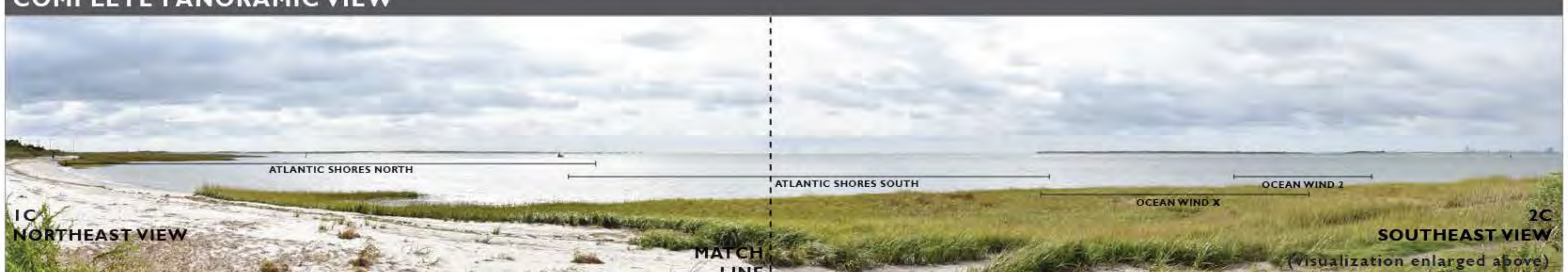
2C: Southeast view showing all projects except Ocean Wind 1

Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

Panoramic Field of View: 69°

PROJECT MAP

COMPLETE PANORAMIC VIEW



Panoramic Field of View: 145°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

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VIEWPOINT
Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

VISUALIZATIONS

VISUALIZATIONS INCLUDED	
1A	Northeast view: only Ocean Wind 1
1B	Northeast view: all visible projects
1C	Northeast view: all visible projects except Ocean Wind 1
2A	Southeast view: only Ocean Wind 1
2B	Southeast view: all visible projects
2C	Southeast view: all visible projects except Ocean Wind 1

**** New York Bight WEA is not visible from this viewpoint due to the land mass in the foreground.**

CUMULATIVE PROJECT INFORMATION

OFFSHORE WIND PROJECT	THEORETICALLY VISIBLE FROM VIEWPOINT*	DISTANCE TO NEAREST WTG (mi)	DISTANCE TO FARTHEST WTG (mi)	NUMBER OF THEORETICALLY VISIBLE TURBINES	HORIZONTAL FIELD OF VIEW
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Atlantic Shores North	Yes	11.2	23.6	131	56°
Atlantic Shores South	Yes	11.9	28.0	202	43°
Ocean Wind 1	Yes	21.9	34.1	69	30°
Ocean Wind 2	Yes	26.3	41.9	24	14°
Ocean Wind X	Yes	16.4	24.0	33	26°
Garden State	No	55.8	66.1	0	0°
Skip Jack	No	64.2	71.6	0	0°
US Wind	No	76.4	89.2	0	0°

*A distance of 40-miles from each viewpoint has been used to define the limits of theoretical visibility. This 40-mile distance aligns with the visual study area used in the Ocean Wind Visual Impact Assessment. For an observation elevation of 25 feet (typical of views from the boardwalks on the coast of New Jersey), the limit of Ocean Wind turbine hub visibility would be 37.3 miles due to earth curvature. While the blade tips are located above the horizon beyond this range, they are unlikely to be detected by observers at these distances due to the limits of visual acuity.

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

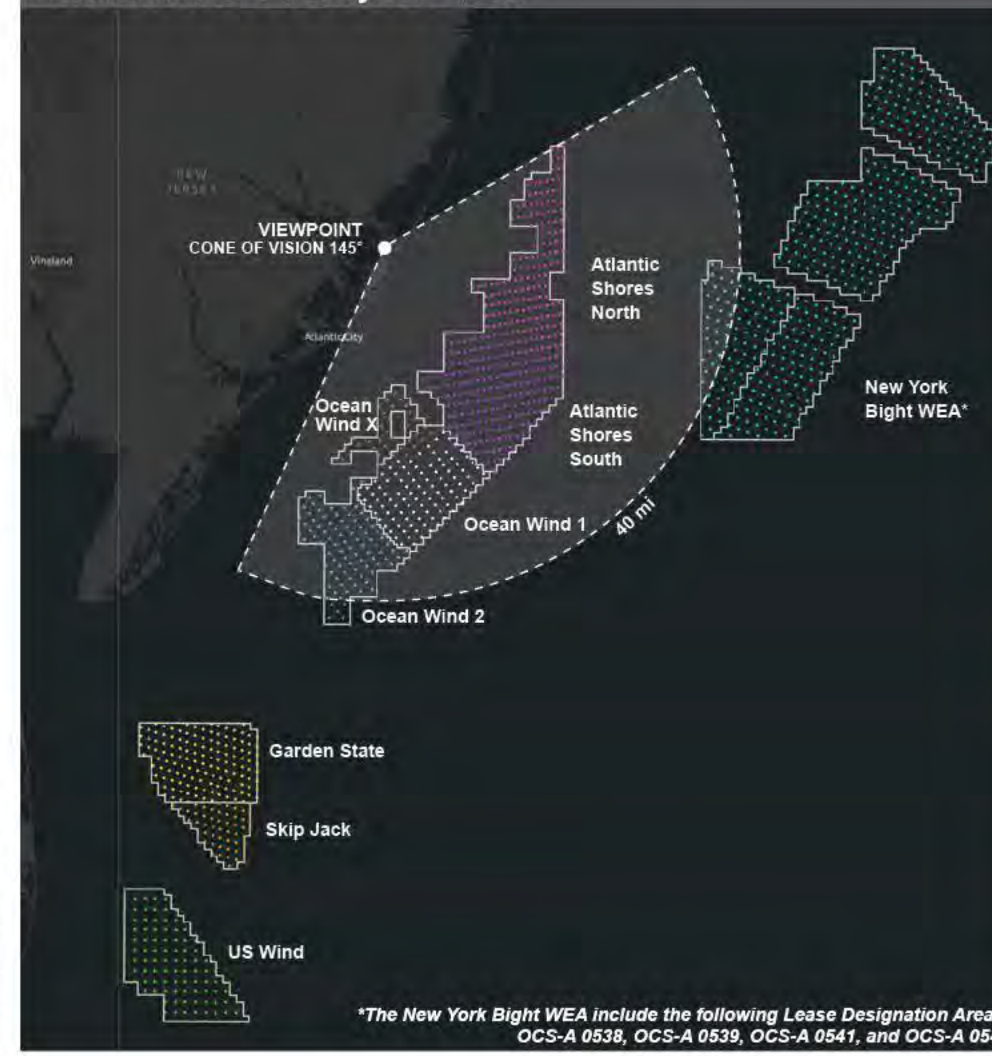
VIEWPOINT INFORMATION

LOCATION	
VIA KOP #	V06
Date / Time	09/20/2018 / 9:40am
Latitude / Longitude	39.508809°/ -74.322008°
Direction of View	Northeast to Southeast

PHOTO	
Camera	NIKON D5500
Resolution	300 dpi
Focal Length	50 mm
Viewer Eye Elevation	7 ft

ENVIRONMENTAL	
Temperature	72°
Humidity	73%
Wind Speed	10 mph
Weather Conditions	Overcast

CUMULATIVE PROJECT MAP



*The New York Bight WEA include the following Lease Designation Areas: OCS-A 0538, OCS-A 0539, OCS-A 0541, and OCS-A 0542

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 145° (based on Nikon D5500 camera lens, where a Normal Photo is 37.26°)

Ocean Wind tjd&a

1A: Northeast view showing only Ocean Wind 1

Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

Ocean Wind 1 not in view

Panoramic Field of View: 69°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 145°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

1B: Northeast view showing all visible projects

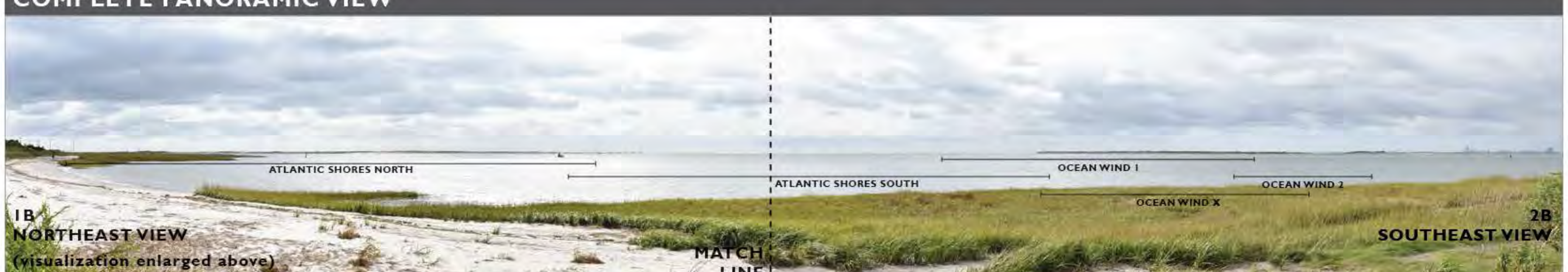
Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

Ocean Wind 1 not in view

Panoramic Field of View: 69°

PROJECT MAP

COMPLETE PANORAMIC VIEW



Panoramic Field of View: 145°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind An Ørsted initiative

tjd&a

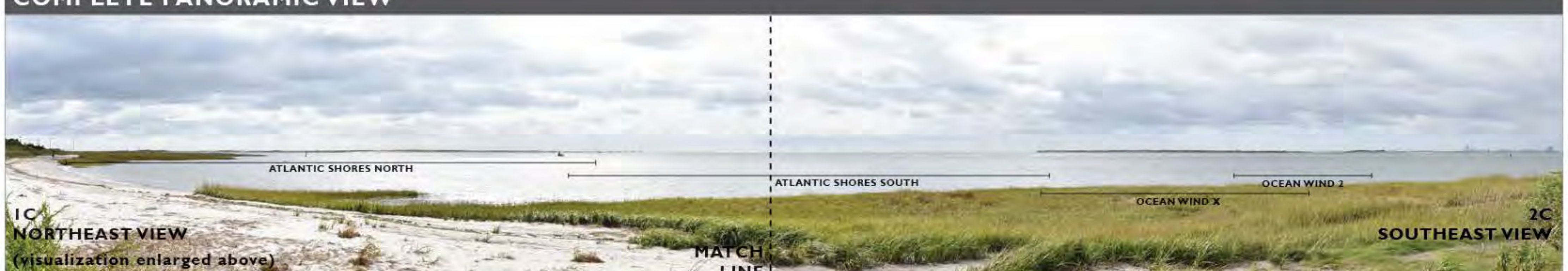
1C: Northeast view showing all projects except Ocean Wind 1
Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

Ocean Wind 1 not in view

Panoramic Field of View: 69°

PROJECT MAP

COMPLETE PANORAMIC VIEW



Panoramic Field of View: 145°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind An Ørsted initiative

tjd&a

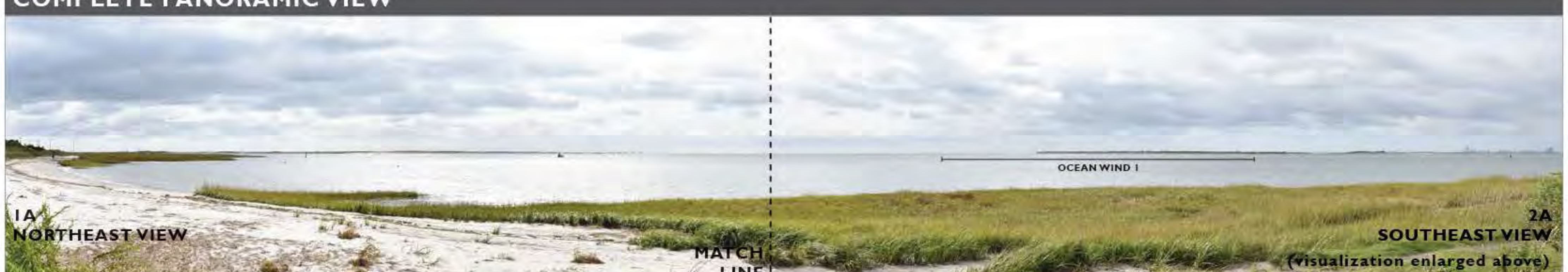
2A: Southeast view showing only Ocean Wind 1

Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

Panoramic Field of View: 69°

PROJECT MAP

COMPLETE PANORAMIC VIEW



Panoramic Field of View: 145°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

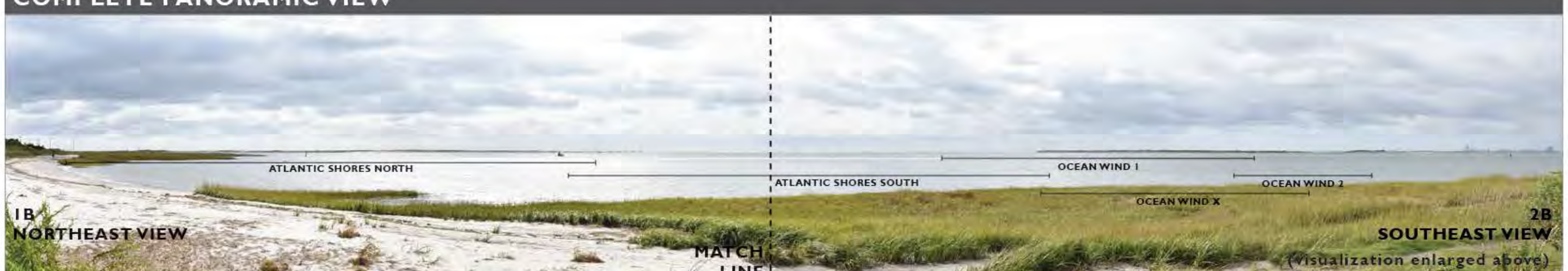
2B: Southeast view showing all visible projects

Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

Panoramic Field of View: 69°

PROJECT MAP

COMPLETE PANORAMIC VIEW



Panoramic Field of View: 145°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

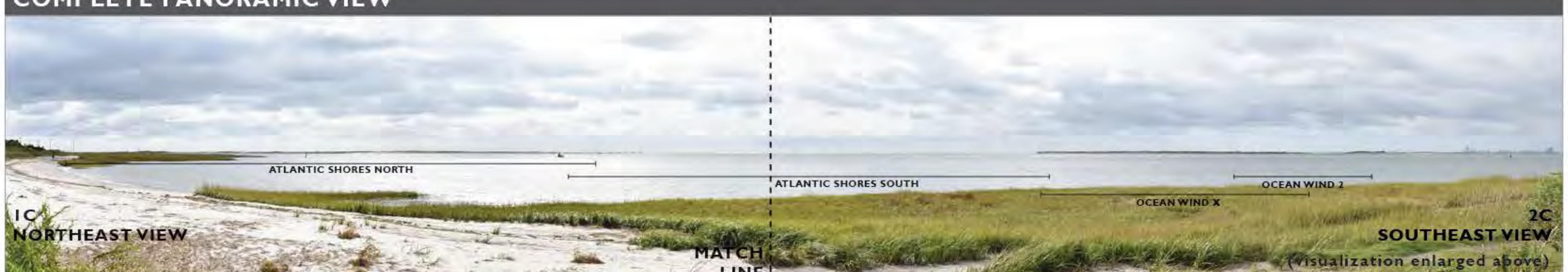
2C: Southeast view showing all projects except Ocean Wind 1

Great Bay Boulevard Wildlife Management Area, Little Egg Harbor Township

Panoramic Field of View: 69°

PROJECT MAP

COMPLETE PANORAMIC VIEW



Panoramic Field of View: 145°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind An Ørsted initiative

tjd&a

VIEWPOINT
Playground Pier, Atlantic City

VISUALIZATIONS

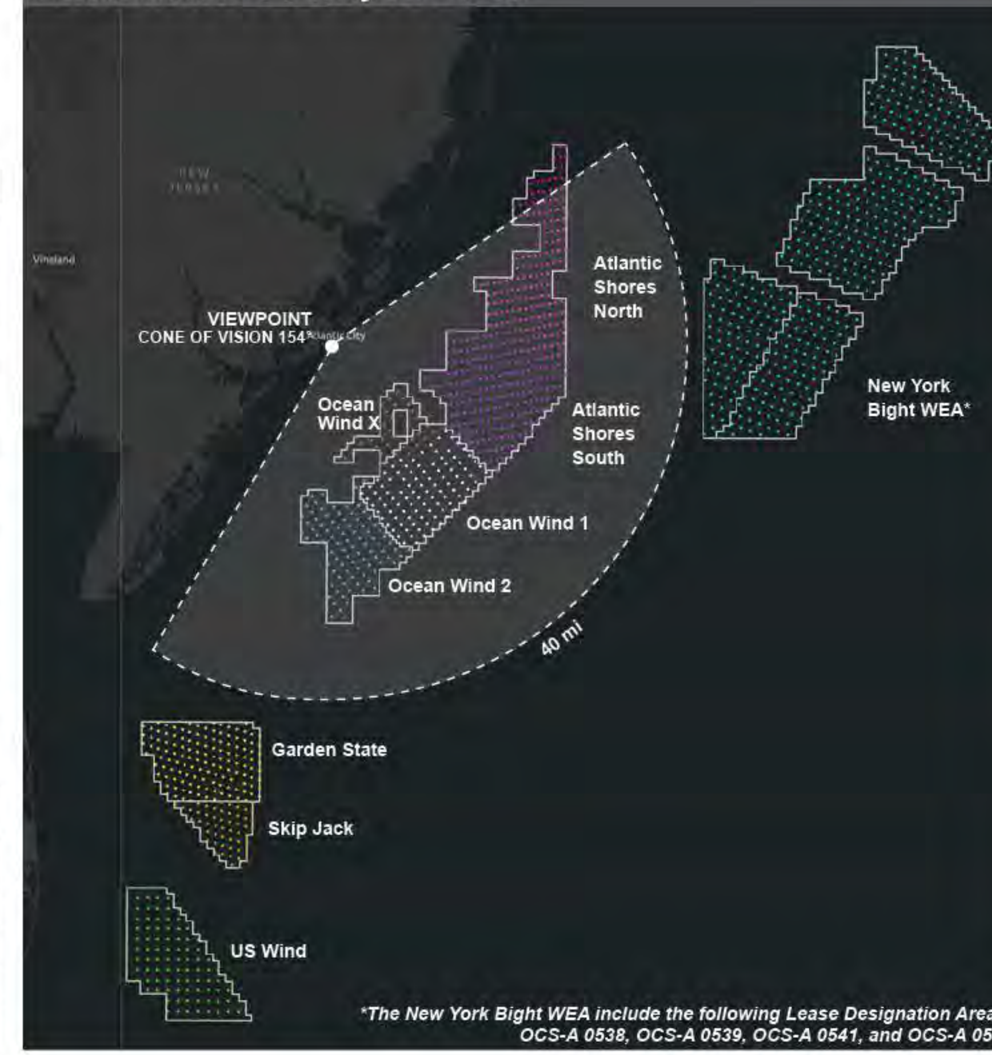
VISUALIZATIONS INCLUDED	
3A	Northeast view: only Ocean Wind 1
3B	Northeast view: all visible projects
3C	Northeast view: all visible projects except Ocean Wind 1
4A	Southeast view: only Ocean Wind 1
4B	Southeast view: all visible projects
4C	Southeast view: all visible projects except Ocean Wind 1

CUMULATIVE PROJECT INFORMATION

OFFSHORE WIND PROJECT	THEORETICALLY VISIBLE FROM VIEWPOINT*	DISTANCE TO NEAREST WTG (mi)	DISTANCE TO FARTHEST WTG (mi)	NUMBER OF THEORETICALLY VISIBLE TURBINES	HORIZONTAL FIELD OF VIEW
New York Bight WEA	No	42.3	78.0	0	0°
Atlantic Shores North	Yes	17.4	34.5	82	25°
Atlantic Shores South	Yes	11.2	26.6	202	43°
Ocean Wind 1	Yes	15.2	24.7	99	41°
Ocean Wind 2	Yes	15.8	30.7	88	30.6°
Ocean Wind X	Yes	9.0	15.2	33	46.8°
Garden State	No	43.8	53.9	0	0°
Skip Jack	No	52.4	59.8	0	0°
US Wind	No	64.2	77.2	0	0°

*A distance of 40-miles from each viewpoint has been used to define the limits of theoretical visibility. This 40-mile distance aligns with the visual study area used in the Ocean Wind Visual Impact Assessment. For an observation elevation of 25 feet (typical of views from the boardwalks on the coast of New Jersey), the limit of Ocean Wind turbine hub visibility would be 37.3 miles due to earth curvature. While the blade tips are located above the horizon beyond this range, they are unlikely to be detected by observers at these distances due to the limits of visual acuity.

CUMULATIVE PROJECT MAP



WIND DIRECTION

NORTHWEST

Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

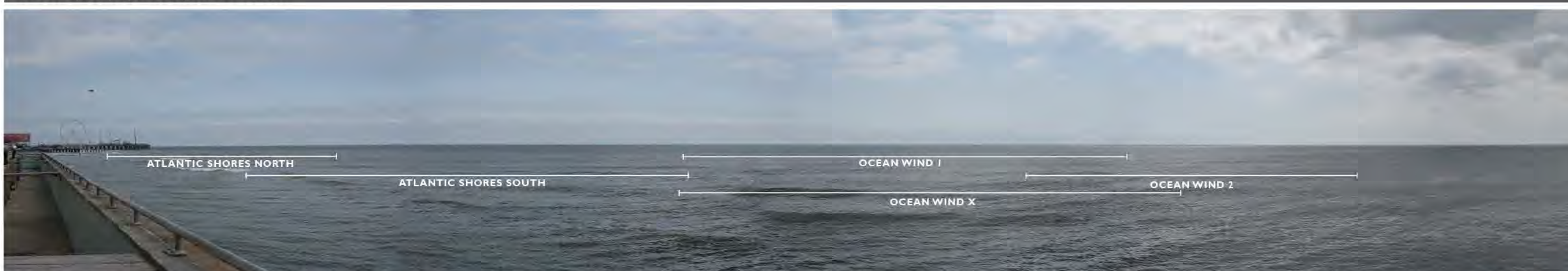
VIEWPOINT INFORMATION

LOCATION	
VIA KOP #	V14
Date / Time	09/19/2018 / 12:28pm
Latitude / Longitude	39.35259 / -74.43357
Direction of View	Northeast to Southeast

PHOTO	
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50 mm
Viewer Eye Elevation	24.33 ft

ENVIRONMENTAL	
Temperature	79°
Humidity	77%
Wind Speed	7 mph
Weather Conditions	Broken Clouds

COMPLETE PANORAMIC VIEW



Panoramic Field of View: 154° (based on Nikon D750 camera lens, where a Normal Photo is 39.6°)

Ocean Wind tjd&a

3A: Northeast view showing only Ocean Wind 1

Playground Pier, Atlantic City

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

tjd&a

3B: Northeast view showing all visible projects

Playground Pier, Atlantic City

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST

Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

3C: Northeast view showing all projects except Ocean Wind 1
Playground Pier, Atlantic City

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

tjd&a

4A: Southeast view showing only Ocean Wind 1

Playground Pier, Atlantic City

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

tjd&a

4B: Southeast view showing all visible projects

Playground Pier, Atlantic City

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind An Ørsted initiative

tjd&a

4C: Southeast view showing all projects except Ocean Wind 1

Playground Pier, Atlantic City

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

tjd&a

VIEWPOINT
Playground Pier, Atlantic City

VISUALIZATIONS

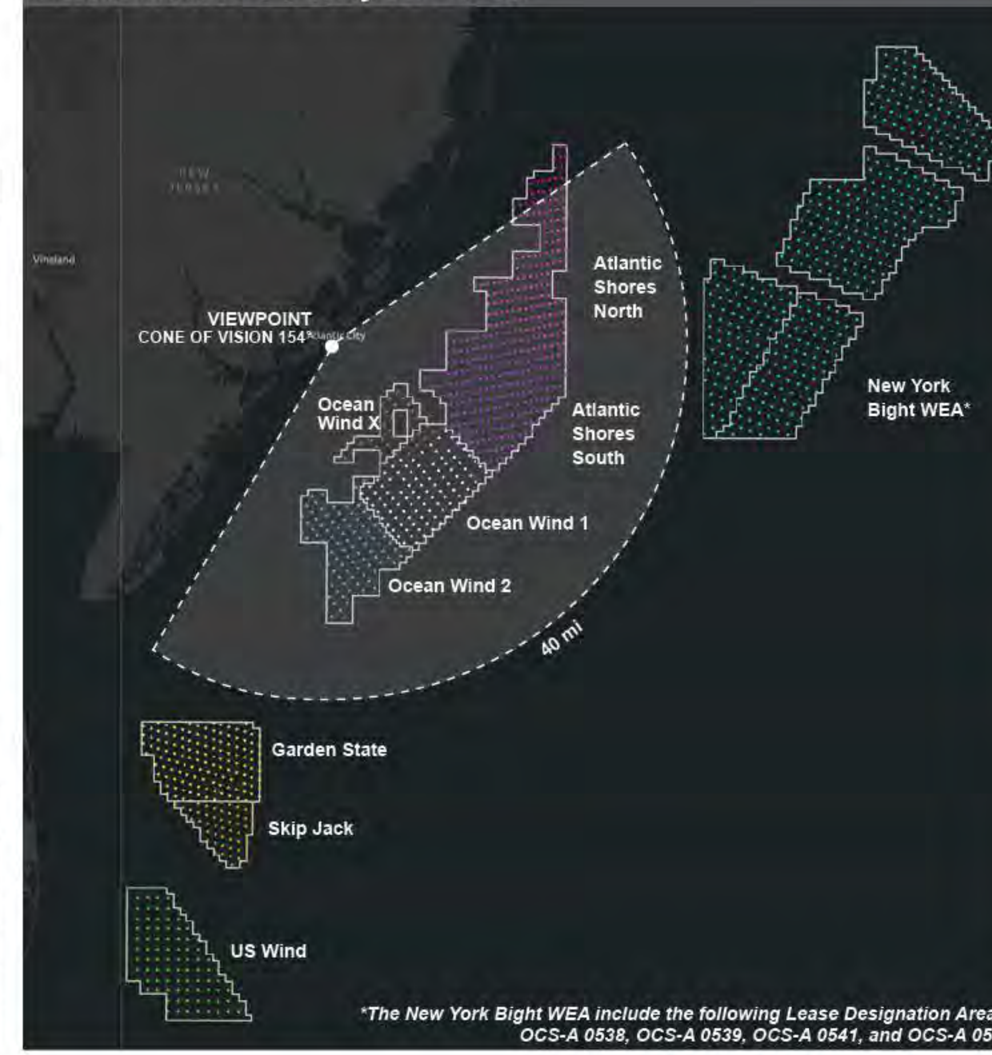
VISUALIZATIONS INCLUDED	
3A	Northeast view: only Ocean Wind 1
3B	Northeast view: all visible projects
3C	Northeast view: all visible projects except Ocean Wind 1
4A	Southeast view: only Ocean Wind 1
4B	Southeast view: all visible projects
4C	Southeast view: all visible projects except Ocean Wind 1

CUMULATIVE PROJECT INFORMATION

OFFSHORE WIND PROJECT	THEORETICALLY VISIBLE FROM VIEWPOINT*	DISTANCE TO NEAREST WTG (mi)	DISTANCE TO FARTHEST WTG (mi)	NUMBER OF THEORETICALLY VISIBLE TURBINES	HORIZONTAL FIELD OF VIEW
New York Bight WEA	No	42.3	78.0	0	0°
Atlantic Shores North	Yes	17.4	34.5	82	25°
Atlantic Shores South	Yes	11.2	26.6	202	43°
Ocean Wind 1	Yes	15.2	24.7	99	41°
Ocean Wind 2	Yes	15.8	30.7	88	30.6°
Ocean Wind X	Yes	9.0	15.2	33	46.8°
Garden State	No	43.8	53.9	0	0°
Skip Jack	No	52.4	59.8	0	0°
US Wind	No	64.2	77.2	0	0°

*A distance of 40-miles from each viewpoint has been used to define the limits of theoretical visibility. This 40-mile distance aligns with the visual study area used in the Ocean Wind Visual Impact Assessment. For an observation elevation of 25 feet (typical of views from the boardwalks on the coast of New Jersey), the limit of Ocean Wind turbine hub visibility would be 37.3 miles due to earth curvature. While the blade tips are located above the horizon beyond this range, they are unlikely to be detected by observers at these distances due to the limits of visual acuity.

CUMULATIVE PROJECT MAP



WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

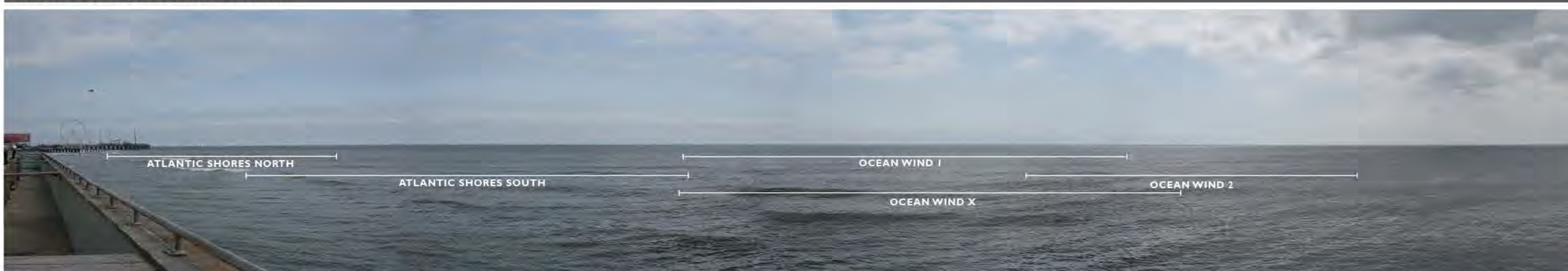
VIEWPOINT INFORMATION

LOCATION	
VIA KOP #	V14
Date / Time	09/19/2018 / 12:28pm
Latitude / Longitude	39.35259 / -74.43357
Direction of View	Northeast to Southeast

PHOTO	
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50 mm
Viewer Eye Elevation	24.33 ft

ENVIRONMENTAL	
Temperature	79°
Humidity	77%
Wind Speed	7 mph
Weather Conditions	Broken Clouds

COMPLETE PANORAMIC VIEW



Panoramic Field of View: 154° (based on Nikon D750 camera lens, where a Normal Photo is 39.6°)

3A: Northeast view showing only Ocean Wind 1

Playground Pier, Atlantic City

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

3B: Northeast view showing all visible projects

Playground Pier, Atlantic City

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

3C: Northeast view showing all projects except Ocean Wind 1

Playground Pier, Atlantic City

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

4A: Southeast view showing only Ocean Wind 1

Playground Pier, Atlantic City

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind An Ørsted initiative

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4B: Southeast view showing all visible projects

Playground Pier, Atlantic City

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

4C: Southeast view showing all projects except Ocean Wind 1

Playground Pier, Atlantic City

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

VIEWPOINT
Corson's Inlet State Park, Ocean City

VISUALIZATIONS

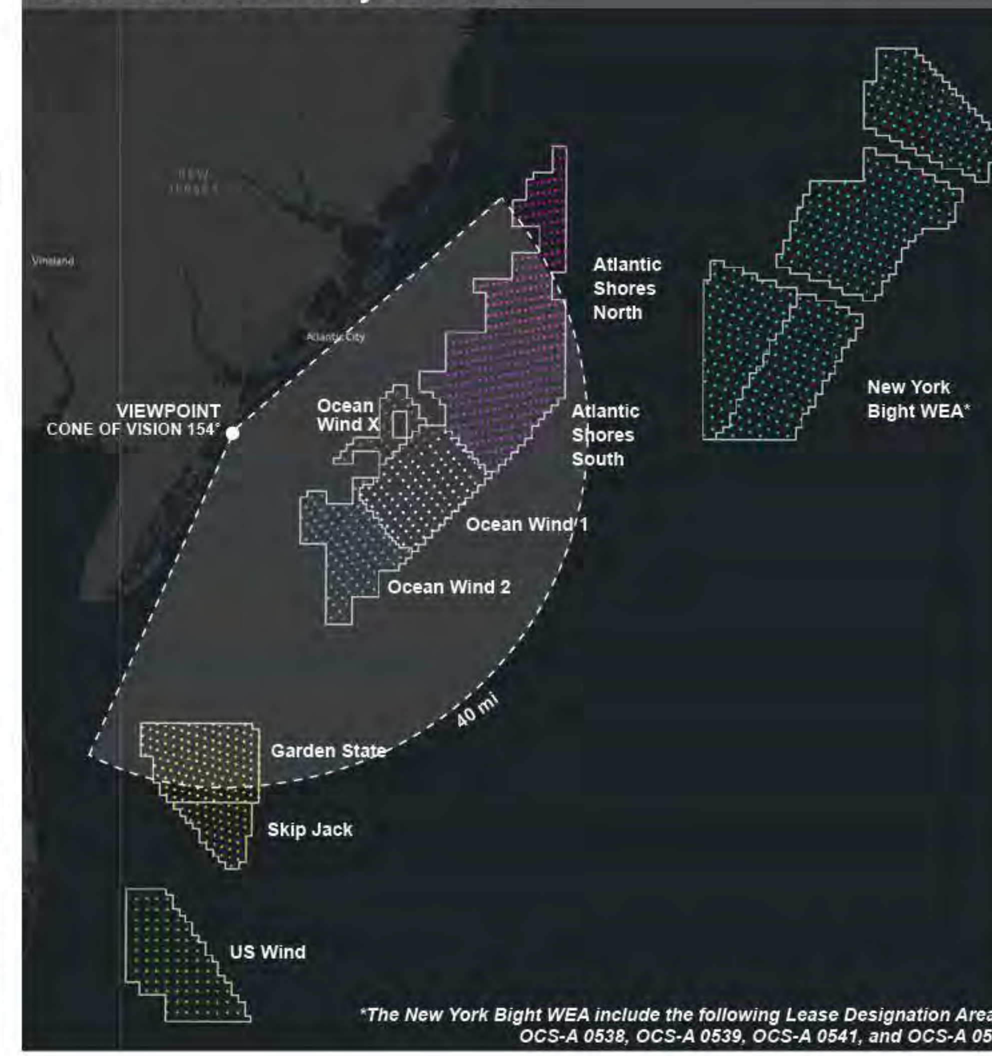
VISUALIZATIONS INCLUDED	
5A	Northeast view: only Ocean Wind 1
5B	Northeast view: all visible projects
5C	Northeast view: all visible projects except Ocean Wind 1
6A	Southeast view: only Ocean Wind 1
6B	Southeast view: all visible projects
6C	Southeast view: all visible projects except Ocean Wind 1

CUMULATIVE PROJECT INFORMATION

OFFSHORE WIND PROJECT	THEORETICALLY VISIBLE FROM VIEWPOINT*	DISTANCE TO NEAREST WTG (mi)	DISTANCE TO FARTHEST WTG (mi)	NUMBER OF THEORETICALLY VISIBLE TURBINES	HORIZONTAL FIELD OF VIEW
New York Bight WEA	No	53.3	91.7	0	0°
Atlantic Shores North	Yes	31.3	49.2	101	25°
Atlantic Shores South	Yes	21.6	38.2	202	43°
Ocean Wind 1	Yes	16.2	29.1	99	34°
Ocean Wind 2	Yes	11.7	24.6	88	40.8°
Ocean Wind X	Yes	13.0	22.6	33	26.5°
Garden State	Yes	33.0	42.1	112	22°
Skip Jack	No	41.9	49.3	0	0°
US Wind	No	52.2	65.8	0	0°

*A distance of 40-miles from each viewpoint has been used to define the limits of theoretical visibility. This 40-mile distance aligns with the visual study area used in the Ocean Wind Visual Impact Assessment. For an observation elevation of 25 feet (typical of views from the boardwalks on the coast of New Jersey), the limit of Ocean Wind turbine hub visibility would be 37.3 miles due to earth curvature. While the blade tips are located above the horizon beyond this range, they are unlikely to be detected by observers at these distances due to the limits of visual acuity.

CUMULATIVE PROJECT MAP



WIND DIRECTION

NORTHWEST

Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

VIEWPOINT INFORMATION

LOCATION	
VIA KOP #	V19
Date / Time	08/15/2018 / 4:55pm
Latitude / Longitude	39.213474°/ -74.642627°
Direction of View	Northeast to Southeast

PHOTO	
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50 mm
Viewer Eye Elevation	15 ft

ENVIRONMENTAL	
Temperature	90°
Humidity	45%
Wind Speed	12 mph
Weather Conditions	Sunny

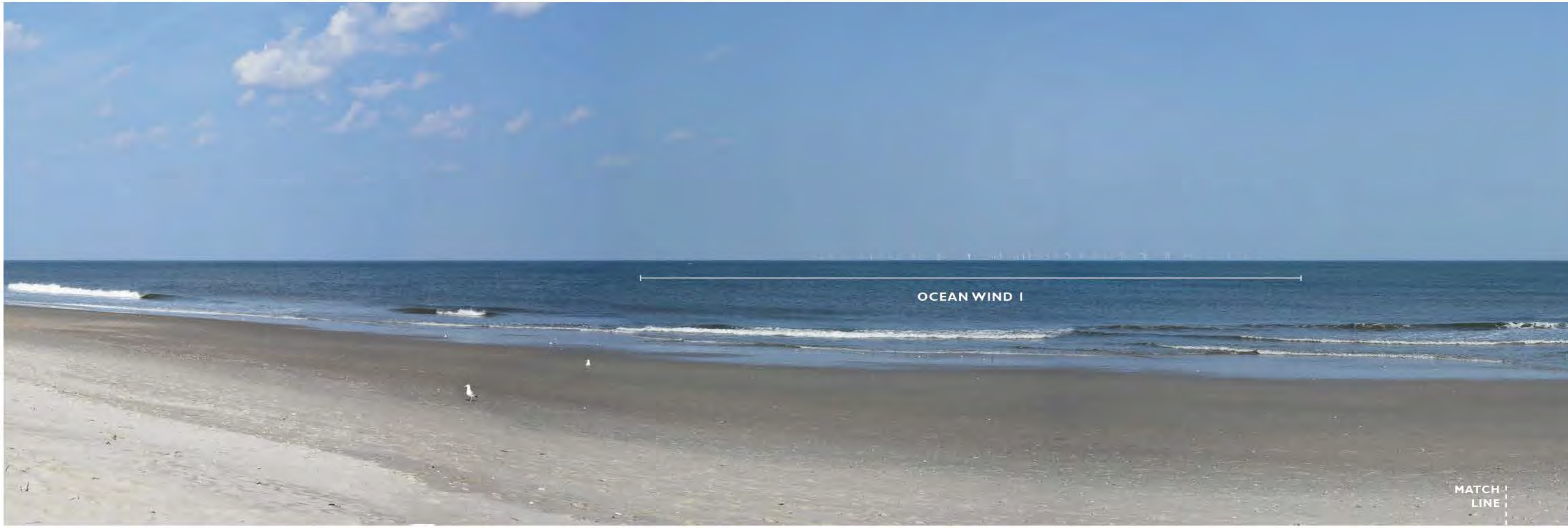
COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154° (based on Nikon D750 camera lens, where a Normal Photo is 39.6°)

Ocean Wind tjd&a

5A: Northeast view showing only Ocean Wind 1

Corson's Inlet State Park, Ocean City



Panoramic Field of View: 80°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind An Ørsted Initiative

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5B: Northeast view showing all visible projects

Corson's Inlet State Park, Ocean City

Panoramic Field of View: 80°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

tjd&a

5C: Northeast view showing all projects except Ocean Wind 1

Corson's Inlet State Park, Ocean City

Panoramic Field of View: 80°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

tjd&a

6A: Southeast view showing only Ocean Wind 1

Corson's Inlet State Park, Ocean City

Panoramic Field of View: 80°

Ocean Wind 1 not in view

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST

Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind An Ørsted initiative

tjd&a

6B: Southeast view showing all visible projects

Corson's Inlet State Park

Panoramic Field of View: 80°
Ocean Wind 1 not in view

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

6C: Southeast view showing all projects except Ocean Wind 1

Corson's Inlet State Park

Panoramic Field of View: 80°
Ocean Wind 1 not in view

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

tjd&a

VIEWPOINT
Corson's Inlet State Park, Ocean City

VISUALIZATIONS

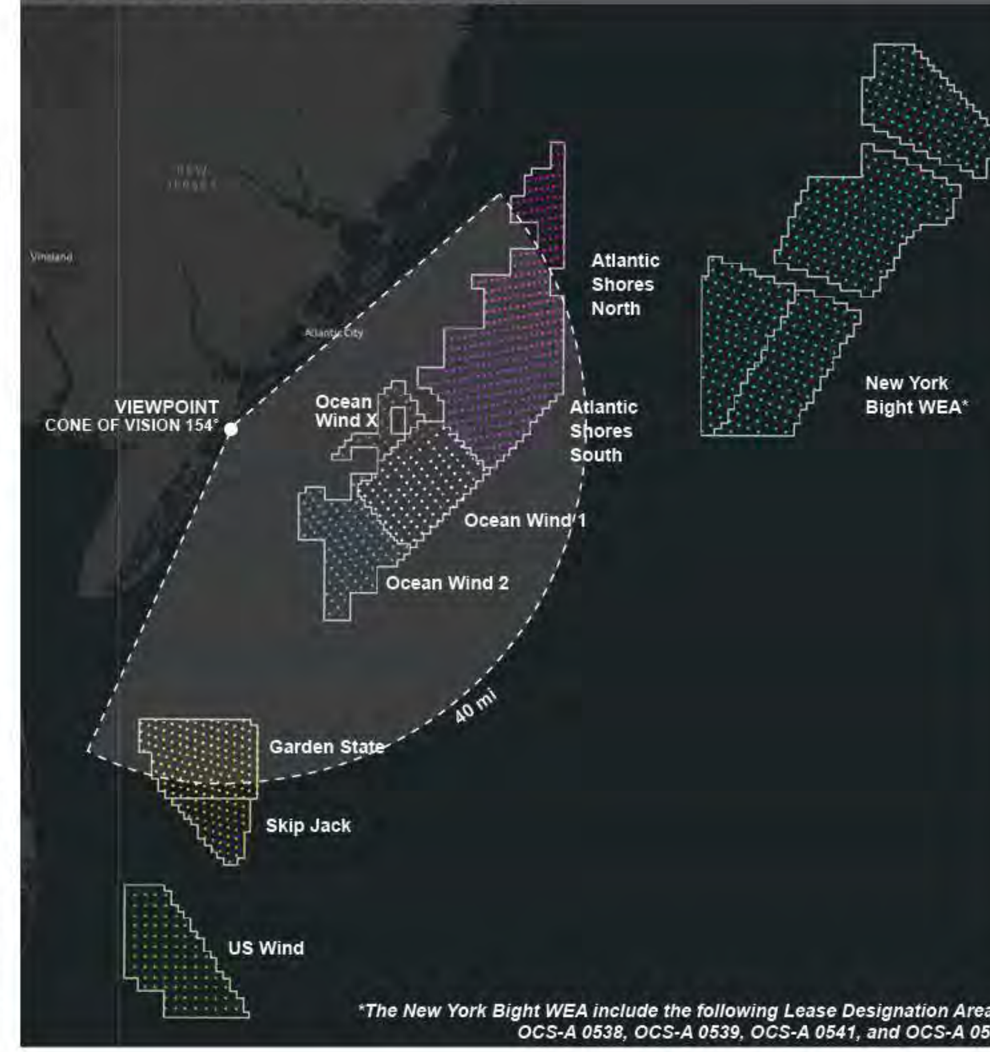
	VISUALIZATIONS INCLUDED
5A	Northeast view: only Ocean Wind 1
5B	Northeast view: all visible projects
5C	Northeast view: all visible projects except Ocean Wind 1
6A	Southeast view: only Ocean Wind 1
6B	Southeast view: all visible projects
6C	Southeast view: all visible projects except Ocean Wind 1

CUMULATIVE PROJECT INFORMATION

OFFSHORE WIND PROJECT	THEORETICALLY VISIBLE FROM VIEWPOINT*	DISTANCE TO NEAREST WTG (mi)	DISTANCE TO FARTHEST WTG (mi)	NUMBER OF THEORETICALLY VISIBLE TURBINES	HORIZONTAL FIELD OF VIEW
New York Bight WEA	No	53.3	91.7	0	0°
Atlantic Shores North	Yes	31.3	49.2	101	25°
Atlantic Shores South	Yes	21.6	38.2	202	43°
Ocean Wind 1	Yes	16.2	29.1	99	34°
Ocean Wind 2	Yes	11.7	24.6	88	40.8°
Ocean Wind X	Yes	13.0	22.6	33	26.5°
Garden State	Yes	33.0	42.1	112	22°
Skip Jack	No	41.9	49.3	0	0°
US Wind	No	52.2	65.8	0	0°

*A distance of 40-miles from each viewpoint has been used to define the limits of theoretical visibility. This 40-mile distance aligns with the visual study area used in the Ocean Wind Visual Impact Assessment. For an observation elevation of 25 feet (typical of views from the boardwalks on the coast of New Jersey), the limit of Ocean Wind turbine hub visibility would be 37.3 miles due to earth curvature. While the blade tips are located above the horizon beyond this range, they are unlikely to be detected by observers at these distances due to the limits of visual acuity.

CUMULATIVE PROJECT MAP



WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

VIEWPOINT INFORMATION

LOCATION	
VIA KOP #	V19
Date / Time	08/15/2018 / 4:55pm
Latitude / Longitude	39.213474°/ -74.642627°
Direction of View	Northeast to Southeast

PHOTO	
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50 mm
Viewer Eye Elevation	15 ft

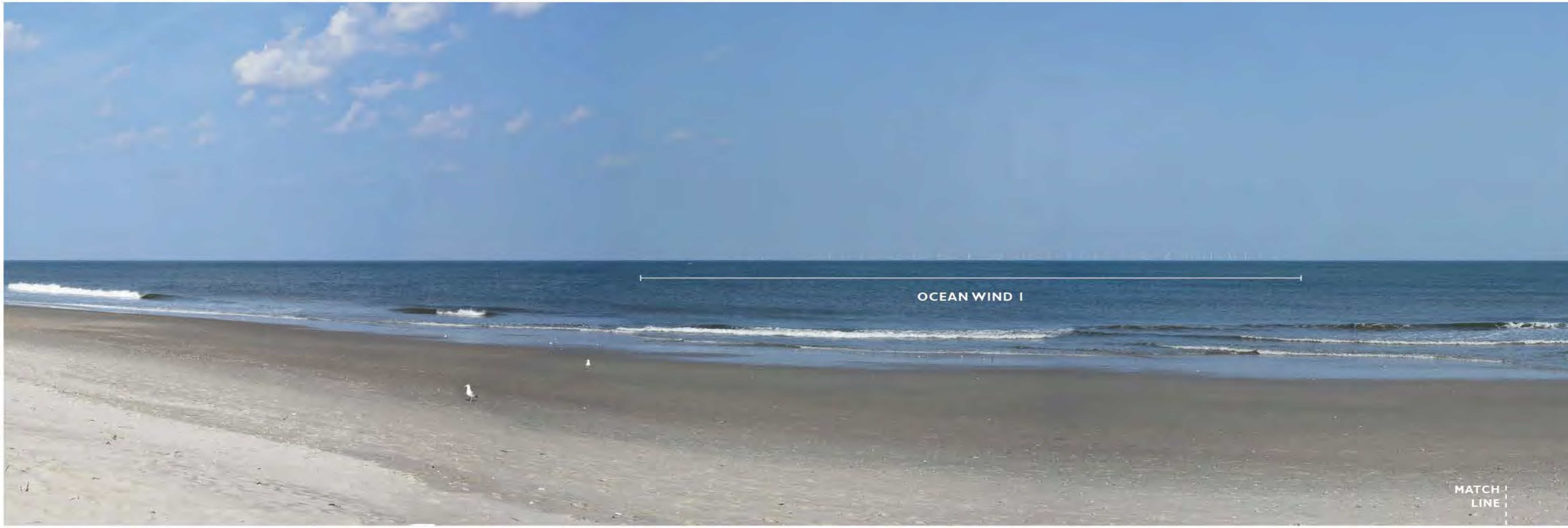
ENVIRONMENTAL	
Temperature	90°
Humidity	45%
Wind Speed	12 mph
Weather Conditions	Sunny

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154° (based on Nikon D750 camera lens, where a Normal Photo is 39.6°)

5A: Northeast view showing only Ocean Wind 1

Corson's Inlet State Park, Ocean City



Panoramic Field of View: 80°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

5B: Northeast view showing all visible projects

Corson's Inlet State Park, Ocean City

Panoramic Field of View: 80°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

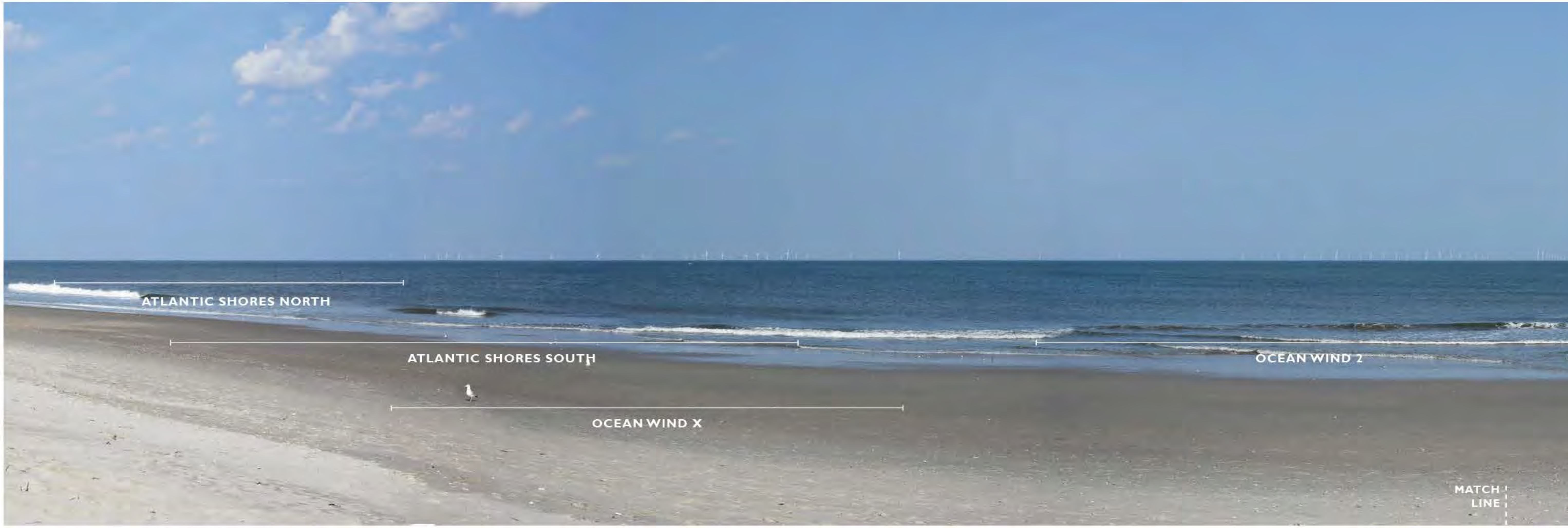
Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

5C: Northeast view showing all projects except Ocean Wind 1

Corson's Inlet State Park, Ocean City



Panoramic Field of View: 80°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

6A: Southeast view showing only Ocean Wind 1

Corson's Inlet State Park, Ocean City

Panoramic Field of View: 80°
Ocean Wind 1 not in view

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

6B: Southeast view showing all visible projects

Corson's Inlet State Park

Panoramic Field of View: 80°

Ocean Wind 1 not in view

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

6C: Southeast view showing all projects except Ocean Wind 1

Corson's Inlet State Park

Panoramic Field of View: 80°

Ocean Wind 1 not in view

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind An Ørsted initiative

tjd&a

VIEWPOINT
Stone Harbor Beach Access, Stone Harbor

VISUALIZATIONS

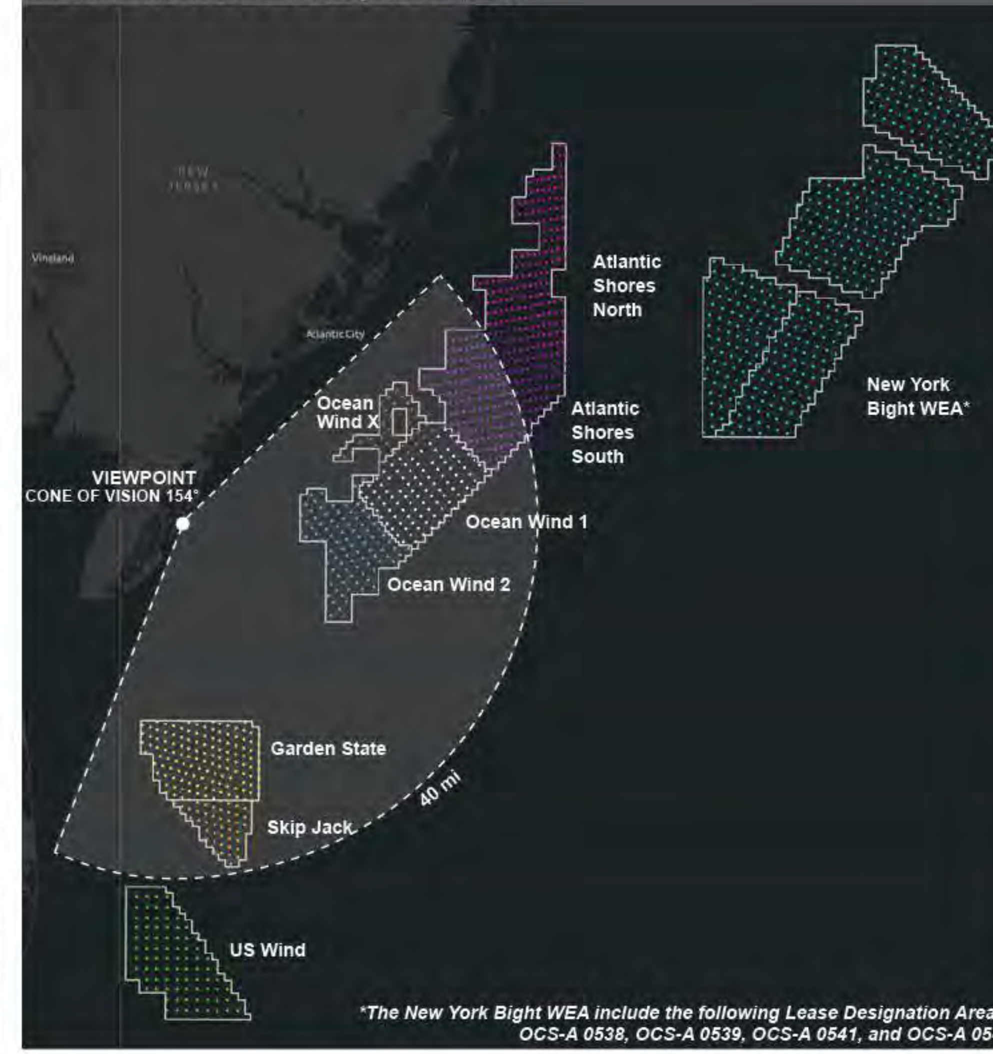
	VISUALIZATIONS INCLUDED
7A	Northeast view: only Ocean Wind 1
7B	Northeast view: all visible projects
7C	Northeast view: all visible projects except Ocean Wind 1
8A	Southeast view: only Ocean Wind 1
8B	Southeast view: all visible projects
8C	Southeast view: all visible projects except Ocean Wind 1

CUMULATIVE PROJECT INFORMATION

OFFSHORE WIND PROJECT	THEORETICALLY VISIBLE FROM VIEWPOINT*	DISTANCE TO NEAREST WTG (mi)	DISTANCE TO FARTHEST WTG (mi)	NUMBER OF THEORETICALLY VISIBLE TURBINES	HORIZONTAL FIELD OF VIEW
New York Bight WEA	No	60.2	101.6	0	0°
Atlantic Shores North	No	41.8	61.2	0	0°
Atlantic Shores South	Yes	31.3	47.2	184	24°
Ocean Wind 1	Yes	20.9	35.2	99	34°
Ocean Wind 2	Yes	13.7	26.0	88	44.4°
Ocean Wind X	Yes	20.3	30.6	33	13.9°
Garden State	Yes	22.0	31.5	131	32°
Skip Jack	Yes	31.0	38.8	52	16°
US Wind	No	40.5	54.7	0	0°

*A distance of 40-miles from each viewpoint has been used to define the limits of theoretical visibility. This 40-mile distance aligns with the visual study area used in the Ocean Wind Visual Impact Assessment. For an observation elevation of 25 feet (typical of views from the boardwalks on the coast of New Jersey), the limit of Ocean Wind turbine hub visibility would be 37.3 miles due to earth curvature. While the blade tips are located above the horizon beyond this range, they are unlikely to be detected by observers at these distances due to the limits of visual acuity.

CUMULATIVE PROJECT MAP



WIND DIRECTION

NORTHWEST

Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

VIEWPOINT INFORMATION

LOCATION	
VIA KOP #	V22
Date / Time	08/14/2018 / 4:22pm
Latitude / Longitude	39.052389° /-74.754855°
Direction of View	Northeast to Southeast

PHOTO	
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50 mm
Viewer Eye Elevation	13 ft

ENVIRONMENTAL	
Temperature	83°
Humidity	63%
Wind Speed	14 mph
Weather Conditions	Partly Cloudy

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154° (based on Nikon D750 camera lens, where a Normal Photo is 39.6°)

7A: Northeast view showing only Ocean Wind 1

Stone Harbor Beach Access, Stone Harbor

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST

Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind An Ørsted initiative

tjd&a

7B: Northeast view showing all visible projects

Stone Harbor Beach Access, Stone Harbor

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

tjd&a

7C: Northeast view showing all projects except Ocean Wind 1

Stone Harbor Beach Access, Stone Harbor

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST

Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind An Ørsted initiative

tjd&a

8A: Southeast view showing only Ocean Wind 1
Stone Harbor Beach Access, Stone Harbor

Panoramic Field of View: 76°
Ocean Wind 1 not in view

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

tjd&a

8B: Southeast view showing all visible projects

Stone Harbor Beach Access, Stone Harbor

Panoramic Field of View: 76°
Ocean Wind 1 not in view

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST

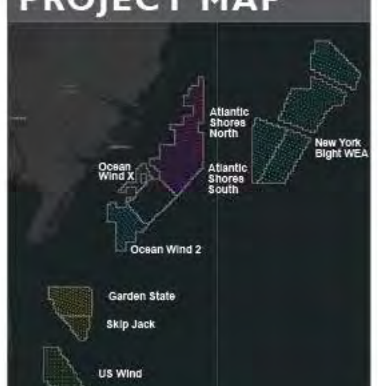
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

8C: Southeast view showing all projects except Ocean Wind 1

Stone Harbor Beach Access, Stone Harbor

Panoramic Field of View: 76°
Ocean Wind 1 not in view

PROJECT MAP



COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

NORTHWEST
Turbine rotors and blades are modeled in all projects to face northwest to approximate the most visually impacting scenario.

Ocean Wind
An Ørsted initiative

tjd&a

VIEWPOINT
Stone Harbor Beach Access, Stone Harbor

VISUALIZATIONS

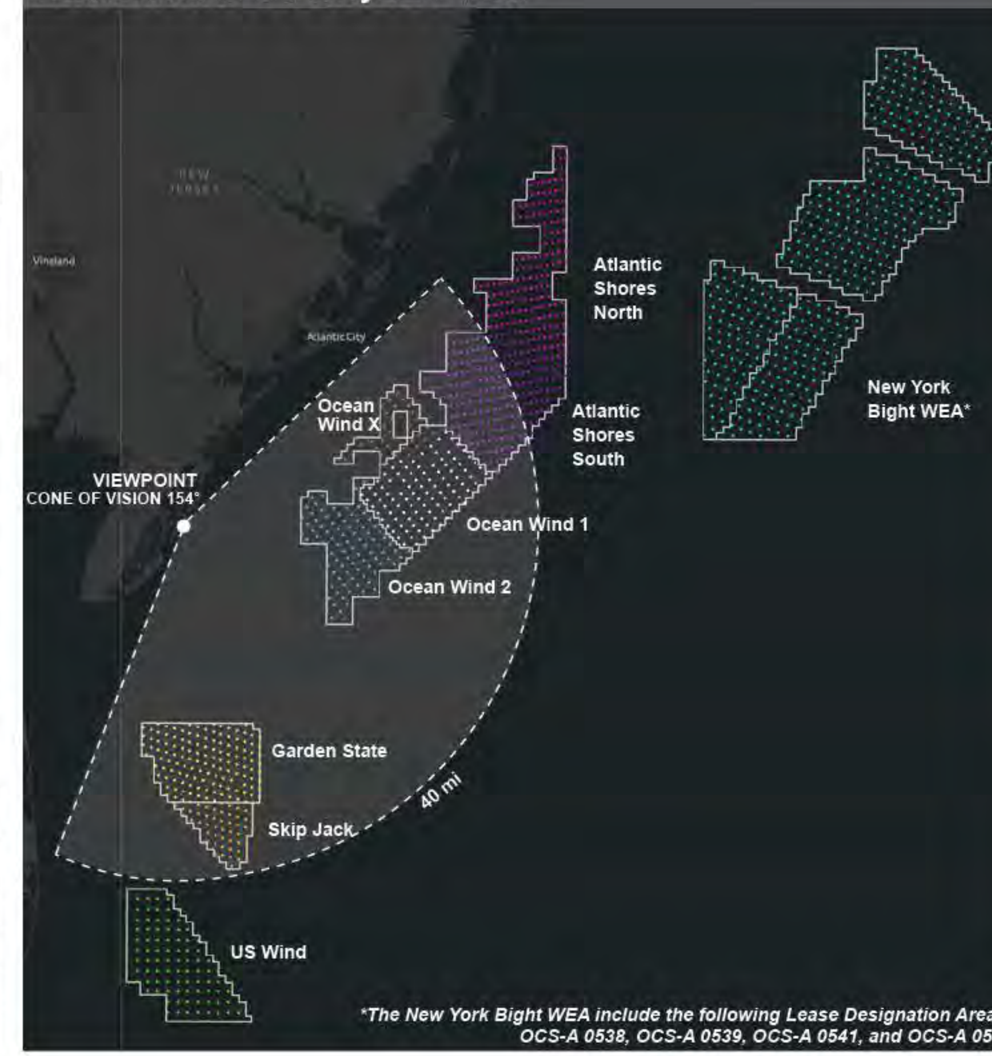
	VISUALIZATIONS INCLUDED
7A	Northeast view: only Ocean Wind 1
7B	Northeast view: all visible projects
7C	Northeast view: all visible projects except Ocean Wind 1
8A	Southeast view: only Ocean Wind 1
8B	Southeast view: all visible projects
8C	Southeast view: all visible projects except Ocean Wind 1

CUMULATIVE PROJECT INFORMATION

OFFSHORE WIND PROJECT	THEORETICALLY VISIBLE FROM VIEWPOINT*	DISTANCE TO NEAREST WTG (mi)	DISTANCE TO FARTHEST WTG (mi)	NUMBER OF THEORETICALLY VISIBLE TURBINES	HORIZONTAL FIELD OF VIEW
New York Bight WEA	No	60.2	101.6	0	0°
Atlantic Shores North	No	41.8	61.2	0	0°
Atlantic Shores South	Yes	31.3	47.2	184	24°
Ocean Wind 1	Yes	20.9	35.2	99	34°
Ocean Wind 2	Yes	13.7	26.0	88	44.4°
Ocean Wind X	Yes	20.3	30.6	33	13.9°
Garden State	Yes	22.0	31.5	131	32°
Skip Jack	Yes	31.0	38.8	52	16°
US Wind	No	40.5	54.7	0	0°

*A distance of 40-miles from each viewpoint has been used to define the limits of theoretical visibility. This 40-mile distance aligns with the visual study area used in the Ocean Wind Visual Impact Assessment. For an observation elevation of 25 feet (typical of views from the boardwalks on the coast of New Jersey), the limit of Ocean Wind turbine hub visibility would be 37.3 miles due to earth curvature. While the blade tips are located above the horizon beyond this range, they are unlikely to be detected by observers at these distances due to the limits of visual acuity.

CUMULATIVE PROJECT MAP



WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

VIEWPOINT INFORMATION

LOCATION	
VIA KOP #	V22
Date / Time	08/14/2018 / 4:22pm
Latitude / Longitude	39.052389° /-74.754855°
Direction of View	Northeast to Southeast

PHOTO	
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50 mm
Viewer Eye Elevation	13 ft

ENVIRONMENTAL	
Temperature	83°
Humidity	63%
Wind Speed	14 mph
Weather Conditions	Partly Cloudy

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154° (based on Nikon D750 camera lens, where a Normal Photo is 39.6°)

7A: Northeast view showing only Ocean Wind 1
Stone Harbor Beach Access, Stone Harbor

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

7B: Northeast view showing all visible projects

Stone Harbor Beach Access, Stone Harbor

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

7C: Northeast view showing all projects except Ocean Wind 1

Stone Harbor Beach Access, Stone Harbor

Panoramic Field of View: 76°

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted Initiative

tjd&a

8A: Southeast view showing only Ocean Wind 1

Stone Harbor Beach Access, Stone Harbor

Panoramic Field of View: 76°
Ocean Wind 1 not in view

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind An Ørsted initiative

tjd&a

8B: Southeast view showing all visible projects

Stone Harbor Beach Access, Stone Harbor

Panoramic Field of View: 76°
Ocean Wind 1 not in view

PROJECT MAP

COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

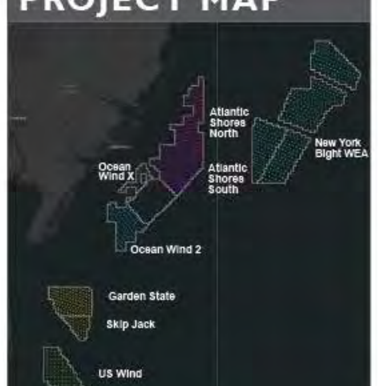
tjd&a

8C: Southeast view showing all projects except Ocean Wind 1

Stone Harbor Beach Access, Stone Harbor

Panoramic Field of View: 76°
Ocean Wind 1 not in view

PROJECT MAP



COMPLETE PANORAMIC VIEW

Panoramic Field of View: 154°

WIND DIRECTION

SOUTHWEST

Turbine rotors and blades are modeled in all projects to face southwest in accordance with prevailing winds.

Ocean Wind
An Ørsted initiative

tjd&a

ATTACHMENT M-3
VISUAL SIMULATIONS OF ACTION ALTERNATIVES

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V06. Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

LANDSCAPE INFORMATION

Field Identification Number. 274

Context Image Dates. 20 September 2018

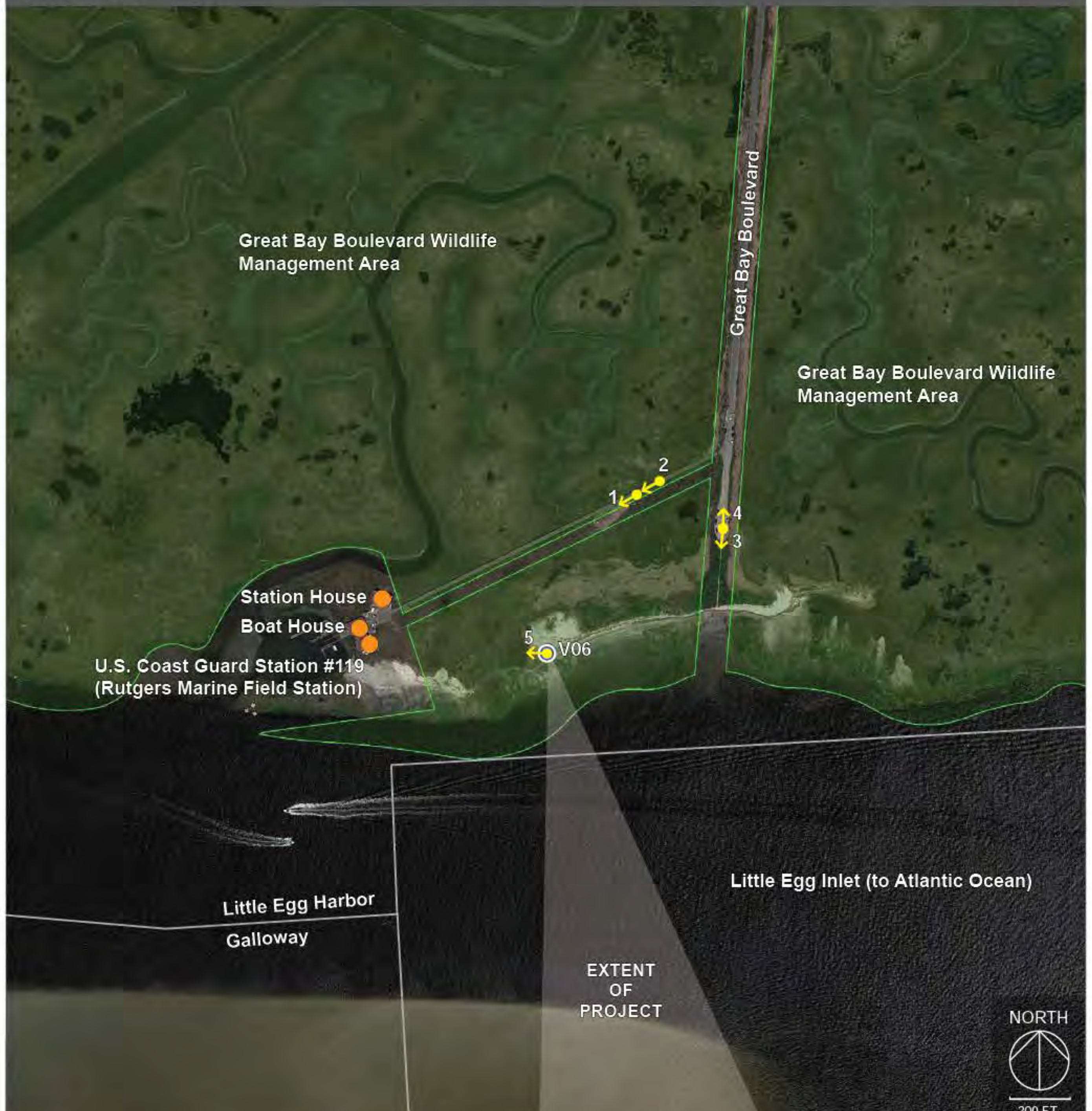
Site Map Aerial Date. 24 May 2018

Physiographic Area. Marsh + Bay

Landscape Similarity Zone (LSZ). Marshland

Scenic Resources. Viewpoint from Great Bay Boulevard Wildlife Management Area. Viewpoint near three structures eligible for the NRHP: U.S. Coast Guard Station #119 (Rutgers Marine Field Station); Station House; and Boat House.

SITE MAP



CONTEXT IMAGES

1. View looking southwest from access gate on boardwalk toward U.S. Coast Guard Station #119 (Rutgers Marine Field Station). Atlantic City skyline is visible on left side of image.

2. View looking southwest from boardwalk toward U.S. Coast Guard Station #119 (Rutgers Marine Field Station) access gate.

3. View looking south from end of Great Bay Boulevard toward beach access.

4. View looking north from the end of Great Bay Boulevard.

5. View looking west from visualization location on beach toward U.S. Coast Guard Station #119 (Rutgers Marine Field Station).

V06. Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

ORIGINAL LAYOUT VISUALIZATION

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW

CONTEXT MAP

ALTERNATIVES ANALYSIS

Original Layout: Turbine layout submitted in COP.

Turbine Dimensions: 906 ft blade tip height, 512 ft hub height, 788 ft rotor diameter.

TURBINE DIMENSIONS

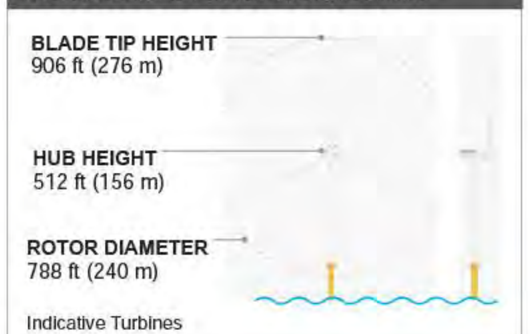


IMAGE DATA

LOCATION

Date	20 September 2018
Time	9:40 AM
Latitude	39.508809°
Longitude	-74.322008°
Direction of View	South
LSZ	Marshland

PHOTO

Field ID	274
Camera	NIKON D5500
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	7'

PROJECT INFRASTRUCTURE

Number of Turbines	99
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	72°
Humidity	73%
Visibility	10 mi
Wind Direction	E
Wind Speed	7 mph
Weather Conditions	Overcast

PROJECT VIEW

Distance to Project	21.85 miles
Project Horizontal Field of View (HFOV)	30°

V06

Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

OCEAN WIND

tjd&a Landscape Architects & Planners

V06. Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

ALTERNATIVE B-1 VISUALIZATION

Ocean Wind
An Ørsted initiative

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW

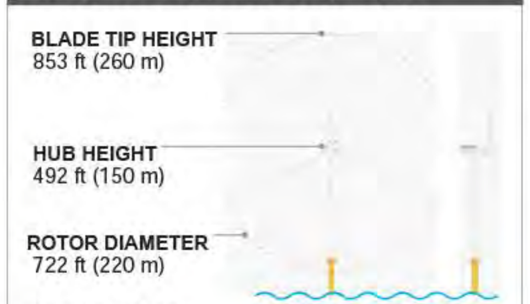
CONTEXT MAP

ALTERNATIVES ANALYSIS

Alternative B-1: Exclusion of up to nine turbine positions in the first two shoreward strings of turbines that includes F01 to K01 and B02 to D02.

Turbine dimensions: 853 ft blade tip height, 492 ft hub height, 722 ft rotor diameter.

TURBINE DIMENSIONS



Indicative Turbines

IMAGE DATA

LOCATION

Date	20 September 2018
Time	9:40 AM
Latitude	39.508809°
Longitude	-74.322008°
Direction of View	South
LSZ	Marshland

PHOTO

Field ID	274
Camera	NIKON D5500
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	7'

PROJECT INFRASTRUCTURE

Number of Turbines	89
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	72°
Humidity	73%
Visibility	10 mi
Wind Direction	E
Wind Speed	7 mph
Weather Conditions	Overcast

PROJECT VIEW

Distance to Project	21.85 miles
Project Horizontal Field of View (HFOV)	28°

V06

Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

OCEAN WIND

tjd&a Landscape Architects & Planners

V06. Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

ALTERNATIVE B-2 VISUALIZATION

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW

CONTEXT MAP

ALTERNATIVES ANALYSIS

Alternative B-2: Exclusion of up to 19 turbine positions in the first three shoreward strings of turbines that includes F01 to K01, A02 to K02, A03 and C03.

Turbine Dimensions: 906 ft blade tip height, 512 ft hub height, 788 ft rotor diameter.

TURBINE DIMENSIONS

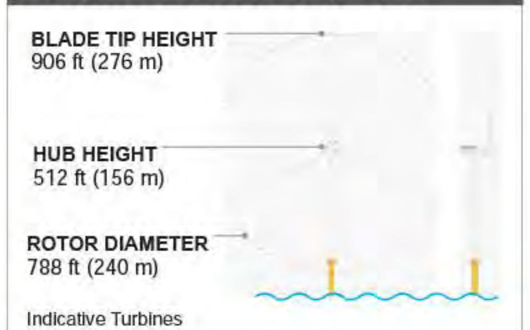


IMAGE DATA

LOCATION

Date	20 September 2018
Time	9:40 AM
Latitude	39.508809°
Longitude	-74.322008°
Direction of View	South
LSZ	Marshland

PHOTO

Field ID	274
Camera	NIKON D5500
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	7'

PROJECT INFRASTRUCTURE

Number of Turbines	79
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	72°
Humidity	73%
Visibility	10 mi
Wind Direction	E
Wind Speed	7 mph
Weather Conditions	Overcast

PROJECT VIEW

Distance to Project	23.53 miles
Project Horizontal Field of View (HFOV)	27°

V06

Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

OCEAN WIND

tjd&a Landscape Architects & Planners

V06. Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

ALTERNATIVE C-1 VISUALIZATION

Ocean Wind
An Ørsted initiative

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW

CONTEXT MAP

ALTERNATIVES ANALYSIS

Alternative C-1: Exclusion of eight turbine positions (A02 to A09), relocation of eight turbine positions to the northern portion of the Ocean Wind Lease Area (C00 to F00 and B01 to E01).

Turbine Dimensions: 906 ft blade tip height, 512 ft hub height, 788 ft rotor diameter.

TURBINE DIMENSIONS

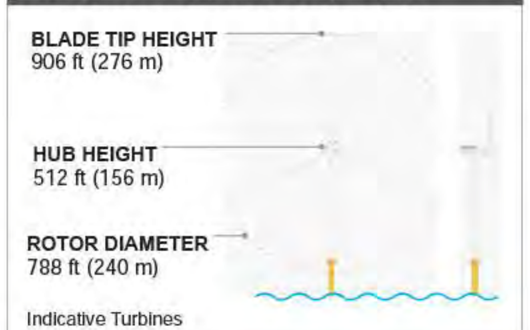


IMAGE DATA

LOCATION

Date	20 September 2018
Time	9:40 AM
Latitude	39.508809°
Longitude	-74.322008°
Direction of View	South
LSZ	Marshland

PHOTO

Field ID	274
Camera	NIKON D5500
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	7'

PROJECT INFRASTRUCTURE

Number of Turbines	98
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	72°
Humidity	73%
Visibility	10 mi
Wind Direction	E
Wind Speed	7 mph
Weather Conditions	Overcast

PROJECT VIEW

Distance to Project	21.19 miles
Project Horizontal Field of View (HFOV)	27°

V06

Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

OCEAN WIND

tjd&a Landscape Architects & Planners

V06. Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

EXISTING CONDITIONS

NORMAL VIEW EXISTING IMAGE

V06

Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

OCEAN WIND

tjd&a

V06. Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

ORIGINAL LAYOUT VISUALIZATION

NORMAL VIEW VISUALIZATION

V06

Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

ORIGINAL VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V06. Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

ALTERNATIVE B-1 VISUALIZATION

NORMAL VIEW VISUALIZATION

V06

Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

ALTERNATIVE B-1 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V06. Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

ALTERNATIVE B-2 VISUALIZATION

Ocean Wind
An Ørsted initiative

NORMAL VIEW VISUALIZATION

V06

Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

ALTERNATIVE B-2 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V06. Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

ALTERNATIVE C-1 VISUALIZATION

NORMAL VIEW VISUALIZATION

V06

Great Bay Boulevard Wildlife Management Area

Little Egg Harbor Township, Ocean County

ALTERNATIVE C-1 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V14. Playground Pier

Atlantic City, Atlantic County

Ocean Wind
An Ørsted initiative

LANDSCAPE INFORMATION

Field Identification Number. 200

Context Image Dates. 19 September 2018

Site Map Aerial Date. 26 August 2016

Physiographic Area. Shoreline

Landscape Similarity Zone (LSZ). Boardwalk

Scenic Resources. Visualization near Atlantic City Convention Hall (NHL); Shelburne Hotel (listed on NRHP); Atlantic City Boardwalk Historic District (identified historic property - no official NRHP eligibility determination).

SITE MAP

CONTEXT IMAGES

1. View looking southeast from the west side of Playground Pier toward the end of the pier.

2. View looking northeast from visualization location at end of Playground Pier toward Central Pier and Steel Pier.

3. View looking west from end of Playground Pier toward Atlantic City. The Atlantic City Convention Hall (NHL) is visible on the right side of the image.

4. View looking northeast from end of playground pier toward Central Pier and Steel Pier.

5. View looking west from visualization location at end of Playground Pier toward Atlantic City shoreline.

V14. Playground Pier

Atlantic City, Atlantic County

ORIGINAL LAYOUT VISUALIZATION

Ocean Wind
An Ørsted initiative

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW 1

EXTENT OF NORMAL VIEW 2

CONTEXT MAP

ALTERNATIVES ANALYSIS

Original Layout: Turbine layout submitted in COP.

Turbine Dimensions: 906 ft blade tip height, 512 ft hub height, 788 ft rotor diameter.

TURBINE DIMENSIONS

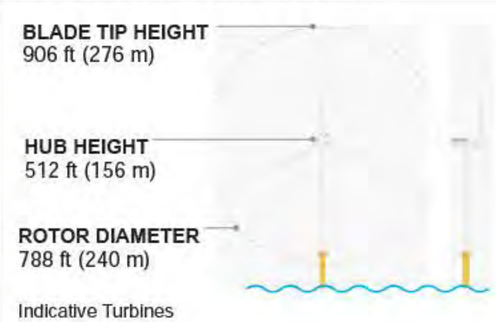


IMAGE DATA

LOCATION

Date	19 September 2018
Time	12:28 PM
Latitude	39.352591°
Longitude	-74.433571°
Direction of View	Southeast
LSZ	Boardwalk

PHOTO

Field ID	200
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	24'

PROJECT INFRASTRUCTURE

Number of Turbines	99
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	79°
Humidity	77%
Visibility	10 mi
Wind Direction	N
Wind Speed	7 mph
Weather Conditions	Broken clouds

PROJECT VIEW

Distance to Project	15.21 miles
Project Horizontal Field of View (HFOV)	41°

V14

Playground Pier

Atlantic City, Atlantic County

OCEAN WIND

tjd&a Landscape Architects & Planners

V14. Playground Pier

Atlantic City, Atlantic County

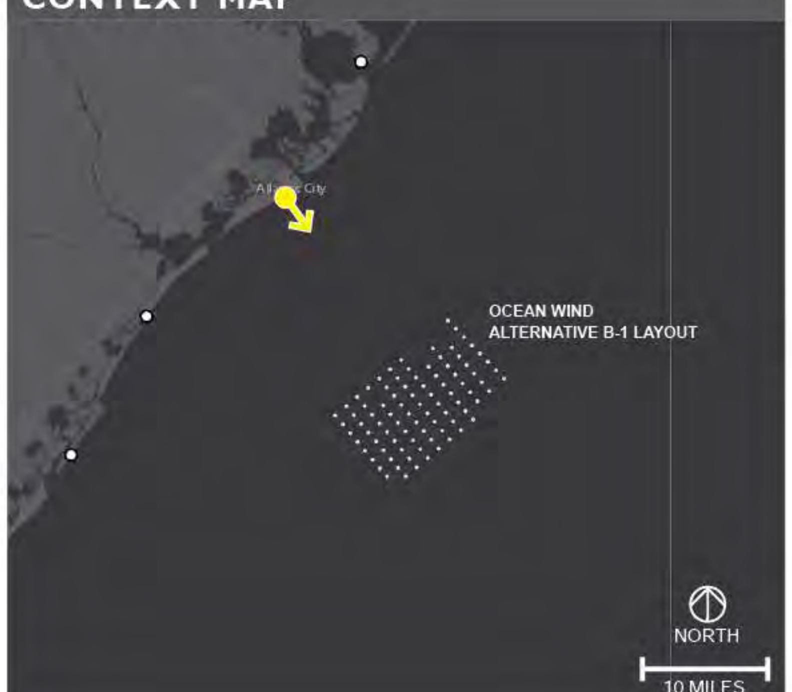
ALTERNATIVE B-1 VISUALIZATION

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW 1

EXTENT OF NORMAL VIEW 2

CONTEXT MAP



ALTERNATIVES ANALYSIS

Alternative B-1: Exclusion of up to nine turbine positions in the first two shoreward strings of turbines that includes F01 to K01 and B02 to D02.

Turbine dimensions: 853 ft blade tip height, 492 ft hub height, 722 ft rotor diameter.

TURBINE DIMENSIONS

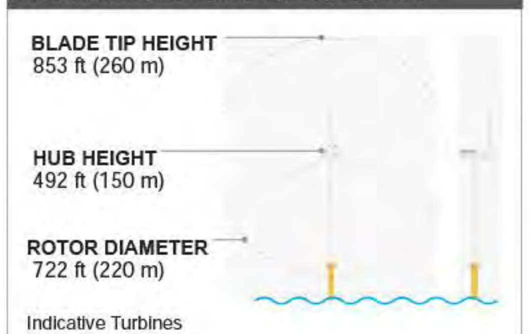


IMAGE DATA

LOCATION

Date	19 September 2018
Time	12:28 PM
Latitude	39.352591°
Longitude	-74.433571°
Direction of View	Southeast
LSZ	Boardwalk

PHOTO

Field ID	200
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	24'

PROJECT INFRASTRUCTURE

Number of Turbines	89
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	79°
Humidity	77%
Visibility	10 mi
Wind Direction	N
Wind Speed	7 mph
Weather Conditions	Broken clouds

PROJECT VIEW

Distance to Project	15.97 miles
Project Horizontal Field of View (HFOV)	40°

V14

Playground Pier

Atlantic City, Atlantic County

OCEAN WIND

tjd&a Landscape Architects & Planners

V14. Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE B-2 VISUALIZATION

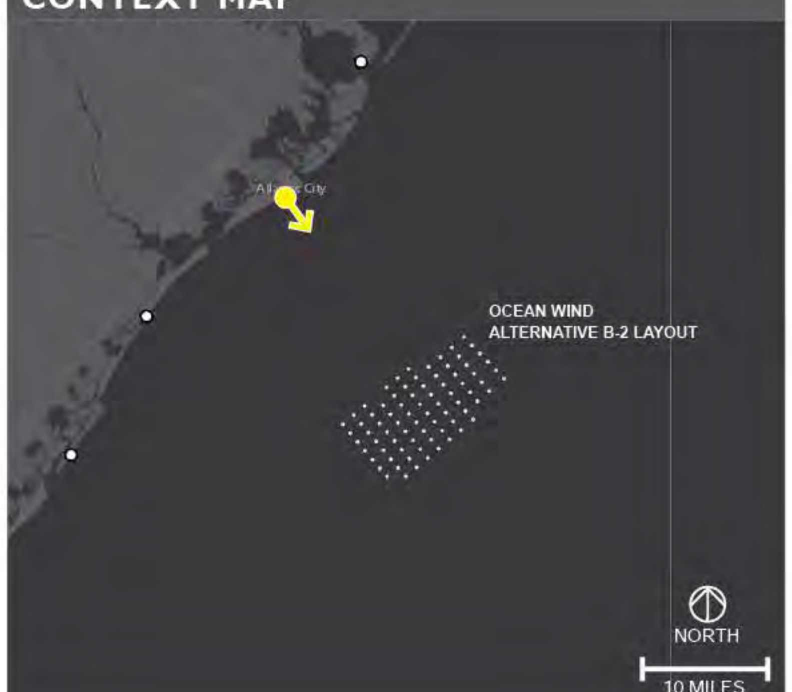
Ocean Wind
An Ørsted initiative

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW 1

EXTENT OF NORMAL VIEW 2

CONTEXT MAP



ALTERNATIVES ANALYSIS

Alternative B-2: Exclusion of up to 19 turbine positions in the first three shoreward strings of turbines that includes F01 to K01, A02 to K02, A03 and C03.

Turbine Dimensions: 906 ft blade tip height, 512 ft hub height, 788 ft rotor diameter.

TURBINE DIMENSIONS

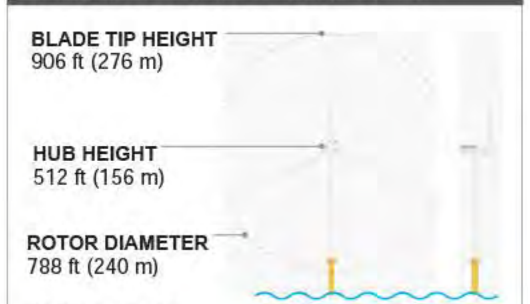


IMAGE DATA

LOCATION

Date	19 September 2018
Time	12:28 PM
Latitude	39.352591°
Longitude	-74.433571°
Direction of View	Southeast
LSZ	Boardwalk

PHOTO

Field ID	200
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	24'

PROJECT INFRASTRUCTURE

Number of Turbines	79
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	79°
Humidity	77%
Visibility	10 mi
Wind Direction	N
Wind Speed	7 mph
Weather Conditions	Broken clouds

PROJECT VIEW

Distance to Project	18.11 miles
Project Horizontal Field of View (HFOV)	38°

V14

Playground Pier

Atlantic City, Atlantic County

OCEAN WIND

tjd&a Landscape Architects & Planners

V14. Playground Pier

Atlantic City, Atlantic County

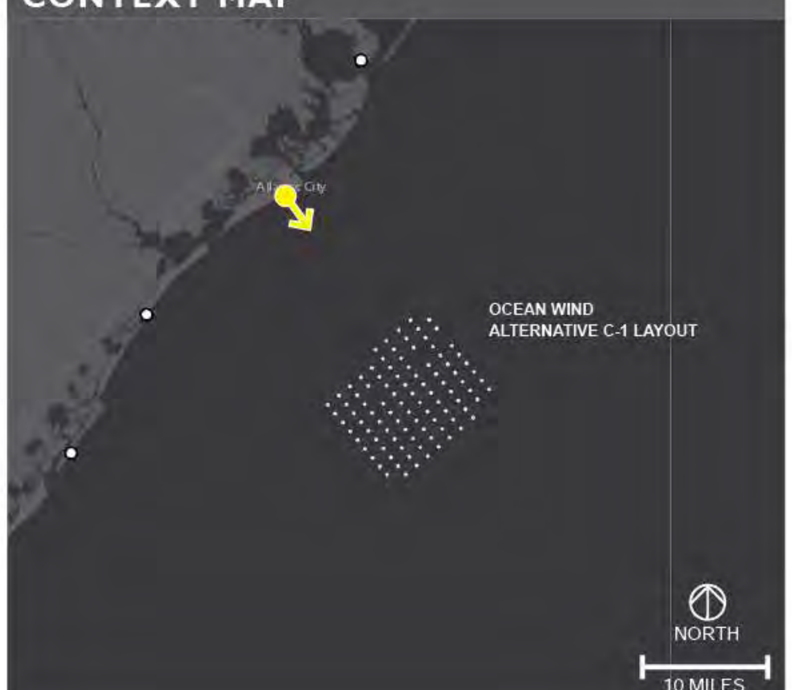
ALTERNATIVE C-1 VISUALIZATION

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW 1

EXTENT OF NORMAL VIEW 2

CONTEXT MAP



ALTERNATIVES ANALYSIS

Alternative C-1: Exclusion of eight turbine positions (A02 to A09), relocation of eight turbine positions to the northern portion of the Ocean Wind Lease Area (C00 to F00 and B01 to E01).

Turbine Dimensions: 906 ft blade tip height, 512 ft hub height, 788 ft rotor diameter.

TURBINE DIMENSIONS

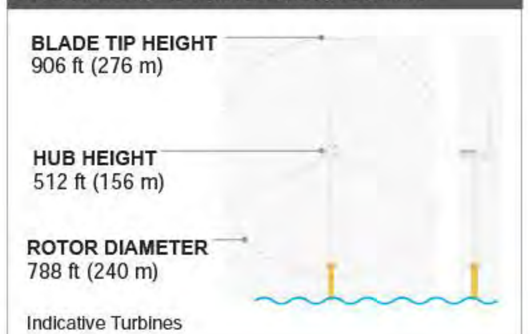


IMAGE DATA

LOCATION

Date	19 September 2018
Time	12:28 PM
Latitude	39.352591°
Longitude	-74.433571°
Direction of View	Southeast
LSZ	Boardwalk

PHOTO

Field ID	200
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	24’

PROJECT INFRASTRUCTURE

Number of Turbines	98
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	79°
Humidity	77%
Visibility	10 mi
Wind Direction	N
Wind Speed	7 mph
Weather Conditions	Broken clouds

PROJECT VIEW

Distance to Project	14.07 miles
Project Horizontal Field of View (HFOV)	35°

V14

Playground Pier

Atlantic City, Atlantic County

OCEAN WIND

tjd&a Landscape Architects & Planners

V14. Playground Pier

Atlantic City, Atlantic County

EXISTING CONDITIONS

NORMAL VIEW I EXISTING IMAGE

V14

Playground Pier

Atlantic City, Atlantic County

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

OCEAN WIND

tjd&a

V14. Playground Pier

Atlantic City, Atlantic County

ORIGINAL LAYOUT VISUALIZATION

NORMAL VIEW I VISUALIZATION

V14

Playground Pier

Atlantic City,
Atlantic County

ORIGINAL
VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V14. Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE B-1 VISUALIZATION

Ocean Wind
An Ørsted initiative

NORMAL VIEW I VISUALIZATION

V14

Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE B-1 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V14. Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE B-2 VISUALIZATION

Ocean Wind
An Ørsted initiative

NORMAL VIEW I VISUALIZATION

V14

Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE B-2 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V14. Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE C-1 VISUALIZATION

Ocean Wind
An Ørsted initiative

NORMAL VIEW I VISUALIZATION

V14

Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE C-1 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V14. Playground Pier

Atlantic City, Atlantic County

EXISTING CONDITIONS

NORMAL VIEW 2
EXISTING IMAGE

V14

Playground Pier

Atlantic City,
Atlantic County

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

OCEAN WIND

tjd&a

V14. Playground Pier

Atlantic City, Atlantic County

ORIGINAL LAYOUT VISUALIZATION

NORMAL VIEW 2 VISUALIZATION

V14

Playground Pier

Atlantic City, Atlantic County

ORIGINAL VISUALIZATION

VIEW NOTE

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TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V14. Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE B-1 VISUALIZATION

Ocean Wind
An Ørsted initiative

NORMAL VIEW 2 VISUALIZATION

V14

Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE B-1 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V14. Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE B-2 VISUALIZATION

Ocean Wind
An Ørsted initiative

NORMAL VIEW 2 VISUALIZATION

V14

Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE B-2 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

HUB HEIGHT
512 ft (156 m)

BLADE TIP HEIGHT
906 ft (276 m)

ROTOR DIAMETER
788 ft (240 m)

OCEAN WIND

tjd&a

V14. Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE C-1 VISUALIZATION

NORMAL VIEW 2 VISUALIZATION

V14

Playground Pier

Atlantic City, Atlantic County

ALTERNATIVE C-1 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V19. Corson's Inlet State Park

Ocean City, Cape May County

Ocean Wind
An Ørsted initiative

LANDSCAPE INFORMATION

Field Identification Number. 140
Context Image Dates. 15 August 2018
Site Map Aerial Date. 26 July 2018
Physiographic Area. Shoreline
Landscape Similarity Zone (LSZ). Beachfront

Scenic Resources. Viewpoint from Corson's Inlet State Park, near Cape May Coastal Wetlands Wildlife Management Area.

SITE MAP

CONTEXT IMAGES


1. View looking northeast from Rush Chattin Bridge toward Corson's Inlet State Park.


2. View looking northeast from beachfront north of state park.


3. View looking southeast from end of trail connecting state park parking lot to beachfront.


4. View looking southwest from beach in state park toward Strathmere.


5. View looking northeast from state park beach toward Ocean City.


6. View looking southwest from west side of state park toward Corson's Inlet Bridge and Strathmere Bay.

V19. Corson's Inlet State Park

Ocean City, Cape May County

ORIGINAL LAYOUT VISUALIZATION

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW 1

EXTENT OF NORMAL VIEW 2

CONTEXT MAP

ALTERNATIVES ANALYSIS

Original Layout: Turbine layout submitted in COP.

Turbine Dimensions: 906 ft blade tip height, 512 ft hub height, 788 ft rotor diameter.

TURBINE DIMENSIONS

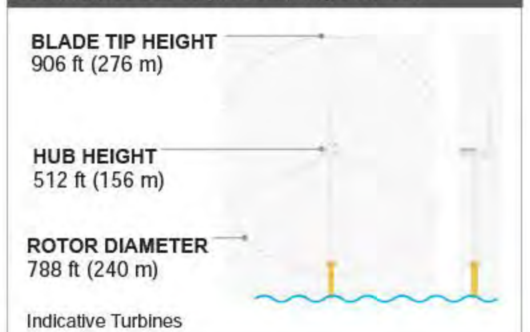


IMAGE DATA

LOCATION

Date	15 August 2018
Time	4:55 PM
Latitude	39.213474°
Longitude	-74.642627°
Direction of View	Southeast
LSZ	Beachfront

PHOTO

Field ID	140
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	15'

PROJECT INFRASTRUCTURE

Number of Turbines	99
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	90°
Humidity	45%
Visibility	10 mi
Wind Direction	W
Wind Speed	12 mph
Weather Conditions	Sunny

PROJECT VIEW

Distance to Project	16.22 miles
Project Horizontal Field of View (HFOV)	34°

V19

Corson's Inlet State Park

Ocean City, Cape May County

OCEAN WIND

tjd&a Landscape Architects & Planners

V19. Corson's Inlet State Park

Ocean City, Cape May County

ALTERNATIVE B-1 VISUALIZATION

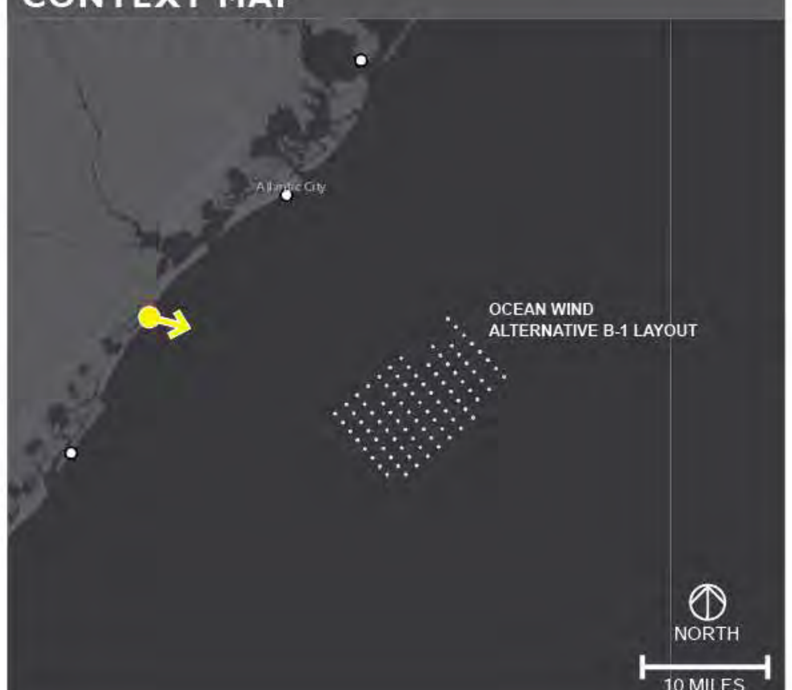
Ocean Wind
An Ørsted initiative

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW 1

EXTENT OF NORMAL VIEW 2

CONTEXT MAP



ALTERNATIVES ANALYSIS

Alternative B-1: Exclusion of up to nine turbine positions in the first two shoreward strings of turbines that includes F01 to K01 and B02 to D02.

Turbine dimensions: 853 ft blade tip height, 492 ft hub height, 722 ft rotor diameter.

TURBINE DIMENSIONS

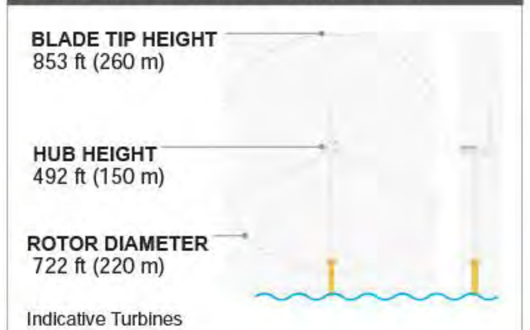


IMAGE DATA

LOCATION

Date	15 August 2018
Time	4:55 PM
Latitude	39.213474°
Longitude	-74.642627°
Direction of View	Southeast
LSZ	Beachfront

PHOTO

Field ID	140
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	15′

PROJECT INFRASTRUCTURE

Number of Turbines	89
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	90°
Humidity	45%
Visibility	10 mi
Wind Direction	W
Wind Speed	12 mph
Weather Conditions	Sunny

PROJECT VIEW

Distance to Project	17.07 miles
Project Horizontal Field of View (HFOV)	33°

V19

Corson's Inlet State Park

Ocean City, Cape May County

OCEAN WIND

tjd&a Landscape Architects & Planners

V19. Corson's Inlet State Park

Ocean City, Cape May County

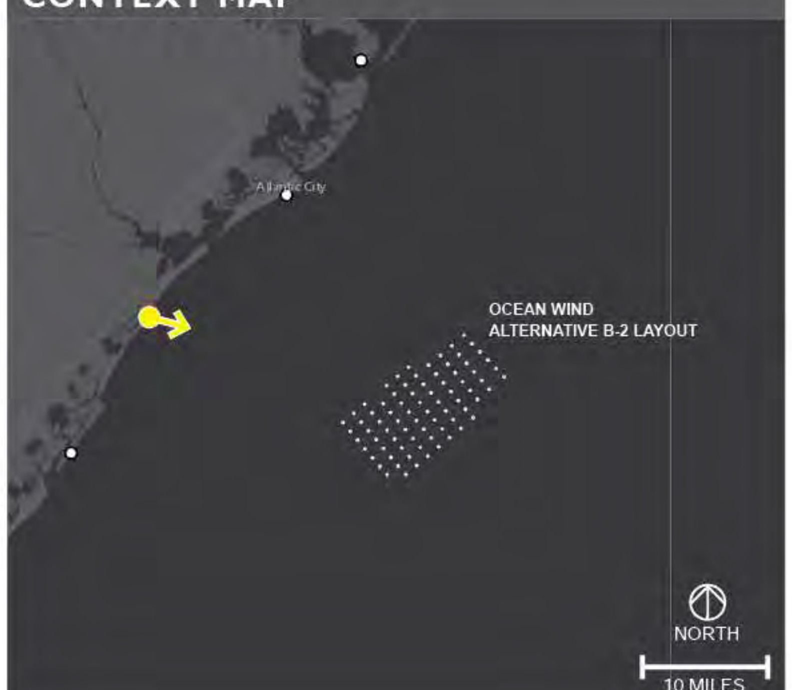
ALTERNATIVE B-2 VISUALIZATION

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW 1

EXTENT OF NORMAL VIEW 2

CONTEXT MAP



ALTERNATIVES ANALYSIS

Alternative B-2: Exclusion of up to 19 turbine positions in the first three shoreward strings of turbines that includes F01 to K01, A02 to K02, A03 and C03.

Turbine Dimensions: 906 ft blade tip height, 512 ft hub height, 788 ft rotor diameter.

TURBINE DIMENSIONS

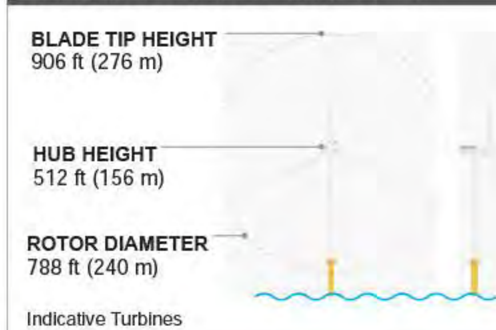


IMAGE DATA

LOCATION

Date	15 August 2018
Time	4:55 PM
Latitude	39.213474°
Longitude	-74.642627°
Direction of View	Southeast
LSZ	Beachfront

PHOTO

Field ID	140
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	15'

PROJECT INFRASTRUCTURE

Number of Turbines	79
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	90°
Humidity	45%
Visibility	10 mi
Wind Direction	W
Wind Speed	12 mph
Weather Conditions	Sunny

PROJECT VIEW

Distance to Project	17.92 miles
Project Horizontal Field of View (HFOV)	30°

V19

Corson's Inlet State Park

Ocean City, Cape May County

OCEAN WIND

tjd&a Landscape Architects & Planners

V19. Corson's Inlet State Park

Ocean City, Cape May County

ALTERNATIVE C-1 VISUALIZATION

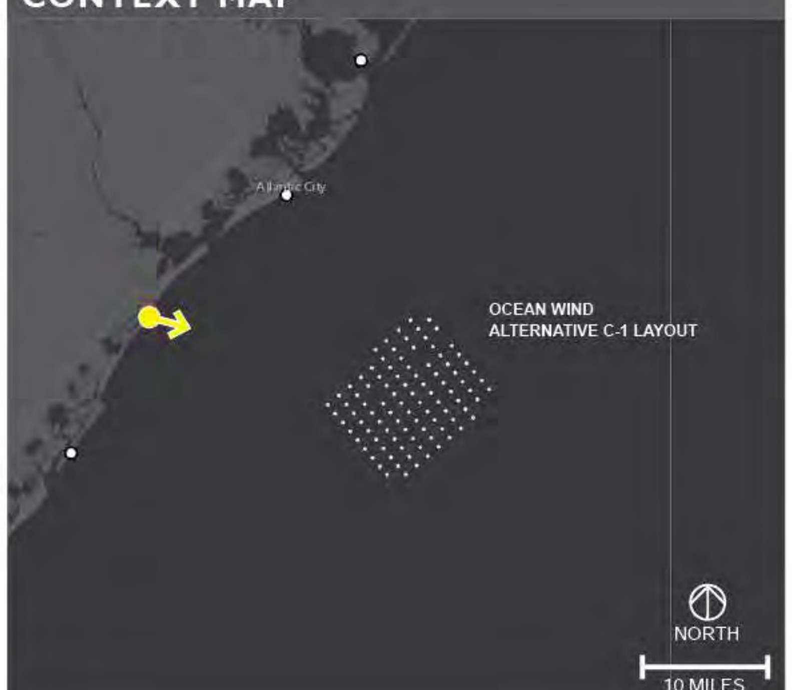
Ocean Wind An Ørsted initiative

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW 1

EXTENT OF NORMAL VIEW 2

CONTEXT MAP



ALTERNATIVES ANALYSIS

Alternative C-1: Exclusion of eight turbine positions (A02 to A09), relocation of eight turbine positions to the northern portion of the Ocean Wind Lease Area (C00 to F00 and B01 to E01).

Turbine Dimensions: 906 ft blade tip height, 512 ft hub height, 788 ft rotor diameter.

TURBINE DIMENSIONS

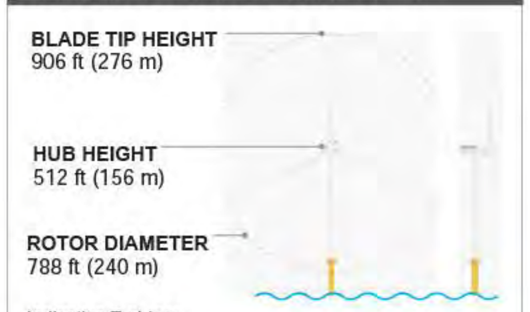


IMAGE DATA

LOCATION

Date	15 August 2018
Time	4:55 PM
Latitude	39.213474°
Longitude	-74.642627°
Direction of View	Southeast
LSZ	Beachfront

PHOTO

Field ID	140
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	15'

PROJECT INFRASTRUCTURE

Number of Turbines	98
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	90°
Humidity	45%
Visibility	10 mi
Wind Direction	W
Wind Speed	12 mph
Weather Conditions	Sunny

PROJECT VIEW

Distance to Project	16.22 miles
Project Horizontal Field of View (HFOV)	33°

V19

Corson's Inlet State Park

Ocean City, Cape May County

OCEAN WIND

tjd&a Landscape Architects & Planners

V19. Corson's Inlet State Park

Ocean City, Cape May County

EXISTING CONDITIONS

Ocean Wind
An Ørsted Initiative

NORMAL VIEW I EXISTING IMAGE

V19

Corson's Inlet State Park

Ocean City, Cape May County

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

OCEAN WIND

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V19. Corson's Inlet State Park

Ocean City, Cape May County

ORIGINAL LAYOUT VISUALIZATION

NORMAL VIEW I VISUALIZATION

V19

Corson's Inlet State Park

Ocean City, Cape May County

ORIGINAL VISUALIZATION

VIEW NOTE

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TURBINE DIMENSIONS

OCEAN WIND

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V19. Corson's Inlet State Park

Ocean City, Cape May County

ALTERNATIVE B-1 VISUALIZATION

NORMAL VIEW I VISUALIZATION

V19

Corson's Inlet State Park

Ocean City, Cape May County

ALTERNATIVE B-1 VISUALIZATION

VIEW NOTE

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TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V19. Corson's Inlet State Park

Ocean City, Cape May County

ALTERNATIVE B-2 VISUALIZATION

NORMAL VIEW I VISUALIZATION

V19

Corson's Inlet State Park

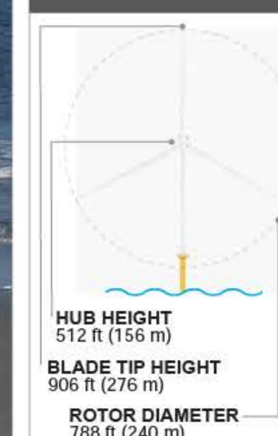
Ocean City, Cape May County

ALTERNATIVE B-2 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS



OCEAN WIND

tjd&a

V19. Corson's Inlet State Park

Ocean City, Cape May County

ALTERNATIVE C-1 VISUALIZATION

Ocean Wind
An Ørsted initiative

NORMAL VIEW I VISUALIZATION

V19

Corson's Inlet State Park

Ocean City, Cape May County

ALTERNATIVE C-1 VISUALIZATION

VIEW NOTE

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TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V19. Corson's Inlet State Park

Ocean City, Cape May County

EXISTING CONDITIONS

Ocean Wind
An Ørsted initiative

NORMAL VIEW 2
EXISTING IMAGE

V19

Corson's Inlet State Park

Ocean City, Cape May County

VIEW NOTE

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OCEAN WIND

tjd&a

V19. Corson's Inlet State Park

Ocean City, Cape May County

ORIGINAL LAYOUT VISUALIZATION

NORMAL VIEW 2 VISUALIZATION

V19

Corson's Inlet State Park

Ocean City, Cape May County

ORIGINAL VISUALIZATION

VIEW NOTE

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TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V19. Corson's Inlet State Park

Ocean City, Cape May County

ALTERNATIVE B-1 VISUALIZATION

NORMAL VIEW 2 VISUALIZATION

V19

Corson's Inlet State Park

Ocean City, Cape May County

ALTERNATIVE B-1 VISUALIZATION

VIEW NOTE

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TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V19. Corson's Inlet State Park

Ocean City, Cape May County

ALTERNATIVE B-2 VISUALIZATION

NORMAL VIEW 2 VISUALIZATION

V19

Corson's Inlet State Park

Ocean City,
Cape May County

ALTERNATIVE B-2 VISUALIZATION

VIEW NOTE

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TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V19. Corson's Inlet State Park

Ocean City, Cape May County

ALTERNATIVE C-1 VISUALIZATION

NORMAL VIEW 2 VISUALIZATION

V19

Corson's Inlet State Park

Ocean City, Cape May County

ALTERNATIVE C-1 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

OCEAN WIND

tjd&a

V22. Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

Ocean Wind
An Ørsted initiative

LANDSCAPE INFORMATION

Field Identification Number. 59
Context Image Dates. 14 August 2018
Site Map Aerial Date. 26 July 2018
Physiographic Area. Shoreline
Landscape Similarity Zone (LSZ). Beachfront

Scenic Resources. Viewpoint from a public beach conservation area. Viewpoint is near Stone Harbor Downtown Commercial Block (identified historic district - no official NRHP eligibility designation).

SITE MAP

CONTEXT IMAGES


1. View looking southeast from the end of 95th Street toward Stone Harbor Beach Patrol, and public beach access.


2. View looking east toward gazebo on 95th Street beach access dune viewing platform.


3. View looking northwest toward 95th Street from 95th Street beach access dune viewing platform.


4. View looking southeast from 95th Street beach access dune viewing platform.


5. View looking southwest from visualization location on the 95th Street beach access ramp.

V22. Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

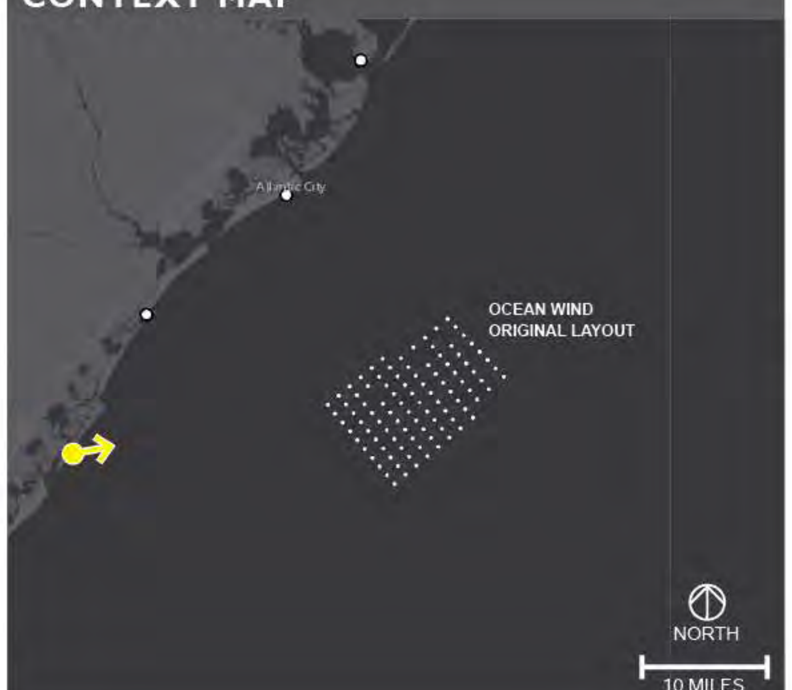
ORIGINAL LAYOUT VISUALIZATION

Ocean Wind
An Ørsted initiative

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW

CONTEXT MAP



ALTERNATIVES ANALYSIS

Original Layout: Turbine layout submitted in COP.

Turbine Dimensions: 906 ft blade tip height, 512 ft hub height, 788 ft rotor diameter.

TURBINE DIMENSIONS

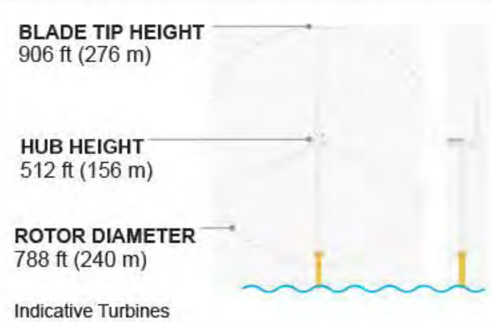


IMAGE DATA

LOCATION

Date	14 August 2018
Time	4:22 PM
Latitude	39.052389°
Longitude	-74.754855°
Direction of View	East
LSZ	Beachfront

PHOTO

Field ID	59
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	13′

PROJECT INFRASTRUCTURE

Number of Turbines	99
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	83°
Humidity	63%
Visibility	10 mi
Wind Direction	W
Wind Speed	14 mph
Weather Conditions	Partly Cloudy

PROJECT VIEW

Distance to Project	20.93 miles
Project Horizontal Field of View (HFOV)	25°

V22

Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

OCEAN WIND

tjd&a Landscape Architects & Planners

Ocean Wind Alternatives Analysis

V22. Stone Harbor Beach Access (Day)

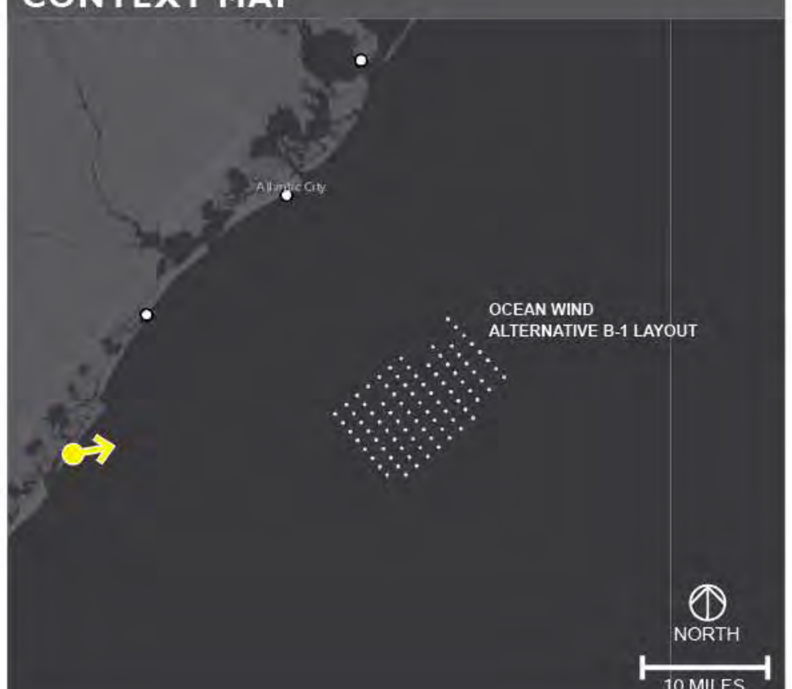
Stone Harbor, Cape May County

ALTERNATIVE B-1 VISUALIZATION

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW

CONTEXT MAP



ALTERNATIVES ANALYSIS

Alternative B-1: Exclusion of up to nine turbine positions in the first two shoreward strings of turbines that includes F01 to K01 and B02 to D02.

Turbine dimensions: 853 ft blade tip height, 492 ft hub height, 722 ft rotor diameter.

TURBINE DIMENSIONS

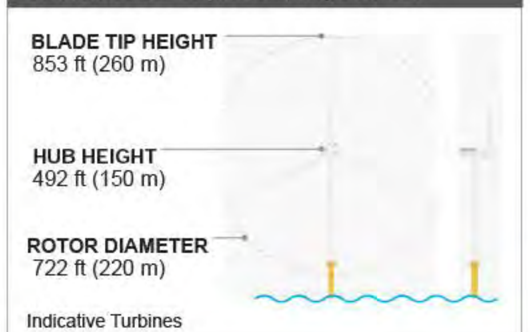


IMAGE DATA

LOCATION

Date	14 August 2018
Time	4:22 PM
Latitude	39.052389°
Longitude	-74.754855°
Direction of View	East
LSZ	Beachfront

PHOTO

Field ID	59
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	13'

PROJECT INFRASTRUCTURE

Number of Turbines	89
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	83°
Humidity	63%
Visibility	10 mi
Wind Direction	W
Wind Speed	14 mph
Weather Conditions	Partly Cloudy

PROJECT VIEW

Distance to Project	21.4 miles
Project Horizontal Field of View (HFOV)	24°

V22

Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

OCEAN WIND

tjd&a Landscape Architects & Planners

V22. Stone Harbor Beach Access (Day)

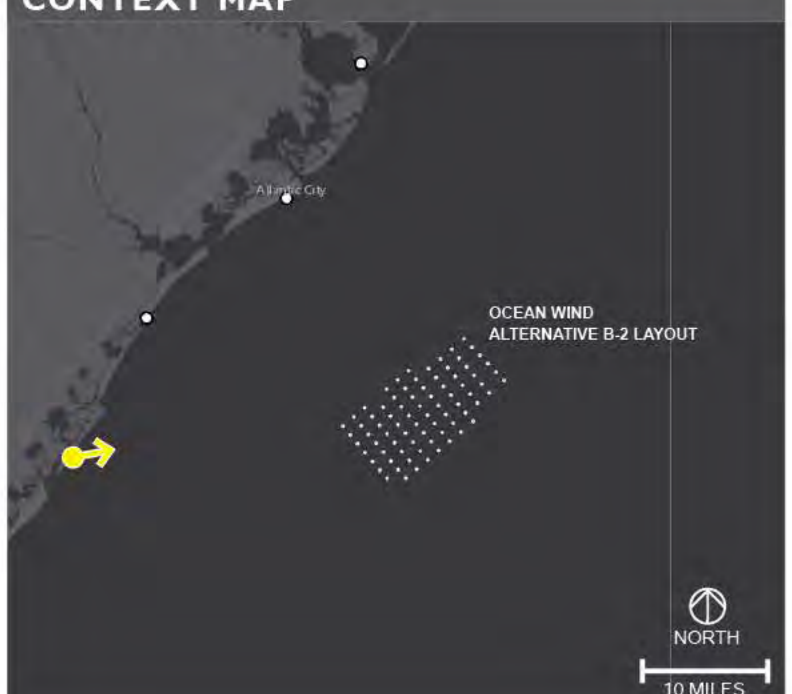
Stone Harbor, Cape May County

ALTERNATIVE B-2 VISUALIZATION

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW

CONTEXT MAP



ALTERNATIVES ANALYSIS

Alternative B-2: Exclusion of up to 19 turbine positions in the first three shoreward strings of turbines that includes F01 to K01, A02 to K02, A03 and C03.

Turbine Dimensions: 906 ft blade tip height, 512 ft hub height, 788 ft rotor diameter.

TURBINE DIMENSIONS

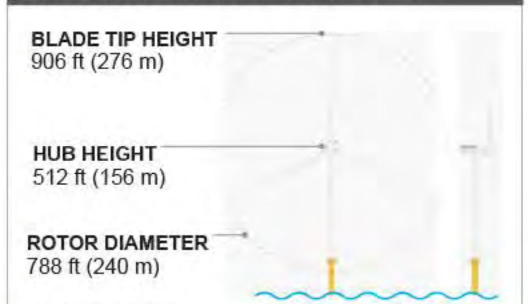


IMAGE DATA

LOCATION

Date	14 August 2018
Time	4:22 PM
Latitude	39.052389°
Longitude	-74.754855°
Direction of View	East
LSZ	Beachfront

PHOTO

Field ID	59
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	13’

PROJECT INFRASTRUCTURE

Number of Turbines	79
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	83°
Humidity	63%
Visibility	10 mi
Wind Direction	W
Wind Speed	14 mph
Weather Conditions	Partly Cloudy

PROJECT VIEW

Distance to Project	21.89 miles
Project Horizontal Field of View (HFOV)	21°

V22

Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

OCEAN WIND

tjd&a Landscape Architects & Planners

V22. Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

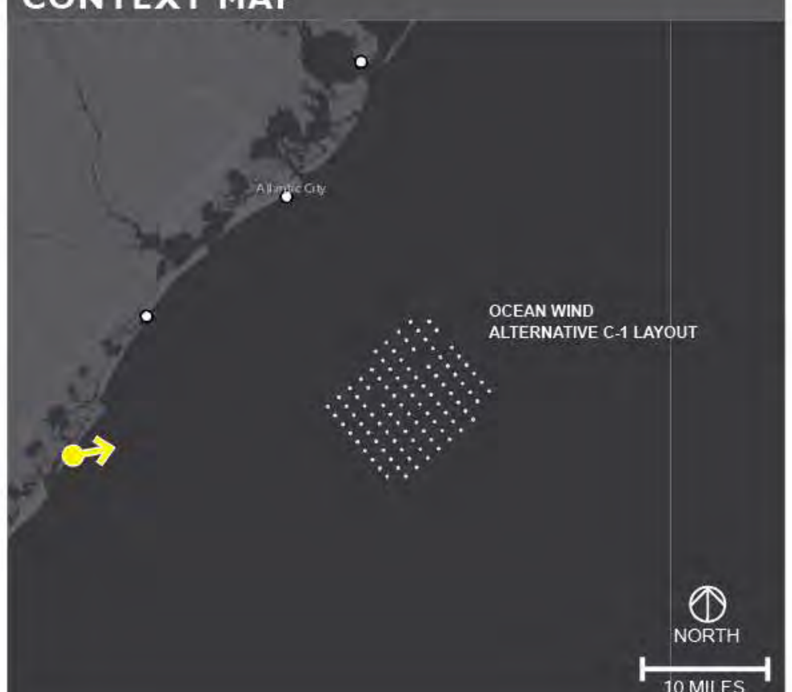
ALTERNATIVE C-1 VISUALIZATION

Ocean Wind
An Ørsted initiative

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW

CONTEXT MAP



ALTERNATIVES ANALYSIS

Alternative C-1: Exclusion of eight turbine positions (A02 to A09), relocation of eight turbine positions to the northern portion of the Ocean Wind Lease Area (C00 to F00 and B01 to E01).

Turbine Dimensions: 906 ft blade tip height, 512 ft hub height, 788 ft rotor diameter.

TURBINE DIMENSIONS

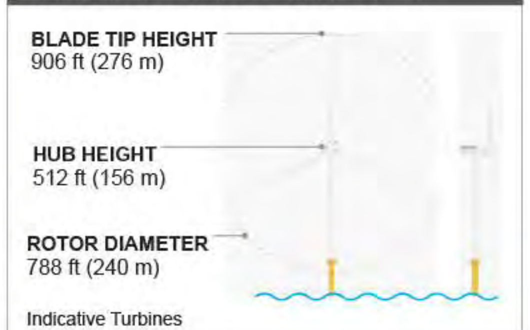


IMAGE DATA

LOCATION

Date	14 August 2018
Time	4:22 PM
Latitude	39.052389°
Longitude	-74.754855°
Direction of View	East
LSZ	Beachfront

PHOTO

Field ID	59
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	13′

PROJECT INFRASTRUCTURE

Number of Turbines	98
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	83°
Humidity	63%
Visibility	10 mi
Wind Direction	W
Wind Speed	14 mph
Weather Conditions	Partly Cloudy

PROJECT VIEW

Distance to Project	20.93 miles
Project Horizontal Field of View (HFOV)	25°

V22

Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

OCEAN WIND

tjd&a Landscape Architects & Planners

V22. Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

EXISTING CONDITIONS

Ocean Wind
An Ørsted Initiative

NORMAL VIEW EXISTING IMAGE

V22

Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

OCEAN WIND

tjd&a

V22. Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

ORIGINAL LAYOUT VISUALIZATION

Ocean Wind
An Ørsted initiative

NORMAL VIEW VISUALIZATION

V22

Stone Harbor Beach Access (Day)

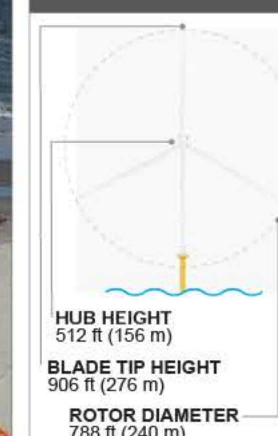
Stone Harbor, Cape May County

ORIGINAL VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS



OCEAN WIND

tjd&a

V22. Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

ALTERNATIVE B-1 VISUALIZATION

NORMAL VIEW VISUALIZATION

V22

Stone Harbor Beach Access (Day)

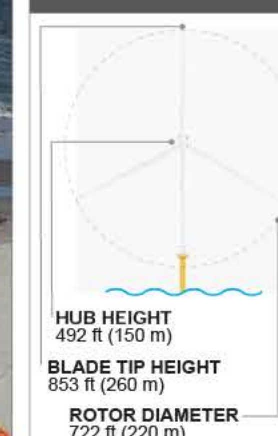
Stone Harbor, Cape May County

ALTERNATIVE B-1 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS



OCEAN WIND

tjd&a

V22. Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

ALTERNATIVE B-2 VISUALIZATION

Ocean Wind
An Ørsted initiative

NORMAL VIEW VISUALIZATION

V22

Stone Harbor Beach Access (Day)

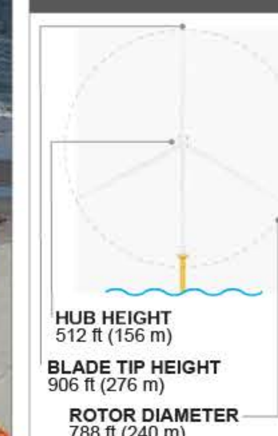
Stone Harbor, Cape May County

ALTERNATIVE B-2 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS



OCEAN WIND

tjd&a

V22. Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

ALTERNATIVE C-1 VISUALIZATION

Ocean Wind
An Ørsted initiative

NORMAL VIEW VISUALIZATION

V22

Stone Harbor Beach Access (Day)

Stone Harbor, Cape May County

ALTERNATIVE C-1 VISUALIZATION

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

OCEAN WIND

tjd&a

ATTACHMENT M-4
NIGHTTIME VISUAL SIMULATIONS

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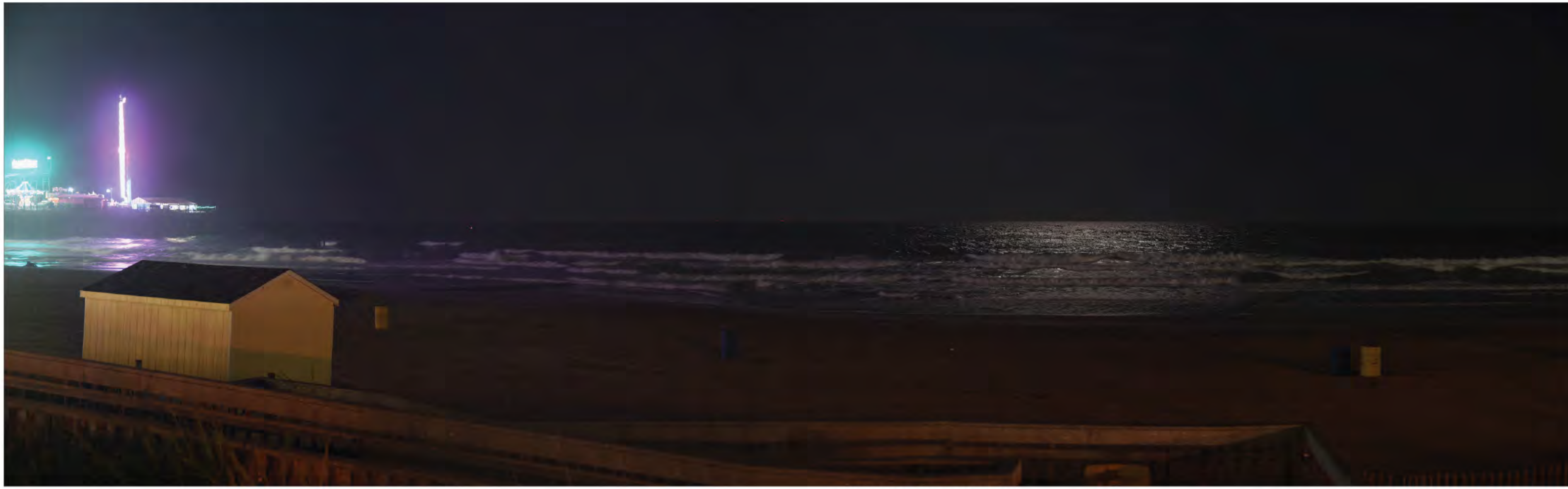
V13. Atlantic City Beachfront (Night)

Atlantic City, Atlantic County

Ocean Wind
An Ørsted initiative

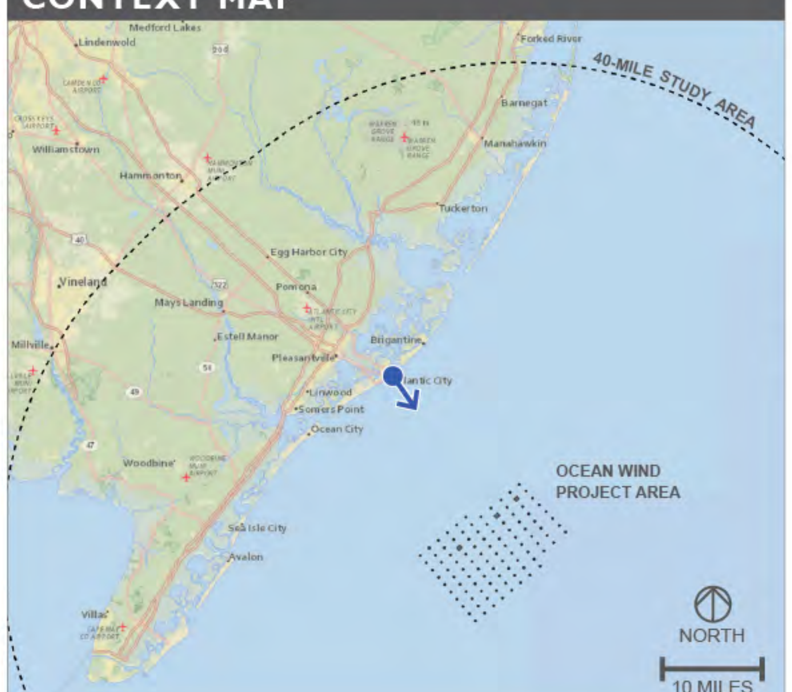
PANORAMIC VISUALIZATION



EXTENT OF NORMAL VIEW 1

EXTENT OF NORMAL VIEW 2

CONTEXT MAP



LOCATION

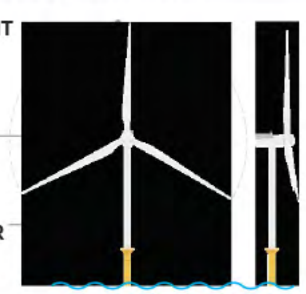
Viewpoint is located on beach access ramp between Steel Pier and Schiff's Central Pier, approximately 140 feet south of the boardwalk.

TURBINE DIMENSIONS

BLADE TIP HEIGHT
906 ft (276 m)

HUB HEIGHT
512 ft (156 m)

ROTOR DIAMETER
788 ft (240 m)



Indicative Turbines

IMAGE DATA

LOCATION

Date	26 July 2018
Time	10:45 PM
Latitude	39.357197°
Longitude	-74.422929°
Direction of View	Southeast
LSZ	Dunes

PHOTO

Field ID	318
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	22'

PROJECT INFRASTRUCTURE

Number of Turbines	99
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	77°
Humidity	90%
Visibility	10 mi
Wind Direction	SW
Wind Speed	3 mph
Weather Conditions	Clear

PROJECT VIEW

Distance to Project	16.04 miles
Project Horizontal Field of View (HFOV)	41°

V13

Atlantic City Beachfront (Night)

Atlantic City, Atlantic County

OCEAN WIND

tjd&a Landscape Architects & Planners

V13. Atlantic City Beachfront (Night)

Atlantic City, Atlantic County

EXISTING CONDITIONS

Ocean Wind
An Ørsted initiative

NORMAL VIEW I EXISTING IMAGE

V13

Atlantic City Beachfront (Night)

Atlantic City, Atlantic County

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

OCEAN WIND

tjd&a

V13. Atlantic City Beachfront (Night)

Atlantic City, Atlantic County

VISUALIZATION

NORMAL VIEW I VISUALIZATION

V13

Atlantic City Beachfront (Night)

Atlantic City, Atlantic County

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

HUB HEIGHT
512 ft (156 m)

BLADE TIP HEIGHT
906 ft (276 m)

ROTOR DIAMETER
788 ft (240 m)

OCEAN WIND

tjd&a

V13. Atlantic City Beachfront (Night)

Atlantic City, Atlantic County

Ocean Wind
An Ørsted Initiative

NORMAL VIEW 2
EXISTING IMAGE

V13

Atlantic City Beachfront (Night)

Atlantic City,
Atlantic County

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

OCEAN WIND

tjd&a

V13. Atlantic City Beachfront (Night)

Atlantic City, Atlantic County

Ocean Wind
An Ørsted Initiative

NORMAL VIEW 2 VISUALIZATION

V13

Atlantic City Beachfront (Night)

Atlantic City, Atlantic County

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS

HUB HEIGHT
512 ft (156 m)

BLADE TIP HEIGHT
906 ft (276 m)

ROTOR DIAMETER
788 ft (240 m)

OCEAN WIND

tjd&a

V23. Stone Harbor Beach Access (Night)

Stone Harbor, Cape May County

PANORAMIC VISUALIZATION

EXTENT OF NORMAL VIEW

CONTEXT MAP

LOCATION

The viewpoint is from the access ramp to the Stone Harbor beachfront, located at 95th Street adjacent to the Beach Patrol building and municipal parking lot.

TURBINE DIMENSIONS

BLADE TIP HEIGHT
906 ft (276 m)

HUB HEIGHT
512 ft (156 m)

ROTOR DIAMETER
788 ft (240 m)

Indicative Turbines

IMAGE DATA

LOCATION

Date	August 14, 2018
Time	8:49 PM
Latitude	39.052389°
Longitude	-74.754855°
Direction of View	East
LSZ	Beachfront

PHOTO

Field ID	77
Camera	NIKON D750
Resolution	300 dpi
Focal Length	50mm
Viewer Eye Elevation	13'

PROJECT INFRASTRUCTURE

Number of Turbines	99
Number of offshore Substations	3

ENVIRONMENTAL

Temperature (°F)	79°
Humidity	69%
Visibility	10 mi
Wind Direction	SW
Wind Speed	8 mph
Weather Conditions	Mostly Cloudy

PROJECT VIEW

Distance to Project	20.93 miles
Project Horizontal Field of View (HFOV)	25°

V23

Stone Harbor Beach Access (Night)

Stone Harbor, Cape May County

OCEAN WIND

tjd&a Landscape Architects & Planners

V23. Stone Harbor Beach Access (Night)

Stone Harbor, Cape May County

EXISTING CONDITIONS

Ocean Wind
An Ørsted Initiative

NORMAL VIEW EXISTING IMAGE

V23

Stone Harbor Beach Access (Night)

Stone Harbor, Cape May County

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

OCEAN WIND

tjd&a

V23. Stone Harbor Beach Access (Night)

Stone Harbor, Cape May County

VISUALIZATION

Ocean Wind
An Ørsted Initiative

NORMAL VIEW VISUALIZATION

V23

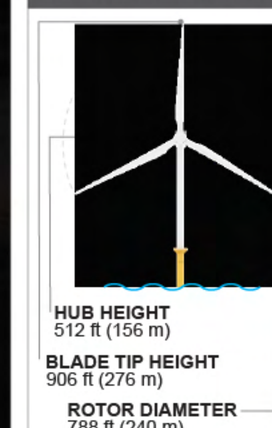
Stone Harbor Beach Access (Night)

Stone Harbor, Cape May County

VIEW NOTE

When printed on 11x17 inch paper, viewer should hold this image approximately 21 inches from eye to replicate actual view.

TURBINE DIMENSIONS



OCEAN WIND

tjd&a

Appendix N. Finding of Adverse Effect for the Ocean Wind 1 Construction and Operations Plan

BOEM has made a Finding of Adverse Effect under Section 106 of the NHPA pursuant to 36 CFR 800.5 for the Ocean Wind 1 Project. BOEM finds that the undertaking would adversely affect the following historic properties:

- Brigantine Hotel, Brigantine City, Atlantic County
- Absecon Lighthouse, Atlantic City, Atlantic County
- Atlantic City Boardwalk, Atlantic City, Atlantic County
- Atlantic City Convention Hall, Atlantic City, Atlantic County
- Ritz-Carlton Hotel, Atlantic City, Atlantic County
- Riviera Apartments, Atlantic City, Atlantic County
- Vassar Square Condominiums, Ventnor City, Atlantic County
- House at 114 South Harvard Avenue, Ventnor City, Atlantic County
- Lucy the Margate Elephant, Margate City, Atlantic County
- Great Egg Coast Guard Station, Longport Borough, Atlantic County
- Ocean City Boardwalk, Ocean City, Cape May County
- Ocean City Music Pier, Ocean City, Cape May County
- The Flanders Hotel, Ocean City, Cape May County
- Hereford Inlet Lighthouse, North Wildwood, Cape May County
- North Wildwood Lifesaving Station, North Wildwood, Cape May County
- U.S. Lifesaving Station #35, Stone Harbor Borough, Cape May County
- Little Egg Harbor U.S. Lifesaving Station #23 (U.S. Coast Guard Station #119), Little Egg Harbor Township, Ocean County
- Thirteen ancient submerged landforms (Targets 21–26, 28–31, and 33–35)

The Project would introduce visual and add cumulative effects from WTG visibility to 17 historic properties where ocean views are character-defining features that contribute to their NRHP eligibility. Thirteen of the 16 identified ancient submerged landforms within the Lease Area (Targets 21–26, 28–31, 33–35) cannot be avoided and would be affected by the Proposed Action, as WTGs, inter-array cables, export cables, and associated work zones are proposed for locations within the defined areas of these resources. As a result, the Project is considered to have the potential to have adverse effects on these marine cultural resources, which are historic properties potentially eligible for listing in the NRHP. For compliance with NHPA Section 110(f) at 36 CFR 800.10, which applies specifically to NHL properties, BOEM has identified two NHLs in the visual APE and determined they will both be visually adversely affected by the undertaking.

The Project would avoid the defined spatial extent of 3 of the 16 identified ancient submerged landforms (Targets 20, 27, and 32), which includes a buffer area. The Project would not encroach on the 50-meter buffer for any of the 19 potential submerged archaeological resources in the Wind Farm Area (Targets 01–03, 06–08, 10–11, and 16–19), BL England Export Cable Route Corridor (Targets 12–14) or Oyster Creek Export Cable Route Corridor (Targets 04, 05, 09, and 15).

BOEM elected to use the NEPA substitution process for Section 106 purposes, as described in 36 CFR 800.8(c), during its review. The regulations at 36 CFR 800.8(c) provide for use of the NEPA substitution process to fulfill a federal agency's NHPA Section 106 review obligations in lieu of the procedures set forth in 36 CFR 800.3 through 800.6. The NEPA substitution process is described at http://www.achp.gov/integrating_nepa_106. Both processes allow participation of consulting parties. Consistent with use of the NEPA substitution process to fulfill Section 106 requirements, BOEM has decided to codify the resolution of adverse effects through a Memorandum of Agreement pursuant to 36 CFR 800.8(c)(4)(i)(B). See Attachment A.

N.1. Project Overview

On August 15, 2019, BOEM received a COP from Ocean Wind 1 proposing an offshore wind energy project within Lease Area OCS-A 0498 offshore New Jersey. In addition, Ocean Wind submitted updates to the COP on March 13, 2020, September 24, 2020, March 24, 2021, November 16, 2021/December 10, 2021, October 14, 2022, and April 24, 2023. In its COP, Ocean Wind is proposing the construction, operation, and eventual decommissioning of a minimum 1,100-MW wind energy project consisting of offshore WTGs and their foundations, OSS and their foundations, scour protection for foundations, inter-array cables linking the individual turbines to the OSS, substation interconnector cables linking the substations to each other, offshore export cables and an onshore export cable system, onshore substations, and connections to the existing electrical grid in New Jersey (see Figure N-1). At their nearest points, WTG and OSS components of the Project would be approximately 13 nm (15 statute miles) southeast of Atlantic City, New Jersey. Offshore Project elements would be on the OCS, with the exception of a portion of the offshore export cables within state waters. Ocean Wind is utilizing a PDE in its COP, which represents a reasonable range of design parameters that may be used for the Project. In reviewing the PDE, BOEM is analyzing the maximum-case scenario that could occur from any combination of the contemplated parameters. This includes alternatives that may require phased identification of historic properties (see Section N.5). BOEM's analysis and review of the PDE may result in the approval of a project that is constructed within that range or a subset of design parameters within the proposed range.

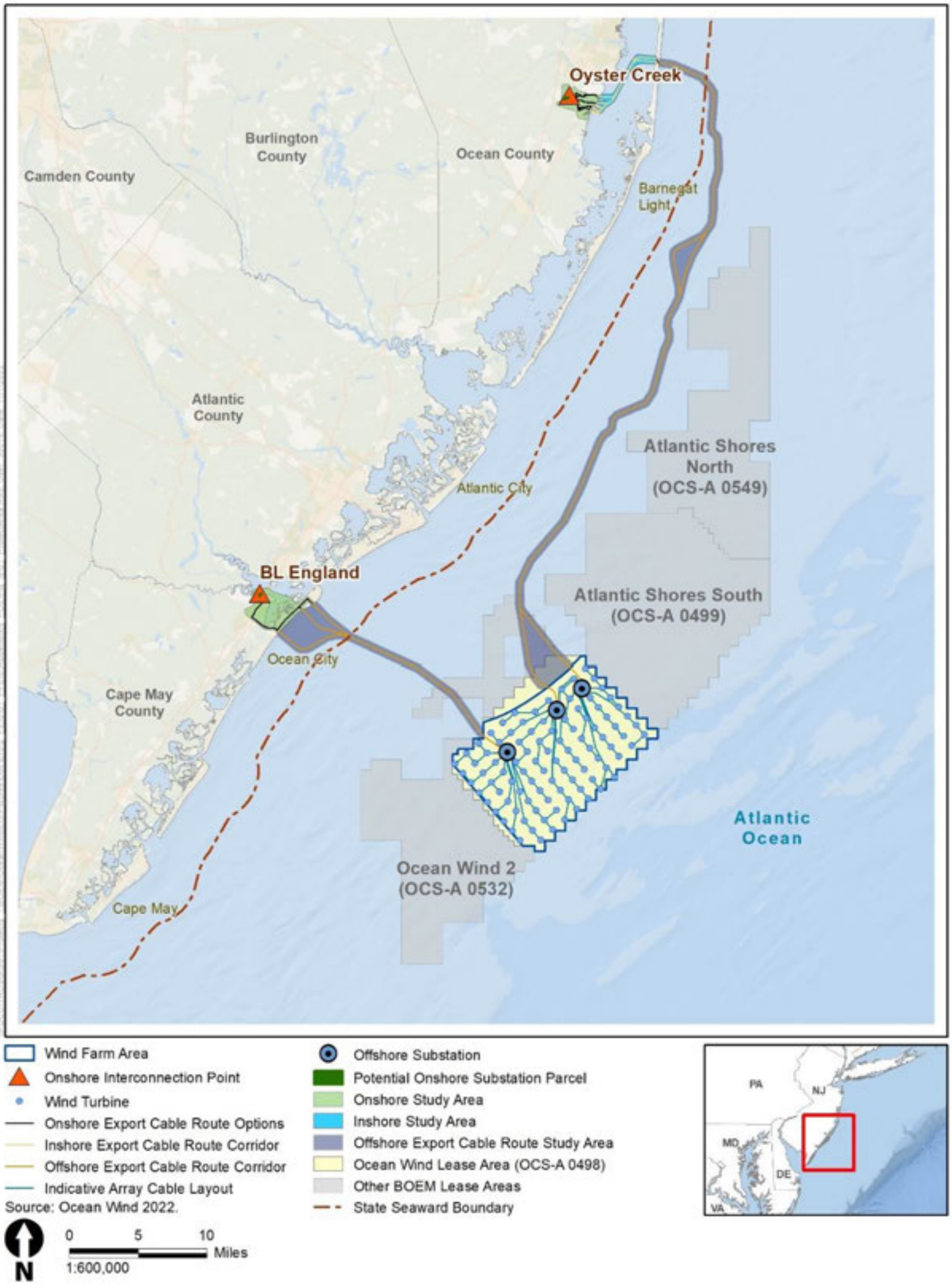


Figure N-1 Ocean Wind 1 COP Proposed Project Elements

If approved by BOEM and other agencies with authority to approve Project components outside BOEM's jurisdiction, Ocean Wind 1 would be allowed to construct and operate WTGs, export cables to shore, and associated facilities, including those outside BOEM's jurisdiction, for a specified term. BOEM is now conducting its environmental and technical reviews of the COP and, on June 24, 2022, published a Draft EIS under NEPA for its decision regarding approval of the plan (BOEM 2022). A detailed description of the proposed Project can be found in Chapter 2, Section 2.1.2, of the Final EIS. This Final EIS considers reasonably foreseeable impacts of the Project, including impacts on cultural resources, including historic properties.

N.1.1 Background

The Project is within a commercial lease area that has received previous Section 106 review by BOEM regarding the issuance of the commercial lease and approval of site assessment activities and is subject to two prior Programmatic Agreements. In 2012, BOEM executed a Programmatic Agreement among the SHPOs of Delaware, Maryland, New Jersey, and Virginia, the ACHP, the Narragansett Indian Tribe, and the Shinnecock Indian Nation (see https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/HP/MidAtlantic-PA_Executed.pdf). Additionally, in 2016, BOEM executed a Programmatic Agreement among the SHPOs of New York and New Jersey, the Shinnecock Indian Nation, and ACHP to consider renewable energy activities offshore New York and New Jersey (see https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/HP/NY-NJ-Programmatic-Agreement-Executed.pdf).

BOEM prepared an environmental assessment to analyze the environmental impacts associated with issuing commercial wind leases and approving site assessment activities within the New Jersey WEA and approved the SAP for Lease Area OCS-A 0498 on May 17, 2018. On December 8, 2020, Ocean Wind submitted an application to BOEM to assign a portion of Lease Area OCS-A 0532. BOEM approved this lease on March 26, 2021.

The Ocean Wind 1 COP proposed installing a maximum of 98 WTGs extending up to 906 feet (276 meters) above MLLW. Ocean Wind would mount the WTGs on monopile foundations. The proposed facility includes up to three OSS, which would be built on either monopile or pile jacket foundations. Where required, scour protection would be placed around foundations to stabilize the seabed near the foundations as well as the foundations themselves. The scour protection would be a maximum of 8.2 feet (2.5 meters) in height, would extend away from the foundation as far as 73 feet (22.3 meters), and would have a maximum seabed penetration of 164 feet (50 meters). Array cables would transfer electrical energy generated by the WTGs to the OSS. OSS would include step-up transformers and other electrical equipment needed to connect the inter-array cables to the offshore export cables. Substations would be connected to one another via substation interconnector cables. Up to two interconnector cables would be buried beneath the seabed floor.

Up to three offshore export cables would be buried under the seabed floor within the two offshore export cable route corridors to connect the proposed wind energy facility to the onshore electrical grid. Up to two offshore export cables would make landfall and deliver electrical power to the Oyster Creek substation. The offshore export cable route corridor to Oyster Creek would begin within the Wind Farm Area and proceed northwest to the Atlantic Ocean side of Island Beach State Park. The inshore export cable route corridor to Oyster Creek would exit the bay side of the Island Beach State Park and cross Barnegat Bay southwest to make landfall near Oyster Creek in either Lacey or Ocean Township. One offshore export cable would make landfall and deliver electrical power to the BL England substation. The BL England offshore export cable route corridor would begin within the Wind Farm Area and proceed west to make landfall in Ocean City, New Jersey.

Landfall locations in Lacey or Ocean Township and Ocean City would include TJBs to connect the offshore export cable to the onshore export cable. Transition of the export cables from offshore to onshore would be accomplished by using open-cut trenching or trenchless methods. Onshore export cables would be buried and housed within a single duct bank buried along the onshore export cable route with a target burial of 4 feet. Installation of onshore export cables would require up to a 50-foot-wide construction corridor. The onshore export cable routes would terminate at the Oyster Creek substation and BL England substation sites.

Dredging may be required in shallow areas in Barnegat Bay to facilitate vessel access for export cable installation west of Island Beach State Park and near the landfall at Lacey or Ocean Township and may occupy a Federal Civil Works Project. Ocean Wind proposes to dredge Barnegat Inlet and the Oyster Creek Channel; operated and maintained by USACE under the Barnegat Inlet Navigation Project. Cable installation may also alter or occupy Federal Civil Works Projects through cable installation beneath the Ocean City beach and dunes/Great Egg Harbor Inlet to Townsend Inlet Project, and cable installation beneath the channel at the Roosevelt Boulevard Bridge and a second location prior to making landfall in Lacey Township/New Jersey Intracoastal Waterway Federal Navigational Project.

The proposed Project has a designed life span of approximately 35 years; some installations and components may remain fit for continued service after this time. Ocean Wind would rehabilitate an existing retired marine terminal to serve as an onshore O&M facility in Atlantic City, New Jersey. The City of Atlantic City intends to secure authorization for marina upgrades; that project is being separately reviewed and authorized by USACE and state and local agencies. The improvements to the O&M facility are not dependent on the proposed Project analyzed in the EIS.

O&M activities would include inspections, preventative maintenance, and, as needed, corrective maintenance for onshore substations, onshore export cables, and grid connections. Ocean Wind would conduct inspections of foundations, bathymetry, scour (and associated scour protection, if deployed), and cable burial. Multi-beam echosounder surveys would be conducted during years 1, 4, and 5 post-commissioning, after which an optimal survey frequency would be determined based on initial findings. Sonar, remotely operated vehicles, drones, and divers may be required. Ocean Wind would conduct annual maintenance of WTGs, including safety surveys, blade maintenance, and painting as needed. OSS would be routinely maintained for preventative maintenance up to 12 times per year. Although the offshore export cables, inter-array cables, and OSS interconnector cables typically have no maintenance requirements unless a failure occurs, cable failures may result from anchors and fishing gear. During these low-probability events, cables would be located, unburied, and lifted above sea level for repair or replacement aboard the cable-handling vessel. Upon completion of the repair, the cable would be lowered onto the seabed, assessed to determine its proximity to the original location, and reburied using a jetting tool. Portions of the cables are anticipated to become exposed due to natural sediment transport processes and would require scour protection replenishment or reburial. Ocean Wind would conduct multi-beam echo sounder bathymetry survey along the cable routes immediately following installation and at 1 year, 2–3 years, and 5–8 years post-commissioning, after which survey frequency would depend on prior survey findings. Additional surveys may be conducted after major storm events as otherwise needed. Ocean Wind would need to use vessels, vehicles, and aircraft during O&M activities described above.

Although the proposed Project is anticipated to have an operation life of 35 years, it is possible that some installations and components may remain fit for continued service after this time. Ocean Wind would have to apply for and be granted an extension if it wanted to operate the proposed Project for more than the 25-year operations term stated in its lease. The process of decommission would remove all facilities, projects, cables, pipelines, and obstructions and clear the seafloor of all obstructions created by the proposed Project. All facilities would need to be removed 15 feet (4.6 meters) below the mudline (30 CFR 285.910(a)). Absent permission from BOEM, Ocean Wind would have to achieve complete decommissioning within 2 years of termination of the lease and either reuse, recycle, or responsibly dispose of all materials removed. Section 106 review will be conducted at the decommissioning stage.

N.1.2 Undertaking

BOEM has determined that the Project constitutes an undertaking subject to Section 106 of the NHPA as amended (54 USC 306108) and its implementing regulations (36 CFR 800), and that the Project activities proposed under the COP have the potential to affect historic properties. Confidential appendices to the COP referenced in this document were sent electronically or by mail depending on expressed preference to all consulting parties on March 21, 2022, and April 1, 2022. The COP, as well as its public and confidential appendices, is hereby incorporated by reference.

The undertaking for this Section 106 review is the Proposed Action. As described in Section 2.1.2 of the Final EIS, the Proposed Action would include the construction, O&M, and eventual decommissioning of an 1,100-MW wind energy facility on the OCS offshore New Jersey, occurring within the range of design parameters outlined in the Ocean Wind 1 COP (Ocean Wind 2023), subject to applicable mitigation measures.

N.1.3 Area of Potential Effects

In general, BOEM defines the APE for such an undertaking to include the following geographic areas:

- The depth and breadth of the seabed potentially affected by any bottom-disturbing activities, constituting the marine archaeological resources portion of the APE;
- The depth and breadth of terrestrial areas potentially affected by any ground-disturbing activities, constituting the terrestrial archaeological resources portion of the APE;
- The viewshed from which renewable energy structures, whether offshore or onshore, would be visible, constituting the viewshed portion of the APE; and
- Any temporary or permanent construction or staging areas, both onshore and offshore, which may fall into any of the above portions of the APE.

These are described below in greater detail with respect to the proposed activities, consistent with BOEM's *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* (BOEM 2020).

N.1.3.1. Marine Archaeological Resources APE

The marine archaeological resources portion of the APE (hereafter marine APE) for the Project is the depth and breadth of the seabed potentially affected by any bottom-disturbing activities and temporary or permanent offshore construction or staging areas. It includes a conservative PDE that can accommodate a number of potential designs, whether monopile or jacketed foundations are used, installed by up to two jack-up vessels, as well as necessary support vessels and barges. The marine APE encompasses activities within the Lease Area (Attachment B, Figure 1), activities within the Oyster Creek export cable route corridor (Attachment B, Figure 2), and activities within the BL England export cable route (Attachment B, Figure 3).

The Lease Area encompasses 75,525 acres (30,564 hectares) with water depths ranging from 52 to 125 feet (16 to 38 meters). Within the Lease Area, the wind farm development would occur in a smaller footprint of 35,353 acres (14,307 hectares). Ocean Wind proposes up to 98 WTGs and up to three OSS within the extent of the PDE. Construction activities would occur within an 850-foot (259-meter) work zone around WTG locations (WTG work zones around Targets 20, 27, and 32 are reduced to 200 meters).

The marine APE includes all offshore areas where seafloor-disturbing activities from inter-array cable trenching and installation, boulder relocation, and vessel anchoring may occur. The maximum vertical extent of seafloor impact would be approximately 164 feet (50 meters) below the seafloor for WTGs and approximately 230 feet (70 meters) for OSS. The array and substation interconnector cables have a target burial depth of 4 to 6 feet (1.2 to 1.8 meters) below the stable seabed. Seafloor disturbance for anchoring of construction vessels would be approximately 26 feet (8 meters). Each main vessel would have up to eight anchors spaced 984 to 1,640 feet (300 to 500 meters) from the vessel.

The marine APE also includes offshore export cable corridors extending from the Lease Area to the sea-to-shore transition at landfall locations in Lacey or Ocean Township and Ocean City, which is inclusive of the landfall on Island Beach State Park in Berkeley Township. The export cable corridors would vary in width between 869 and 3,117 feet (265 and 950 meters). The BL England export cable route would be approximately 32 miles (51 kilometers) and approximately 3,406 acres (1,378 hectares). The Oyster Creek export cable route would be approximately 71 miles (114 kilometers) and approximately 10,775 acres (4,360 hectares). Offshore export cables would typically be buried below the seabed similarly to the array cables. The maximum vertical seafloor disturbance from export cable burial is approximately 6 feet (1.8 meters) and 26 feet (8 meters) for associated anchoring/spudding of construction vehicles.

N.1.3.2. Terrestrial Archaeological Resources APE

The terrestrial archaeological resources portion of the APE (hereafter terrestrial APE) includes areas of potential ground disturbance associated with the onshore construction and operation of the Project. The APE is presented as a conservative PDE and includes the landfall sites, underground cable routes, substation sites, and equipment laydown areas. The depth and breadth of potential ground-disturbing activities are described below for each location. Attachment A, Figure 4, depicts the terrestrial APE for onshore cable and landfall site alternatives for BL England in detail. Attachment B, Figure 5, depicts the terrestrial archaeological resources for onshore cable and landfall site alternatives for Oyster Creek.

The terrestrial APE includes the sea-to-shore transition landfall sites. Transition of the export cables from offshore to onshore would be accomplished by using open-cut trenching or trenchless methods. Ground-disturbing activities from installation of the TJB and associated excavation would occur at the BL England landfall sites options illustrated in Attachment A, Figure 4, and Oyster Creek landfall site options illustrated in Attachment B, Figure 5.

From the TJB at the landfall sites, Ocean Wind would install the onshore export cable underground. Burial of the export cable in a single duct bank would require up to a 50-foot-wide (15-meter-wide) construction corridor and up to a 30-foot-wide (9-meter-wide) permanent easement for Oyster Creek and BL England cable corridors excluding landfall locations and cable splice locations. The northern Oyster Creek onshore cable route option that crosses Route 9 and Oyster Creek on a southwest diagonal would be installed using trenchless technology to avoid opening Route 9 in an area that has had recent utility work.

The onshore cable would connect to the proposed onshore substation parcels. Ground-disturbing activities associated with construction of the Oyster Creek substation would occur on a previously disturbed 31.5-acre (127,476-m^2) parcel at the former Oyster Creek nuclear plant in Lacey Township. Ground-disturbing activities associated with construction of the BL England substation would occur within a previously disturbed 13-acre (52,609-m^2) parcel at the former coal, oil, and diesel plant in Upper Township.

N.1.3.3. Visual APE

The APE for visual effects analysis (hereafter visual APE) includes the viewshed from which renewable energy structures—whether offshore or onshore—would be visible. Offshore, the visual APE includes a boundary of 40 miles radial distance from the Wind Farm Area, which is the approximate maximum theoretical distance—a distance that does not factor in certain environmental factors such as weather or environmental conditions—at which the WTGs could be visible (COP Volume III, Appendix F-3, page 23; Ocean Wind 2023). However, subsequent desktop analysis, visualizations, and field verification determined that the actual visibility of Wind Farm Area infrastructure beyond 25 miles is unlikely (COP Volume III, Appendix F-3, page 23; Ocean Wind 2023). See Attachment B, Figure 6, Sheets 1–16.

Geographic information system analysis and subsequent field investigation delineated the visual APE methodically through a series of steps, beginning with the maximum theoretical distance WTGs could be visible. This was determined by first considering the visibility of a WTG from the water level to the tip of an upright rotor blade at a height of 906 feet. The analysis then accounted for how distance and EC impede visibility as the distance increases between the viewer and WTGs (i.e., by a 40-mile distance, even blade tips would be below the sea level horizon line). The mapping effort then removed all areas with obstructed views toward WTGs, such as those views impeded by intervening topography, vegetation, and structures. Areas with unobstructed views of offshore Project elements then constituted the APE. Attachment B, Figure 6 Map Index, also depicts reasonably foreseeable future project areas for consideration of cumulative effects within the APE.

Onshore, the visual APE includes a 0.25-mile boundary around the BL England substation location (see Attachment B, Figure 7) and a minimum 0.25-mile boundary around the Oyster Creek substation location (see Attachment B, Figure 8). Any overhead lines would fall within these boundaries (COP Volume III, Appendix F-3, page 19; Ocean Wind 2023). All other elements would be underground and would not be visible.

N.2. Steps Taken to Identify Historic Properties

N.2.1 Technical Reports

To support the identification of historic properties within the APE, Ocean Wind provided survey reports detailing the results of cultural resource investigations within the terrestrial, marine, and visual portions of the APE. Table N-1 provides a summary of these efforts to identify historic properties, including results and key findings of each investigation.

Collectively, BOEM finds that these reports represent a good-faith effort to identify historic properties within the Project APE. The documents summarized in Table N-1 have been shared with consulting parties and are hereby incorporated by reference.

BOEM has reviewed the reports summarized in Table N-1, found them sufficient, and reached the following conclusions:

- The marine archaeological investigations include surveys of most areas of potential seafloor disturbance following BOEM's *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585*. BOEM has reviewed the data currently available in the marine archaeological survey report and, for portions of the APE that have been surveyed, has determined that the data are sufficient for identifying historic properties within the marine APE.
- BOEM has reviewed the terrestrial archaeological reports submitted to date and has determined that the investigations summarized in the reports are sufficient for identifying historic properties within

the terrestrial APE.

- BOEM has reviewed the VIA with visual simulations and the assessment of visual effects on historic properties for the entire PDE and determined the studies and reports are sufficient for identifying and assessing effects on historic properties within the visual APE. BOEM finds that the APE for potential visual effects analyzed is appropriate for the scale and scope of the undertaking. BOEM further finds that the inventory of historic properties is sufficient to consult on the undertaking, and represents a good-faith effort to identify historic properties within the visual APE potentially affected by the undertaking, as defined at 36 CFR 800.4.

In addition to the conclusions summarized above, BOEM has found that the assessment of effects on historic properties within the marine, terrestrial, and visual APEs contained within these reports is sufficient to apply the criteria of adverse effects and to continue consultations with consulting parties for resolving adverse effects on historic properties. *Assessment of Effects on Historic Properties in the Visual APE* (Section N.3.1.3) considers recommendations from the assessment of visual effects on historic properties technical report and comments provided by consulting parties during the consultation process described in Section N.2.2. Therefore, BOEM's findings herein deviate from the technical report recommendations, as BOEM has determined seven additional historic properties to be adversely affected by the Project.

Consequent to the reports prepared for the COP submittal, ICF prepared for BOEM a technical report to support BOEM's cumulative effects analysis, the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Farm Project* (BOEM 2022). The Cumulative Historic Resources Visual Effects Analysis presents the analysis of cumulative visual effects where BOEM has determined, in review of the Historic Resources Visual Effects Assessment (COP Volume III, Appendix F-3; Ocean Wind 2023), that historic properties would be adversely affected by the Project. The effects of other reasonably foreseeable wind energy development activities are additive to those adverse effects from the Project itself, resulting in cumulative effects. Seventeen historic properties within the viewshed of WTGs for the Project and other reasonably foreseeable offshore wind energy development activities would be adversely affected by cumulative visual effects. These 17 historic properties are the Brigantine Hotel in Brigantine City; Absecon Lighthouse, Atlantic City Boardwalk, Atlantic City Convention Hall, Ritz-Carlton Hotel, and Riviera Apartments in Atlantic City; Vassar Square Condominiums and the house at 114 South Harvard Avenue in Ventnor City; Lucy the Margate Elephant in Margate City; Great Egg Coast Guard Station in Longport Borough; Ocean City Boardwalk, Ocean City Music Pier, and the Flanders Hotel in Ocean City; Hereford Inlet Lighthouse and North Wildwood Lifesaving Station in North Wildwood; U.S. Lifesaving Station #35 in Stone Harbor Borough; and Little Egg Harbor U.S. Lifesaving Station #23 in Little Egg Harbor Township. Two of these adversely affected properties—Atlantic City Convention Hall and Lucy the Margate Elephant—are NHLs.

Table N-1 Summary of Cultural Resources Investigations Performed by Ocean Wind in the Terrestrial, Marine, and Visual APE

Portion of APE	Report	Description	Key Findings / Recommendation
Onshore	Phase I Archaeological Investigation, Ocean Wind Offshore Wind Farm (Lease Area CS-A0498), Oyster Creek and BL England, Terrestrial Archaeological Resource Assessment, Cape May and Ocean Counties, New Jersey (COP Volume III, Appendix F-2; Ocean Wind 2023).	A desktop study of known archaeological sites within 0.33 mile (0.53 kilometer) of the landfall locations and cable routes; an analysis of potential historic structures within the preliminary APE that may have archaeological components; a shovel probe survey of substation locations and cable routes. The terrestrial preliminary APE includes the footprint of the proposed onshore facilities associated with construction, operations, and maintenance, including the onshore substation and onshore export cable route corridors, as well as temporary work areas including staging and laydown areas.	This report identified or revisited six archaeological resources within 250 meters of the terrestrial preliminary APE; five of these resources are within the terrestrial preliminary APE, and one immediately adjacent. These archaeological resources date to pre-contact and post-contact periods. A total of 1,312 shovel test and seven 1- by 1-meter units were excavated throughout the terrestrial preliminary APE. Of the six sites intersecting or abutting the preliminary APE, two (28-CM-032 and 28-OC-249) have been recommended or determined to be eligible for listing on the NRHP. The remaining four sites have undetermined NRHP eligibility. All six sites are anticipated to be avoided by Project-related impacts, and one site (28-OC-249) also has recommendations for specific avoidance measures including temporary fencing and archaeological monitoring during construction. Avoidance measures and monitoring will be detailed in stipulations in the Memorandum of Agreement. A recommendation of “No Adverse Effect” is made for all six archaeological sites.
Offshore	Marine Archaeological Resources Assessment for the Ocean Wind Offshore Wind Farm for Lease Area OCS-A 0498 Construction and Operations Plan (COP Volume III, Appendix F-1; Ocean Wind 2023).	A marine archaeological resource assessment of HRG survey data collected by both intrusive and non-intrusive surveying methods. The marine preliminary APE for submerged cultural resources consists of areas affected by ground-disturbing activities associated with construction and O&M, including the seafloor footprint of the Wind Farm Area and export cable route corridors, extending to maximum of 50 meters (164 feet) beneath the seafloor and 70 meters (230 feet) for OSS. Survey was conducted using a suite of marine vessel-based remote-sensing instruments to locate submerged cultural resources including	This report identified 19 potential submerged archaeological resources within the marine preliminary APE—12 within the Wind Farm Area, three along the BL England corridor, and four along the Oyster Creek corridor. The majority of these are either known shipwrecks or potential shipwrecks. Avoidance buffers are recommended for each potential submerged archaeological resource. The report concluded that Ocean Wind would be able to follow the recommended 50-meter avoidance buffer for all of the 19 resources. Further archaeological investigation is recommended if avoidance is infeasible. The report also identified 16 ancient submerged landforms within the marine preliminary APE: 13 of these are within the Wind Farm Area, one is in the BL

Portion of APE	Report	Description	Key Findings / Recommendation
		side-scan sonars, multibeam echosounders, sub-bottom profilers, and marine magnetometers. Marine survey was conducted by Alpine Ocean Seismic Survey, Inc., Earth Sciences & Surveying International, Fugro USA Marine, Inc., and Gardline Limited over five separate survey periods between July 2018 and March 2020. A 2023 update to the report provided supplemental survey data to Table 13 and Figure 30, and revision to the Marine Post-Review Discovery Plan, but did not result in any revision to the findings or recommendations.	England export cable route corridor, and two are in the Oyster Creek export cable route corridor. Coring of these features, along with laboratory analysis, suggested they are similar to features previously determined to be TCPs. It has therefore been presumed that they are eligible for listing in the NRHP, and they may also contain archaeological components. Archaeological mitigation was recommended if avoidance of ancient submerged landforms is infeasible, and the report outlines a proposed approach to mitigation for impacts on geomorphic features of archaeological interest.
Offshore	Ocean Wind Offshore Wind Farm, Cape May and Ocean Counties, New Jersey Memorandum of March 2023 Fieldwork HAA 5614-22; NJ SHPO #18-1184; HPO-E2022-239 (April 2023)	A terrestrial archaeological resource assessment for the Ocean Wind Terrestrial Archaeological Resource Assessment: eight discrete previously unsurveyed areas now included in the Project's APE resulting from minor changes in the Project alternative, including site visits and systematic archaeological shovel testing.	Terrestrial archaeology survey of eight discrete locations in response to changes to Project alternatives in the terrestrial APE: six in the Oyster Creek segment and two in the BL England segment. Two historic artifacts were recovered, but both were recommended not significant. Archaeological monitoring was recommended for the Crook Horn Creek portion of BL England Terrestrial APE.
Visual	Ocean Wind Visual Effects on Historic Properties (COP Volume III, Appendix F-3; Ocean Wind 2023)	A study evaluating visual impacts on historic properties. The preliminary APE for visual effects from the Project generally extends from Wildwood in Cape May County in the south to Beach Haven in Ocean County to the north for the Project's offshore components. Onshore, the visual preliminary APE includes a 0.25-mile boundary around the BL England substation location and a minimum 0.25-mile boundary around the Oyster Creek substation location. The offshore visual preliminary APE was initially	This report identified nine historic districts and 40 individual buildings or structures within the Offshore Infrastructure preliminary APE. A "No Adverse Effect" recommendation was made for 39 properties, and a potential for adverse effect was recommended for 10 properties. These 10 properties included the Brigantine Hotel in Brigantine City; Atlantic City Boardwalk, Atlantic City Convention Hall, Ritz-Carlton Hotel, and Riviera Apartments in Atlantic City; Vassar Square Condominiums and the house at 114 South Harvard Avenue in Ventnor City; Lucy the Margate Elephant in Margate City; and Ocean City Boardwalk and Ocean City Music Pier in Ocean City. The visual effects

Portion of APE	Report	Description	Key Findings / Recommendation
		established based on the theoretical limits of visibility of Project components. These limits were then refined based on computer-based viewshed analysis that incorporated topography and the presence of intervening vegetation, buildings, and structures in the landscape to determine the extent of visibility of offshore components. The preliminary APE was further refined through desktop analysis and field verification to confirm previous analyses and establish the maximum visibility threshold of 25 miles from select locations with direct views of the Project. The onshore visual preliminary APE was established as parcels adjacent to or intersected by the proposed underground onshore export cable routes and properties within a buffer around the proposed substation sites and associated overhead grid connections representing the maximum extent of visual and atmospheric effects based on the density of intervening development and vegetation.	analysis included two designated NHL properties in the offshore infrastructure preliminary APE. A Potential for Adverse Effect was recommended for both properties: Atlantic City Convention Hall and Lucy the Margate Elephant. This report also analyzed visual effects on historic properties within the onshore infrastructure preliminary APE. Three properties were analyzed, and a recommendation of No Adverse Effect was made for all of them. Mitigation options to resolve adverse effects from visual impacts were recommended for BOEM's consideration.

Portion of APE	Report	Description	Key Findings / Recommendation
Visual	Architectural Intensive Level Survey, Ocean Wind Offshore Windfarm, New Jersey (SEARCH, Inc. 2021)	An architectural survey of aboveground resources supporting the analysis presented in the Historic Resources Visual Effects Assessment. The preliminary APE for visual effects from the Project generally extends from Wildwood in Cape May County in the south to Beach Haven in Ocean County to the north for the Project's offshore components. Onshore, the visual preliminary APE includes a 0.25-mile boundary around the BL England substation location and a minimum 0.25-mile boundary around the Oyster Creek substation location. The offshore visual preliminary APE was initially established based on the theoretical limits of visibility of Project components. These limits were then refined based on computer-based viewshed analysis that incorporated topography and the presence of intervening vegetation, buildings, and structures in the landscape to determine the extent of visibility of offshore components. The preliminary APE was further refined through desktop analysis and field verification to confirm previous analyses and establish the maximum visibility threshold of 25 miles from select locations with direct views of the Project. Two additional criteria were evaluated to determine if properties merited intensive survey in addition to views of Project components: a property's specific orientation toward the ocean and architectural features indicative of a design that was responsive to a property's beachfront location. The onshore visual preliminary APE was established as parcels adjacent to or intersected by the proposed underground onshore export cable routes and properties within a buffer around the proposed substation sites and	This report delineated the preliminary APE for visual effects for onshore architectural properties, identified historic properties within the preliminary APE, and provided eligibility recommendations for those historic properties identified in the preliminary APE. The preliminary APE includes portions of Atlantic, Cape May, and Ocean Counties with views of Project components. An intensive-level survey was completed for 304 historic properties within the offshore preliminary APE, 21 of which are NRHP-listed or -eligible properties. An intensive-level survey of the 32 historic properties identified in the onshore preliminary APE determined that three properties were NRHP-listed or -eligible. Effect evaluations were not addressed in this report and are included in the separate *Ocean Wind Visual Effects on Historic Properties* report (COP Volume III, Appendix F-3; Ocean Wind 2023).

Portion of APE	Report	Description	Key Findings / Recommendation
		associated overhead grid connections representing the maximum extent of visual and atmospheric effects based on the density of intervening development and vegetation.	
Visual	March 2023 Survey of Eight Additional Built Resources in Atlantic County (March 2023)	A study evaluating visual effects on eight historic properties in Atlantic County not previously included in the *Ocean Wind Visual Effects on Historic Properties Report* (February 2023) or *Architectural Intensive Level Survey* (October 2022), including research, completed NJ SHPO Inventory Forms, and NRHP eligibility recommendations for each resource.	All eight historic properties were recommended not eligible for listing in the NRHP, including Holiday Inn, 2201 Boardwalk, Atlantic City, New Jersey; Malibu Motel, 108 S. Montpelier Avenue, Atlantic City, New Jersey; The Plaza, 101 S. Plaza Place, Atlantic City, New Jersey; 5000 Boardwalk, Ventnor City, New Jersey; Regency Towers, 5200 Boardwalk, New Jersey; The Oxford, 112 S. Oxford Avenue; 111 S. Cambridge Avenue, Ventnor City, New Jersey

Sources: COP Volume III, Appendix F-1, F-2, F-3; Ocean Wind 2023; Hartgen Archeological Associates, Inc. 2021; SEARCH, Inc. 2021.

N.2.2 Consultation and Coordination with the Parties and Public

N.2.2.1. Early Coordination

Since 2009, BOEM has coordinated OCS renewable energy activities offshore New Jersey with its federal, state, local, and tribal government partners through its Intergovernmental Renewable Energy Task Force. BOEM has met regularly with federally recognized tribes that may be affected by renewable energy activities in the area since 2011, specifically during planning for the issuance of leases and review of site assessment activities. BOEM also hosts public information meetings to help keep interested stakeholders updated on major renewable energy milestones. Information pertaining to BOEM's Intergovernmental Renewable Energy Task Force meetings is available at https://www.boem.gov/renewable-energy/state-activities/renewable-energy-task-force-meetings-1 and information pertaining to BOEM's stakeholder engagement efforts is at https://www.boem.gov/renewable-energy/state-activities/new-jersey-public-information-meetings.

N.2.2.2. NEPA Scoping and Public Hearings

On March 30, 2021, BOEM announced its Notice of Intent to prepare an EIS for the Ocean Wind 1 COP. This purpose of the Notice of Intent was to solicit input on issues and potential alternatives for consideration in the EIS. Throughout the scoping process, federal agencies; state, tribal, and local governments; and the general public had the opportunity to help BOEM determine significant resources and issues, IPFs, reasonable alternatives, and potential mitigation measures to be analyzed in the EIS, as well as provide additional information. BOEM also used the NEPA commenting process to allow for public involvement in the NHPA Section 106 consultation process, as permitted by 36 CFR 800.2(d)(3). Through this notice, BOEM announced its intention to inform its NHPA Section 106 consultation using the NEPA commenting process and invited public comment and input regarding the identification of historic properties or potential effects on historic properties from activities associated with approval of the Ocean Wind 1 COP.

Additionally, BOEM held virtual public scoping meetings, which included specific opportunities for engaging on issues relative to NHPA Section 106 for the undertaking, on April 13, 15, and 20, 2021. Virtual public scoping meeting materials and records are available at https://www.boem.gov/Ocean-Wind-Scoping-Virtual-Meetings.

Through this NEPA scoping process, BOEM received comments related to cultural, historic, archaeological, or tribal resources. These are presented in BOEM's EIS Scoping Report (BOEM 2021) and are summarized as follows:

- Several commenters stated that BOEM should comply with Section 106 of the NHPA including adequate consultation with SHPOs and other stakeholders.
- Several commenters stated that BOEM should recognize tribal sovereignty and provide adequate government-to-government consultation with tribal governments.
- Several commenters opined that the foundations of historic structures (including those in the Ocean City Historic District) are likely to be damaged by excavation for the installation of cables.
- Some commenters expressed concern that the Project might cause physical disturbance to archaeological resources, historic architectural resources, or historic properties.
- One commenter stated that the EIS should consider offshore shipwrecks that are not currently listed in the NRHP but have the potential to be listed.

- One commenter expressed the opinion that information about Project noise in the COP was inadequate and expressed concern about operational and construction noise in the historic district could affect its setting.
- One commenter asked what impact the Project would have on historic structures that rely on a microclimate of cooler air created by the barrier island.

On June 24, 2022, BOEM published a Notice of Availability for the Draft EIS. As part of this process, BOEM announced three virtual public hearings on July 14, 20, and 26, 2022. The public comment period was extended by 15 days and closed on August 23, 2022. The input received via this process has been used to inform preparation of the Final EIS.

N.2.2.3. NHPA Section 106 Consultations

On March 9, 2021, BOEM contacted ACHP and New Jersey SHPO to provide Project information and notify of BOEM's intention to use the NEPA process to fulfill Section 106 obligations in lieu of the procedures set forth in 36 CFR 800.3 through 800.6.

On March 17, 2021, BOEM mailed letters to Absentee-Shawnee Tribe of Indians of Oklahoma, the Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, the Rappahannock Tribe, the Narragansett Indian Tribe, Shawnee Tribe, Stockbridge-Munsee Community Band of Mohican Indians, and the Shinnecock Indian Nation to provide information about the Project, an invitation to be a consulting party to the NHPA Section 106 review of the COP, and the Notice of Intent to prepare an EIS. BOEM also used this correspondence to notify of its intention to use the NEPA substitution process for Section 106 purposes, as described in 36 CFR 800.8(c), during its review. BOEM identified these tribes for outreach based on associations with geographic areas known to be ancestral homelands and thus potentially containing historic properties of religious and cultural significance to them. On March 19, 2021, BOEM contacted Absentee-Shawnee Tribe of Indians of Oklahoma, the Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, the Rappahannock Tribe, the Narragansett Indian Tribe, Shawnee Tribe, Stockbridge-Munsee Community Band of Mohican Indians, and the Shinnecock Indian Nation by email. This correspondence included electronic versions of documents mailed on March 17, 2021. BOEM also notified the tribal governments that the agency found it necessary to delay the formal issuance of the NOI and provided corrections to information in the previously mailed letters, including clarification that the Project website (https://www.boem.gov/ocean-wind at the time of the NOI)[1] would not be active until the day of NOI issuance, and notification that comment deadline would be extended based on the date of NOI issuance and, therefore, would no longer be April 23, 2021.

On March 30, 2021, BOEM corresponded with 205 points of contact from local, state, and federal government agencies and agencies and organizations due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties by mail and email, including information about the project, an invitation to be a consulting party to the NHPA Section 106 review of the COP, and the Notice of Intent to prepare an EIS. BOEM also used this correspondence to notify of its intention to use the NEPA substitution process for Section 106 purposes, as described in 36 CFR 800.8(c), during its review. To aid those consulting parties not familiar with the NEPA substitution process, BOEM developed a *National Environmental Policy Act (NEPA) Substitution for Section 106 Consulting Party Guide* (available at https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/NEPA-Substitution-Consulting-Party-

[1] The Project website has since been updated to https://www.boem.gov/renewable-energy/state-activities/ocean-wind-1.

Guide.pdf), which it attached to this correspondence. This correspondence also included outreach to previously contacted tribes to provide updated information about the Notice of Intent, which had changed subsequent to the March 19, 2021, correspondence. In addition, this correspondence to tribes included an invitation to participate as NEPA cooperating agencies and provided an associated Memorandum of Understanding.

During the period of April 13–16, 2021, outreach was conducted by phone to confirm receipt of correspondence among the governments and organizations that had not responded to the invitation to consult. The list of the governments and organizations contacted is included in Attachment C. Entities that responded to BOEM's invitation or were subsequently made known to BOEM and added as consulting parties are listed in Attachment D.

On May 5, 2021, BOEM invited Absentee-Shawnee Tribe of Indians of Oklahoma, the Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, the Narragansett Indian Tribe, Shawnee Tribe, Stockbridge-Munsee Community Band of Mohican Indians, and the Shinnecock Indian Nation to participate in a government-to-government consultation meeting. The email outreach also notified the tribes that public scoping meeting recordings and materials could be accessed via the virtual meeting website.

On May 17, 2021, BOEM corresponded with tribes who responded to the government-to-government consultation meeting invitation—the Delaware Nation and Delaware Tribe of Indians—to schedule the meeting during a day and time of mutual availability. BOEM followed up the request for scheduling on May 27 and June 1, 2021.

On June 8, 2021, BOEM invited the Delaware Nation and Delaware Tribe of Indians to participate in a government-to-government consultation meeting on Thursday, June 17, 2021, from 10:00 a.m. to 12:30 p.m. Eastern time.

BOEM hosted a government-to-government consultation meeting with the Delaware Nation and Delaware Tribe of Indians on June 17, 2021. During the meeting, BOEM presented information about the Project and solicited input regarding reasonable alternatives for consideration in the EIS; the identification of historic properties or potential effects on historic properties from activities associated with the proposed Project; and potential measures to avoid, minimize, or mitigate impacts on environmental and cultural resources to be analyzed in the EIS.

On July 2, 2021, BOEM distributed a draft meeting summary of the June 17, 2021, government-to-government consultation meeting and requested representatives from the Delaware Nation and Delaware Tribe of Indians provide comment. BOEM provided maps showing the Project, adjacent projects, and excerpts from the COP showing the preliminary APE. BOEM also provided additional information about terrestrial and marine archaeological surveys performed prior to COP submission, and provided BOEM's *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* (BOEM 2020), which provides recommendations to lessees to ensure their cultural resources investigations contain sufficient technical information for BOEM COP reviews. BOEM also offered to facilitate a call among the Delaware Nation and Delaware Tribe of Indians with the New Jersey SHPO to discuss the issue of pre-investigation consultation activities within New Jersey.

On August 5, 2021, BOEM conduced outreach by phone to Absentee-Shawnee Tribe of Indians of Oklahoma, Eastern Shawnee Tribe of Oklahoma, the Narragansett Indian Tribe, Shawnee Tribe, and the Shinnecock Indian Nation.

On August 17, 2021, and September 3, 2021, BOEM reached out via email to Absentee-Shawnee Tribe of Indians of Oklahoma, the Eastern Shawnee Tribe of Oklahoma, the Narragansett Indian Tribe, Shawnee Tribe, and the Shinnecock Indian Nation to remind them of the March 30, 2021, invitations to participate as Section 106 consulting parties or NEPA cooperating agencies and requested their feedback.

In response to a request for Section 106 consulting party status and participation as a sovereign tribal nation in the NEPA cooperating agency review process by the Mashantucket Pequot Indian Tribal Nation, BOEM distributed materials on November 19, 2021, which included presentations provided at the virtual public scoping meetings; the NEPA Substitution for Section 106 Consulting Party Guide; the June 17, 2021, government-to-government consultation meeting agenda and PowerPoint presentation; the Ocean Wind 1 COP Scoping Report; and Ocean Wind 1 Cooperating Agency interagency meeting records. However, in a letter dated November 22, 2021, the Mashantucket Pequot Tribal Nation indicated that they no longer wanted to consult on the Project.

On January 24, 2022, BOEM conducted outreach to New Jersey SHPO to request input regarding options for scheduling the Ocean Wind 1 Section 106 Consultation Meeting #1. Katherine J. Marcopol responded on January 25, 2022, with date and time preferences. The meeting invitation with a meeting agenda was distributed to consulting parties on January 30, 2022.

At the request of consulting parties, BOEM elected to reschedule Ocean Wind 1 Section 106 Consultation Meeting #1. On February 14, 2022, BOEM distributed a Doodle Poll to request input on preferences for the rescheduled meeting date by February 18, 2022. A meeting invitation with virtual meeting participation details was distributed to consulting parties on February 23, 2022.

BOEM distributed correspondence to remind consulting parties of the upcoming consulting parties meeting and share materials including meeting agenda, presentation slides, Section 106 consultation Milestones Schedule and Approximate Dates summary, and Notification of Updates to the Ocean Wind 1 Offshore Wind Farm Project letter on March 3, 2022.

On March 8, 2022, BOEM held virtual NHPA Section 106 Consultation Meeting #1. The presentation included a brief Project overview, review of NEPA Substitution for NHPA Section 106 Process, overview of Section 106 consultation opportunities for the Project, NHPA Section 110(f) compliance requirements, and question and answer session with discussion. On March 31, 2022, BOEM shared with consulting parties a summary of the NHPA Section 106 Consultation Meeting #1 and materials presented at that meeting.

On March 21, 2022, BOEM shared with consulting parties the complete terrestrial archaeological resources report, complete marine archaeological resources report, complete Historic Resources Visual Effects Assessment, and complete Cumulative Historic Resources Visual Effects Analysis. At that time, BOEM also shared with consulting parties a technical memorandum detailing the delineation of the APE for the Project.

On April 1, 2022, BOEM shared with consulting parties a supplemental architectural intensive-level survey report.

On March 28, 2022, and April 4 and 14, 2023, BOEM conducted outreach to consulting parties to request input regarding options for scheduling the Ocean Wind 1 Section 106 Consultation Meeting #2. The meeting invitation with a meeting agenda was distributed to consulting parties on April 26, 2022.

BOEM held virtual NHPA Section 106 Consultation Meeting #2 on May 4, 2022. The presentation included a discussion of the documents distributed for consulting party review, and included a question and answer session with discussion.

BOEM distributed a Notice of Availability to notify the consulting parties that the Draft EIS was available for public review and comment for the period of June 24 to August 8, 2022. BOEM subsequently distributed a notice that the Draft EIS comment period was extended by 15 days to conclude on August 23, 2022.

On October 17, 2022, USACE, Philadelphia District formally accepted BOEM's invitation to be a NEPA Cooperating Agency and acknowledged BOEM as the lead federal agency for Section 106 in writing. USACE was added as a participating Section 106 Consulting Party.

On November 2, 2022, BOEM held a government-to-government consultation meeting with The Shinnecock Indian Nation and the Delaware Tribe of Indians. The Shinnecock Indian Nation was added as a participating Section 106 Consulting Party.

On November 11, 2022, BOEM shared with consulting parties the revised terrestrial archaeological resources report, revised marine archaeological resources report, revised Historic Resources Visual Effects Assessment, revised architectural intensive-level survey report, revised Cumulative Historic Resources Visual Effects Analysis, and revised Appendix N, *Finding of Adverse Effect for the Ocean Wind 1 Construction and Operations Plan*, with attachments including the draft Memorandum of Agreement. BOEM also distributed a consulting parties comments response matrix, which itemizes consultation comments received from consulting parties on documents distributed by BOEM on March 21 and April 1, 2022, and provides BOEM's responses to those comments.

On November 18, 2022, BOEM distributed additional consultation invitations to property owners associated with adversely affected properties who had not previously accepted consulting party status including Legacy Vacation Resorts (Brigantine Hotel), New Jersey Casino Reinvestment Development Authority (Atlantic City Convention Hall), Ritz Condominium Association (Ritz-Carlton Hotel), Max Gurwicz Enterprises (Riviera Apartments), Vassar Square Condominium Association (Vassar Square Condominiums), private homeowners of 114 South Harvard Avenue, and The Save Lucy Committee, Inc. (Lucy the Margate Elephant).

On November 7, 2022, BOEM conducted outreach to consulting parties to request input regarding options for scheduling the Ocean Wind 1 Section 106 Consultation Meeting #3 by November 11, 2022. The meeting invitation with a meeting agenda was distributed to consulting parties on November 16, 2022.

BOEM held virtual NHPA Section 106 Consultation Meeting #3 on November 30, 2022. The presentation included a discussion of revised technical reports for historic properties identification and effects assessment, including the marine archaeological resources assessment, terrestrial archaeological resources assessment, Historic Resources Visual Effects Assessment, and Cumulative Historic Resources Visual Effects Analysis. The meeting also included review of the revised finding of effect, review of the draft Memorandum of Agreement, and included a question-and-answer session with discussion.

On February 2, 2023, BOEM distributed additional consultation invitations to property owners associated with adversely affected properties who had not previously accepted consulting party status including The Inlet Public/Private Association (Absecon Lighthouse), Long Port Historical Society (Great Egg Coast Guard Station), Flanders Condominium Association (Flanders Hotel), North Wildwood (Hereford Inlet Lighthouse), New Jersey Division of Law & Public Safety, Marine Service Bureau (North Wildwood Lifesaving Station), Stone Harbor Museum (U.S. Lifesaving Station #35), and Rutgers University, School of Environmental and Biological Sciences (Little Egg Harbor U.S. Lifesaving Station #23).

On February 3, 2023, BOEM shared with consulting parties the revised marine archaeological resources assessment, Historic Resources Visual Effects Assessment, Cumulative Historic Resources Visual Effects

Analysis, finding of effect, draft Memorandum of Agreement, and updated Ocean Wind 1 COP Volume I, Volume II, Volume III Appendix L, and Volume III Appendix AD. BOEM also distributed a consulting parties comments response matrix, which itemizes consultation comments received from consulting parties on documents distributed by BOEM.

On February 15, 2023, BOEM distributed additional consultation invitations to New Jersey Office of Historic Sites and Parks as property owners associated with adversely affected Absecon Lighthouse.

On January 19, 2023, BOEM conducted outreach to consulting parties to request input regarding options for scheduling the Ocean Wind 1 Section 106 Consultation Meeting #4. That meeting was originally scheduled for February 10, 2022.

At the request of consulting parties, BOEM elected to reschedule Ocean Wind 1 Section 106 Consultation Meeting #4. On February 7, 2023, BOEM distributed a Doodle Poll to request input on preferences for the rescheduled meeting date by February 10, 2023. A meeting invitation with virtual meeting participation details and meeting materials was distributed to consulting parties on February 15, 2023.

BOEM held virtual NHPA Section 106 Consultation Meeting #4 on February 22, 2023. The presentation included a review of the Section 106 consultation schedule; discussion of BOEM's response to consulting party comments; review of the revised marine archaeological resources assessment, revised Cumulative Historic Resources Visual Effects Analysis, finding of effect, and draft Memorandum of Agreement; and included a question and answer session with discussion.

Given New Jersey SHPO was unable to participate in NHPA Section 106 Consultation Meeting #4, BOEM held a virtual meeting with New Jersey SHPO on February 24, 2023, to brief them and receive input on topics discussed during the consultation meeting on February 22, 2023.

Given Delaware Tribe of Indians was unable to participate in NHPA Section 106 Consultation Meeting #4, BOEM held virtual meetings with Delaware Tribe of Indians on March 20, 2023, and April 3, 2023, to brief them and receive input on topics discussed during the consultation meeting on February 22, 2023. The Stockbridge-Munsee Community Band of Mohican Indians also joined the April 3, 2023, meeting.

On March 20, 2023, BOEM held a virtual meeting with Rutala Associates, LLC, representative for the City of Margate and the Save Lucy Committee, Inc., the respective owner and manager of the Lucy the Margate Elephant property, to brief them on the Project and receive input on BOEM's determination of adverse effect on Lucy the Margate Elephant and BOEM's proposed mitigation for the property.

On March 28, 2023, BOEM distributed additional consultation invitations to property owners associated with adversely affected properties who had not previously accepted consulting party status including Legacy Vacation Resorts (Brigantine Hotel); New NJDEP, Office of Historic Sites & Parks (Absecon Lighthouse); Atlantic City (Atlantic City Boardwalk); New Jersey Casino Reinvestment Development Authority (Atlantic City Convention Hall); Max Gurwicz Enterprises (Riviera Apartments); Donald & June Feith (House at 114 South Harvard Avenue); Longport Historical Society (Great Egg Harbor Lighthouse); Flanders Condominium Association (Flanders Hotel); New Jersey Department of Law & Public Safety, Marine Service Bureau (North Wildwood Lifesaving Station); and Stone Harbor Museum (U.S. Lifesaving Station #35). In addition to consultation invitations, BOEM requested individual meetings with these property owners to discuss BOEM's proposed mitigation for their respective property.

On March 28, 2023, BOEM also distributed meeting requests to property owners associated with adversely affected properties who are participating in consultation to discuss Ocean Wind's proposed mitigation for their respective property including Ritz Condominium Association (Ritz-Carlton Hotel);

Vassar Square Condominium Association (Vassar Square Condominiums); Rutala Associates, LLC (Lucy the Margate Elephant); USCG (Great Egg Harbor Lighthouse and Hereford Inlet Lighthouse); Ocean City (Ocean City Boardwalk and Ocean City Music Pier); Flanders Condominium Association (Flanders Hotel); Michael J. Donohue, Blaney Donohue & Weinberg, P.C., representing City of North Wildwood (Hereford Inlet Lighthouse); and University of Rutgers, Department of Marine and Coastal Sciences, School of Environmental and Biological Sciences (Little Egg Harbor U.S. Lifesaving Station #23).

On March 30, 2023, New Jersey SHPO concurred with BOEM's Finding of Effect for the Project, including for the 17 historic properties in the visual APE and 13 ancient submerged landforms in the marine APE.

On April 10, 2023, BOEM held a virtual meeting with the Flanders Condominium Association to brief them on the Project and receive input on BOEM's determination of adverse effect on the Flanders Condominium t and BOEM's proposed mitigation for the property.

On April 17, 2023, BOEM held a virtual meeting with the property owner for 114 South Harvard Avenue to brief them on the Project and receive input on BOEM's determination of adverse effect on their property and BOEM's proposed mitigation for the property.

BOEM held virtual NHPA Section 106 Consultation Meeting #5 on April 24, 2023. The presentation included a review of the Section 106 consultation schedule, discussion of BOEM's response to consulting party comments, and review of March 2023 historic property and terrestrial archaeological resources surveys and draft Memorandum of Agreement; and included a question-and-answer session with discussion.

Additional consultation meetings may be scheduled prior to issuance of the ROD if further consultation is needed to resolve adverse effects via a Memorandum of Agreement. Additional consultation will occur if alternatives that required phased identification (see Section N.5) are selected.

N.3. Application of the Criteria of Adverse Effect

The Criteria of Adverse Effect under NHPA Section 106 (36 CFR 800.5(a)(1)) states that an undertaking has an adverse effect on a historic property

> when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association…Adverse Effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

According to the Section 106 regulations, adverse effects on historic properties include, but are not limited to (36 CFR 800.5(a)(2)):

i. Physical destruction of or damage to all or part of the property;

ii. Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary of the Interior's standards for the treatment of historic properties (36 CFR part 68) and applicable guidelines;

iii. Removal of the property from its historic location;

iv. Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;

v. Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;

vi. Neglect of a property, which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and

vii. Transfer, lease, or sale of property out of federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

N.3.1 Assessment of Effects on Historic Properties

This section documents assessment of effects for the affected historic properties in the marine APE, terrestrial APE, and visual APE.

N.3.1.1. Assessment of Effects on Historic Properties in the Marine APE

This section assesses effects on shipwrecks, potential shipwrecks, and ancient submerged landforms in the marine APE. Based on the information presented below, BOEM finds the Project would result in no adverse effects on the 19 known submerged archaeological resources and adverse effects on 13 of the 16 ancient submerged landforms. More substantial impacts could occur if the final Project design cannot avoid known resources or if previously undiscovered resources are discovered during construction.

N.3.1.1.1 Shipwrecks and Potential Shipwrecks

Marine remote-sensing studies within the marine APE identified a total of 19 submerged cultural resources, the majority of which are either known shipwrecks (Targets 1, 9, 12–14, 17, 18) or potential shipwrecks (Targets 2–8, 10, 11, 15, 16, 19) from the Historic period (COP Volume III, Appendix F-1, pages 168–169; Ocean Wind 2023). All 19 submerged cultural resources would be avoided, with 50-meter avoidance buffers, by all Project activities that are part of the undertaking. As a result, the Project is not anticipated to result in adverse effects on these 19 resources.

N.3.1.1.2 Ancient Submerged Landforms

Marine geophysical remote-sensing studies performed in the marine APE identified 16 ancient submerged landforms with the potential to contain Native American archaeological resources within the Lease Area and two export cable route corridors. Remnant submerged landscape features are considered by Native American tribes in the region to be culturally significant resources as the lands where their ancestors lived and as locations where events described in tribal histories occurred prior to inundation. In addition, BOEM recognizes these ancient submerged landforms are similar to features previously determined to be TCPs and presumed to be eligible for listing in the NRHP under Criterion A.

Ancient submerged landforms in the marine APE are considered archaeologically sensitive. Although the marine geophysical remote-sensing studies performed to identify historic properties did not find direct evidence of pre-contact Native American cultural materials, they do represent a good-faith effort to identify submerged historic properties within the APE potentially affected by the undertaking, as defined at 36 CFR 800.4. If undiscovered archaeological resources are present within the identified ancient submerged landforms and they retain sufficient integrity, these resources could be eligible for listing on the NRHP under Criterion D (COP Volume III, Appendix F-1; Ocean Wind 2023).

Due to the size of the offshore remote-sensing survey areas in the marine APE, the full extent or size of individual ancient submerged landforms cannot be defined. Thirteen ancient submerged landforms (Targets 21–26, 28–31, and 33–35) within the Lease Area cannot be avoided by the Project, as WTGs and associated work zones are proposed for locations within the defined areas of these resources. The Project commits to avoiding impacts on three ancient submerged landforms (Targets 20, 27, and 32), all within the Lease Area. As such, the undertaking would result in adverse effects on 13 ancient submerged landforms due to potential permanent, physical destruction of or damage to areas within the defined location of the resources.

N.3.1.2. Assessment of Effects on Historic Properties in the Terrestrial APE

Archaeological survey performed within the terrestrial APE identified six archaeological sites. Two are expansions of previously reported sites, one is an adjacent previously reported site for which additional data are lacking, and three are newly reported. All six archaeological sites would be avoided by all Project activities that are part of the undertaking. Therefore, BOEM finds no adverse effect on historic properties in the terrestrial APE (COP Volume III, Appendix F-2; page 221; Ocean Wind 2023).

Furthermore, an Terrestrial Archaeological Monitoring Plan has been developed (see Attachment A, *Memorandum of Agreement*, Attachment 5, *Terrestrial Archaeological Monitoring Plan*). The plan outlines terrestrial archaeological monitoring protocols, goals for construction crew training, expectations for documentation, requirements for archaeological and tribal monitors, temporary avoidance measures, process for determining if monitoring construction activity is necessary, reporting requirements, post-review discoveries, notifications contact list, and attachments including maps to identify areas where monitoring is required and areas for avoidance.

N.3.1.3. Assessment of Effects on Historic Properties in the Visual APE

Review of the offshore visual area identified 9 historic districts and 40 individual historic properties, and review of the onshore visual area identified three historic properties. Of these, 17 historic properties would be adversely affected by visual impacts from the proposed Project (COP Volume III, Appendix F-3; Ocean Wind 2023). The 17 adversely affected historic properties within the visual APE are those that retain maritime setting, and where maritime setting contributes to the properties' NRHP eligibility. Each property continues to offer significant seaward views that support the integrity of its maritime setting. Those seaward views include vantage points with the potential for an open view from each property toward the offshore Project elements. BOEM's analysis considers potential for visual adverse effects from the ADLS-controlled obstruction lighting system at night. Based on historical air traffic data obtained from FAA, the total duration that an ADLS-controlled lighting system for the Project would have been activated is 1 hour 19 minutes and 17 seconds over a 1-year period (COP Volume III, Appendix AD; Ocean Wind 2023). Given the ADLS is triggered so infrequently, this source of nighttime lighting is not contributing to visual adverse effects on historic properties. However, other temporary nighttime lighting from construction would contribute to visual adverse effects for the 17 properties.

Where BOEM found adverse visual effects on these historic properties, BOEM also determined that the undertaking would cause cumulative visual effects (BOEM 2022). Cumulative effects are additive effects; where BOEM has determined adverse effects would occur from Project actions on historic properties, BOEM then assessed if those effects would add to the potential adverse effects of other reasonably foreseeable actions and thereby result in cumulative effects.

N.3.1.3.1 Brigantine Hotel, Brigantine City, New Jersey

This property is at 1400 Ocean Avenue in Brigantine City and is approximately 16.0 miles from the Wind Farm Area. It consists of an 11-story Art-Deco-inspired hotel constructed in 1926–1927. It was surveyed for the Project in January 2021 and recommended eligible for individual listing in the NRHP under Criterion A for Ethnic Heritage: Black, due to its associations with prominent African American figures and its role in integrating the Jersey Shore. While it may have held significance under Criterion C as an example of an Art Deco low-rise hotel, it is no longer able to convey that potential significance due to diminished integrity of design, materials, and workmanship (COP Volume III, Appendix F-3, page 50; Ocean Wind 2023).

This property is directly on the beach, ocean views were an important consideration in the building's design and siting, and the property retains clear views of the ocean into the present. Although the Project would not affect the building's integrity of location, design, materials, and workmanship, both ground-level and above-ground-level views may be affected by the presence of the Project on the horizon. Because seascape views are considered a character-defining feature of the property because it represents a recreational property type associated with tourist activity in New Jersey, which heightens the importance of its setting, in particular those of sea views within the setting, the Project "may affect significant character-defining features of the property or may diminish one or more aspects of integrity," and a Potential for Adverse Effect finding is therefore recommended (COP Volume III, Appendix F-3, page 50; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the Brigantine Hotel is 16.3 miles from the nearest WTG associated with the Project and 9.2 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from the Brigantine Hotel is 561 WTGs. Of these, 98 theoretically visible WTGs (18 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Brigantine Hotel when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.2 Absecon Lighthouse, Atlantic City, Atlantic County

This property is at the intersection of Pacific Avenue and Rhode Island Avenue in Atlantic City and is approximately 15.3 miles from the Wind Farm Area. Constructed in 1856, the lighthouse originally marked the inlet between Absecon and Brigantine Islands, although that channel has since shifted northward. The Absecon Lighthouse consists of a 171-foot-tall iron and brick tower that tapers from a diameter of 27 feet at its base to 13 feet, 7.5 inches at the lantern. A catwalk at a storage level just below the lens provided lightkeepers with views of the Absecon Inlet. Original secondary structures included a keeper's house, assistant keeper's house, and oil house, now all demolished. The building was surveyed in January 2021 and was individually listed in the NRHP in 1970. Absecon Lighthouse is significant for navigational history (Criterion A) and architecture (Criterion C) but does not include additional information regarding historic integrity (COP Volume III, Appendix F-3, page 51; Ocean Wind 2023).

While sea views are not listed as a character-defining feature of the property, the resource type and height were identified as characteristics of the historic property and, due to the property type, sea views may be character-defining features. The Project would not be visible at ground level, as the ocean is completely screened by intervening development. However, the Project would be partially visible from the lighthouse's lantern, with the southern half of the Wind Farm Area screened by Ocean Resort and Casino tower (built circa 2010) and the northern half of the Wind Farm Area visible. A finding of No Adverse Effect was recommended for the Absecon Lighthouse, as its integrity has been diminished by the loss of its secondary structures and the property's complete surrounding by modern development, and given views of the Project are limited only to partial views from the lantern. However, through consultation BOEM determined that the Project would result in an Adverse Effect on Absecon Lighthouse (COP Volume III, Appendix F-3, pages 53–54; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the Absecon Lighthouse is 15.6 miles from the nearest WTG associated with the Project and 9.0 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from Absecon Lighthouse is 618 WTGs. Of these, 98 theoretically visible WTGs (16 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Absecon Lighthouse when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.3 Atlantic City Boardwalk, Atlantic City, New Jersey

This property is along the oceanfront between South New Jersey and South Georgia Avenue in Atlantic City and is approximately 15.3 miles from the Wind Farm Area. The first iteration of the Atlantic City Boardwalk was constructed in 1870, with a seasonal structure built between South Massachusetts Avenue and what is now Columbia Place (between South Mississippi and Missouri Avenues). A widened but still seasonal boardwalk was constructed in 1880. A permanent structure was constructed in 1884 with electric lighting, which was replaced in 1890 due to hurricane damage and replaced again by a steel-braced boardwalk in 1898. Several piers were added in the 1890s, including Playground Pier, Central Pier, and Steel Pier. The Atlantic City Boardwalk was identified as a potential historic property in 1978, with New Jersey SHPO data indicating a boundary extending from the Atlantic City Convention Hall (South Georgia Avenue) to just northeast of South New Jersey Avenue. New Jersey SHPO data indicate the property's potential significance is associated with the commercial and recreation-related growth of Atlantic City (Criterion A) (COP Volume III, Appendix F-3, page 55; Ocean Wind 2023).

This property is directly on the oceanfront, ocean views were an important consideration in the structure's design and siting and influenced in the construction of commercial and recreational properties along the seashore. The property retains clear views of the ocean into the present. Although the Project would not affect the building's integrity of location, design, materials, and workmanship, ground-level views may be affected by the presence of the Project on the horizon. Because seascape views are considered a character-defining feature of the property, the Project "may affect significant character-defining features of the property or may diminish one or more aspects of integrity," and a Potential for Adverse Effect finding is therefore recommended (COP Volume III, Appendix F-3, page 56; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the Atlantic City Boardwalk is 15.2 miles from the nearest WTG associated with the Project and 8.8 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from Atlantic City Boardwalk is 561 WTGs. Of these, 98 theoretically visible WTGs (18 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Atlantic City Boardwalk when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.4 Atlantic City Convention Hall, Atlantic City, New Jersey

This property is at 2301 Boardwalk in Atlantic City and is approximately 15.5 miles from the Wind Farm Area. Constructed in 1929, the building consists of a massive barrel-roofed auditorium behind the two-story entrance loggia and a one-story curved limestone exedra (arcade) along the Boardwalk. It was surveyed for the Project in January 2021 and was individually listed in the NRHP in 1987 and designated an NHL in 1987. The property is listed in the NRHP under Criterion A as a recreational venue that hosted concerts, pageants, and sporting and political events. The property is also an NHL-designated property (COP Volume III, Appendix F-3, pages 63–64; Ocean Wind 2023).

This property is directly on the Atlantic City Boardwalk, ocean views were an important consideration in the building's design and siting, and the property retains ocean views from its interior at its ground floor entrances, screened partially by the exedra, and from the second-floor ballroom. Although the Project would not affect the building's integrity of location, design, materials, and workmanship, both ground-level and above-ground-level views may be affected by the presence of the Project on the horizon. Because seascape views are considered a character-defining feature of the property, the Project "may affect significant character-defining features of the property or may diminish one or more aspects of integrity," and a Potential for Adverse Effect finding is therefore recommended (COP Volume III, Appendix F-3, page 63; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind Offshore Wind Farm Project*, the Atlantic City Convention Hall is 15.5 miles from the nearest WTG associated with the Project and 9.2 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from Atlantic City Convention Hall is 561 WTGs. Of these, 98 theoretically visible WTGs (18 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Atlantic City Convention Hall when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.5 Ritz-Carlton Hotel, Atlantic City, New Jersey

This property is at 2715 Boardwalk in Atlantic City and is approximately 15.3 miles from the Wind Farm Area. It consists of a five-story hotel, designed by Philadelphia's Horace Trumbauer in association with New York-based Warren and Wetmore and constructed in 1921, that has been converted to a condominium building. It was surveyed for the Project in January 2021 and recommended eligible for individual listing in the NRHP under Criterion A for Commerce as an urban hotel on the seashore and Criterion C for Architecture for Trumbauer's design, which maximized rooms with northeast and southwest sea views (COP Volume III, Appendix F-3, page 66; Ocean Wind 2023).

This property is directly on the Atlantic City Boardwalk, ocean views were an important consideration in the building's design and siting, and the property retains clear views of the ocean into the present, although architectural elements oriented toward the Wind Farm Area have been subject to modification, most notably at the mezzanine level on the exterior, where a redesign with replacement materials creates a solid screen in front of double-height arched windows. Although the Project would not affect the building's integrity of location, design, materials, and workmanship, both ground-level and above-ground-level views may be affected by the presence of the Project on the horizon. Because seascape views are considered a character-defining feature of the property, the Project "may affect significant character-defining features of the property or may diminish one or more aspects of integrity," and a Potential for Adverse Effect finding is therefore recommended (COP Volume III, Appendix F-3, pages 66–67; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the Ritz-Carlton Hotel is 15.5 miles from the nearest WTG associated with the Project and 9.3 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from the Ritz-Carlton Hotel is 561 WTGs. Of these, 98 theoretically visible WTGs (18 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Ritz-Carlton Hotel when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.6 Riviera Apartments, Atlantic City, New Jersey

This property is at 116 South Raleigh Avenue in Atlantic City and is approximately 15.6 miles from the Wind Farm Area. It consists of a nine-story apartment building constructed in 1930. It was surveyed for the Project in January 2021 and recommended eligible for individual listing in the NRHP under Criterion C for its Spanish-influenced Art Deco architectural style (COP Volume III, Appendix F-3, page 68; Ocean Wind 2023).

This property is directly on the Atlantic City Boardwalk, ocean views were an important consideration in the building's design and siting, and the property retains clear views of the ocean into the present. Although the Project would not affect the building's integrity of location, design, materials, and workmanship, both ground-level and above-ground-level views may be affected by the presence of the Project on the horizon. Because seascape views are considered a character-defining feature of the property, the Project "may affect significant character-defining features of the property or may diminish one or more aspects of integrity," and a Potential for Adverse Effect finding is therefore recommended (COP Volume III, Appendix F-3, page 69; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the Riviera Apartments are 15.6 miles from the nearest WTG associated with the Project and 8.8 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from Riviera Apartments is 561 WTGs. Of these, 98 theoretically visible WTGs (18 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Riviera Apartments when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.7 Vassar Square Condominiums, Ventnor City, New Jersey

This property is at 116 South Vassar Square in Ventnor City and is approximately 16 miles from the Wind Farm Area. It consists of a 21-story building constructed in 1969. The building was surveyed in January 2021 and recommended individually eligible for the NRHP under Criterion C as a good example of mid-century high-rise design that embodies the New Formalist architectural style (COP Volume III, Appendix F-3, page 72; Ocean Wind 2023).

The Vassar Square Condominiums building is directly on the Atlantic City Boardwalk, the building was designed to maximize ocean view for residents, and the property continues to have clear open views of the seascape. Although the Project would not affect the building's integrity of location, design, materials, and workmanship, ground-level and above-ground-level views may be affected by the presence of the Project on the horizon. Because seascape views were an important consideration in the building's design, the Project "may alter a characteristic of the property that qualifies it for NRHP-eligibility," and a Potential for Adverse Effect finding is therefore recommended (COP Volume III, Appendix F-3, page 74; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the Vassar Square Condominiums are 15.6 miles from the nearest WTG associated with the Project and 9.7 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from Vassar Square

Condominiums is 561 WTGs. Of these, 98 theoretically visible WTGs (18 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Vassar Square Condominiums when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.8 House at 114 South Harvard Avenue, Ventnor City, New Jersey

This property is approximately 15.7 miles from the Wind Farm Area. It consists of a 2.5-story French Eclectic style residence constructed in 1925. The building was surveyed in January 2021 and recommended eligible for individual listing in the NRHP under Criterion C as a good example of early 20th century beachfront housing (COP Volume III, Appendix F-3, page 81; Ocean Wind 2023).

The viewshed of this property features views of the seascape with limited visual obstructions. As a result, the Project is anticipated to be visible on the horizon. Although the building does not face the water, ocean views seem to have been an important consideration to its design. The Project would not affect the building's integrity of location, design, materials, and workmanship; however, integrity of setting, feeling, and association may be affected by the Project. Because seascape views were an important consideration in the building's design, the Project "may alter a characteristic of the property that qualifies it for NRHP-eligibility," and a Potential for Adverse Effect finding was therefore recommended (COP Volume III, Appendix F-3, page 82; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the house at 114 South Harvard Avenue is 15.7 miles from the nearest WTG associated with the Project and 9.9 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from the house at 114 Harvard Avenue is 561 WTGs. Of these, 98 theoretically visible WTGs (18 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the house at 114 South Harvard Avenue when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.9 Lucy the Margate Elephant, Margate City, New Jersey

This property is at 9200 Atlantic Avenue in Margate City and is approximately 15.3 miles from the Wind Farm Area. Lucy the Margate Elephant, originally known as Elephant Bazaar, was built in 1881 to promote real estate development in what is now Margate City. It consists of a six-story, elephant-shaped building. Alterations to the property include the partitioning of the domed interior space in 1902 and replacement of the original howdah (canopied seat) after it was destroyed in a storm in 1928. In 1970, the building was moved a few blocks from its original location to its current location. The building was surveyed in January 2021 and was individually listed in the NRHP in 1971 and designated an NHL in 1976. Lucy's significance as an architectural folly and sculpture, while not specified in its NRHP nomination, likely falls under Criteria A and C (COP Volume III, Appendix F-3; pages 83–84; Ocean Wind 2023).

This property is situated between Atlantic Avenue and the oceanfront and continues to have open views of the ocean from its upper levels, including the Project area; ground-level ocean views from the property have been partially screened by infill. Views of the seascape and beachfront were important considerations of the building's design and purpose as a tourist attraction that represents the vision of a late nineteenth-century entrepreneur for seaside development that continued through the 20th century, a vision reflected in Margate's growth all around the building. Although the Project would not affect the building's integrity of location, design, materials, and workmanship, it could affect its integrity of setting, feeling, and association. Therefore, a Potential for Adverse Effect finding was recommended (COP Volume III, Appendix F-3, pages 84–85; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, Lucy the Margate Elephant is 16.0 miles from the nearest WTG associated with the Project and 10.8 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from Lucy the Margate Elephant is 561 WTGs. Of these, 98 theoretically visible WTGs (18 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on Lucy the Margate Elephant when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.10 Great Egg Coast Guard Station, Longport Borough, Atlantic County

This property is at 2301 Atlantic Avenue in Longport Borough and is approximately 15.2 miles from the Wind Farm Area. Constructed in 1938 to replace an 1888 lifesaving station at the same site, the Great Egg Coast Guard Station is an example of the 1934 Roosevelt Design for Coast Guard stations. The main massing of building is two and a half stories with a central three-story tower, with a stylistic overlay of Colonial Revival features such as a symmetrical fenestration, dormers, and front porch with Doric columns topped with a balustrade. The building was surveyed in January 2021 and was individually listed in the NRHP in 2005. Great Egg Coast Guard Station is listed under Criterion C as an example of the 1934 Roosevelt Design for Coast Guard stations (COP Volume III, Appendix F-3, pages 86–87; Ocean Wind 2023).

This property is one and a half blocks (approximately 0.14 mile) from the ocean front, with intervening development ranging from one to three stories. Due its location and intervening development, the Wind Farm Area would not be visible at ground level. However, the Wind Farm Area would be partially visible from the station's tower, although it is approximately the same height as other two and a half- to three-story buildings between the property and the ocean. The U.S. Government Lifesaving Stations, Houses of Refuge, and pre-1950 U.S. Coast Guard Lifeboat Stations Multiple-Property Documentation Form advises that a station's relationship to the shoreline and ocean views may be important for evaluating a lifesaving station's setting. A finding of No Adverse Effect was recommended for the Great Egg Coast Guard Station because its integrity will not be affected, as views of the Wind Farm Area are limited and therefore do not qualify as a substantial alteration of the property's setting. However, through consultation BOEM determined that the Project would result in an Adverse Effect on Absecon Lighthouse (COP Volume III, Appendix F-3, pages 53–54; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the Great Egg Coast Guard Station is 16.1 miles from the nearest WTG associated with the Project and 10.9 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from Great Egg Coast Guard Station is 592 WTGs. Of these, 98 theoretically visible WTGs (17 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Great Egg Coast Guard Station when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.11 Ocean City Boardwalk, Ocean City, New Jersey

This property is along the oceanfront between East 6th Street and East 14th Street in Ocean City and is approximately 15.0 miles from the Wind Farm Area. The first iteration of the Ocean City Boardwalk was constructed in 1880, with a seasonal structure built between 2nd Street to 4th Street and West Avenue. The

Boardwalk was expanded to in 1885, extending to a amusement pavilion at 11th Street. The Boardwalk was reconstructed in 1928 following a fire that destroyed the original structure the year before. The 1928 boardwalk was built on a concrete foundation, with some portions of the structure reconstructed after the Ash Wednesday Storm in 1962 and other portions of the structure's 1928 concrete foundation reconstructed with wood in the 2000s. Due to local ordinance restrictions on oceanfront construction east of the Boardwalk, only the Ocean City Music Pier stands on the ocean side of the structure. For the purposes of the Project's Section 106 compliance, the Ocean City Boardwalk was treated as eligible for the NRHP under Criterion A as a result of the survey undertaken for the Project, with a boundary extending from East 6th Street to East 14th Street, reflecting the concentration of commercial development along its length (COP Volume III, Appendix F-3, pages 98–99; Ocean Wind 2023).

This property is directly on the beach, and ocean views were an important consideration in the structure's design and siting and influenced the construction of commercial and recreational properties along the seashore. The property retains clear views of the ocean into the present. Although the Project would not affect the building's integrity of location, design, materials, and workmanship, ground-level views may be affected by the presence of the Project on the horizon. Because seascape views are considered a character-defining feature of the property, the Project "may affect significant character-defining features of the property or may diminish one or more aspects of integrity," and a Potential for Adverse Effect finding is therefore recommended (COP Volume III, Appendix F-3, page 56; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the Ocean City Boardwalk is 15.6 miles from the nearest WTG associated with the Project and 10.9 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from Ocean City Boardwalk is 581 WTGs. Of these, 98 theoretically visible WTGs (17 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Ocean City Boardwalk when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.12 Ocean City Music Pier, Ocean City, New Jersey

This property is at 811 Boardwalk in Ocean City and is approximately 15.0 miles from the Wind Farm Area. The property consists of a multi-story Mediterranean Revival-style building constructed in 1928. According to New Jersey SHPO records, the building was determined to be eligible for individual listing in the NRHP under Criteria A and C in 1990. Although these records do not explain under which significance criteria the property is eligible, a subsequent review determined that it was likely eligible under Criterion A for its prominent role as an entertainment venue on the Ocean City Boardwalk and under Criterion C for being a good example of the Mediterranean Revival style (COP Volume III, Appendix F-3, page 102; Ocean Wind 2023).

This property is on the Ocean City Boardwalk, is situated between the boardwalk and the oceanfront, and continues to have open views of the ocean, including the Project area. Views of the seascape and beachfront were important considerations of the building's design. Although the Project would not affect the building's integrity of location, design, materials, and workmanship, it could affect its integrity of setting, feeling, and association. Therefore, a Potential for Adverse Effect finding was recommended (COP Volume III, Appendix F-3, page 103; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the Ocean City Music Pier is 15.6 miles from the nearest WTG associated with the Project and 11.0 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from Ocean City Music Pier is 581 WTGs. Of these, 98 theoretically visible WTGs (17 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Ocean City Music Pier when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.13 The Flanders Hotel, Ocean City, Cape May County

This property is at 719 East 11th Street in Ocean City and is approximately 15.0 miles from the Wind Farm Area. The Flanders Hotel, built in 1923, consists of a nine-story U-shaped Spanish-Colonial Revival style hotel, a two-story commercial and solarium annex, a pool, and a parking lot. The hotel's eighth-story terrace on the north wing was enclosed in 1960 and the original three saltwater pools adjacent to the solarium on the building's east side were removed in 1978. A two-story addition was constructed on the hotel's south wing in the 1990s. The Flanders Hotel was surveyed in January 2021 and was individually listed in the NRHP in 2005. The property is listed under Criterion A in the areas of Entertainment and Recreation and Community Planning and Development for its historical development as a seaside resort and under Criterion C for its Spanish-Colonial Revival style design (COP Volume III, Appendix F-3, pages 104–106; Ocean Wind 2023).

This property is a half-block removed from the Ocean City Boardwalk. The property continues to have open views of the ocean from the guest rooms on the upper floors of the building. However, alterations and additions have limited or blocked views of the ocean from original spaces such as the eighth-story terrace, tower at the southeast corner of the building, and guest rooms on lower-level floors of the south wing. Furthermore, the adjacent development of the amusement park Playland's Castaway Cove partially screens ocean views from the property on its north and east sides. As the historic spaces designed to provide expansive ocean views have been altered themselves, or have had these views limited by new construction at and in the vicinity of the property, a Finding of No Adverse Effect was recommended for the Flanders Hotel. However, through consultation BOEM determined that the Project would result in an Adverse Effect on the Flanders Hotel (COP Volume III, Appendix F-3, pages 104–107; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the Flanders Hotel is 15.8 miles from the nearest WTG associated with the Project and 11.3 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from the Flanders Hotel is 662 WTGs. Of these, 98 theoretically visible WTGs (15 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Flanders Hotel when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.14 Hereford Inlet Lighthouse, North Wildwood, Cape May County

This property is at 113 North Central Avenue in North Wildwood and is approximately 23.4 miles from the Wind Farm Area. Constructed in 1874 and relocated in the early twentieth century, the Hereford Inlet Lighthouse originally marked the Hereford Inlet between North Wildwood and Stone Harbor, 150 feet to the west of the building's present site. The building consists of one- and two-story masses surrounding a central four-story tower. USCG automated the lighthouse in 1964 and has since converted it to a museum. The Hereford Inlet Lighthouse was listed in the NRHP in 1977. The property is listed under Criterion A in the area of Commerce for its role as a navigational aid of the Hereford Inlet, an important waterway for local commerce, and under Criterion A for its design (COP Volume III, Appendix F-3, page 119; Ocean Wind 2023).

The property is situated near the ocean front, with a tidal flat between the property and the ocean. The Project would not be visible at ground level, as the southern half of the Wind Farm Area would be obscured by intervening development. However, the Wind Farm Area would be visible from the lighthouse's lantern. A finding of No Adverse Effect was recommended for the Hereford Inlet Lighthouse, as its integrity has been diminished by its relocation and the introduction of modern development in the vicinity of the property. However, through consultation BOEM determined that the Project would result in an Adverse Effect on Hereford Inlet Lighthouse (COP Volume III, Appendix F-3, pages 53–54; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the Hereford Inlet Lighthouse is 23.6 miles from the nearest WTG associated with the Project and 15.9 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from Hereford Inlet Lighthouse is 549 WTGs. Of these, 98 theoretically visible WTGs (18 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Hereford Inlet Lighthouse when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.15 North Wildwood Lifesaving Station, North Wildwood, Cape May County

This property is at 113 North Central Avenue in North Wildwood and is approximately 23.4 miles from the Wind Farm Area. Constructed in 1938 to replace an 1888 lifesaving station at the same site, the North Wildwood Lifesaving Station is an example of the 1934 Roosevelt Design for Coast Guard stations. The main massing of building is two and a half stories with a central three-story tower, with a stylistic overlay of Colonial Revival features such as a symmetrical fenestration, dormers, and front porch with Doric columns topped with a balustrade. While New Jersey SHPO records do not include information on the building's significance, it is likely significant under Criterion A for Maritime History and under Criterion C as an example of the 1934 Roosevelt Design for Coast Guard stations. The building was surveyed in January 2021 and for the purposes of the Project's Section 106 compliance, and was treated as eligible for the NRHP under Criteria A and C (COP Volume III, Appendix F-3, page 116; Ocean Wind 2023).

The property is situated near the ocean front, with a tidal flat between the property and the ocean. The Project would be minimally visible at ground level, as the southern half of the Wind Farm Area would be partially obscured by intervening development. However, this half of the Wind Farm Area would be visible from the lifesaving station's tower. A finding of No Adverse Effect was recommended for the North Wildwood Lifesaving Station because its tower was a consequence of its architectural design, rather than its historic function as before and immediately after World War II manned lookouts were replaced automated technologies and administrative nature of stations replaced lookout functions. Furthermore, its integrity would not be affected, as views of the Wind Farm Area would be limited and therefore do not qualify as a substantial alteration of the property's setting. However, through consultation BOEM determined that the Project would result in an Adverse Effect on North Wildwood Lifesaving Station (COP Volume III, Appendix F-3, pages 53–54; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the North Wildwood Lifesaving Station is 23.6 miles from the nearest WTG associated with the Project and 15.9 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from North Wildwood Lifesaving Station is 528 WTGs. Of these, 98 theoretically visible WTGs (19 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the North Wildwood Lifesaving Station when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.16 U.S. Lifesaving Station #35, Stone Harbor Borough, Cape May County

This property is at 11617 2nd Avenue in Stone Harbor and is approximately 21.9 miles from the Wind Farm Area. Constructed in 1895, U.S. Lifesaving Station #35 (now the Steven C. Ludlum American Legion Post 331) is an example of the 1893 Duluth Design by George R. Tolman. The station consists of three sections: the southern primary lifesaving station building, a central four-story tower, and northern boat room. U.S. Lifesaving Station #35 was surveyed in January 2021 and was individually listed in the NRHP in 2008. The property is listed under Criterion A in the areas of Transportation and Maritime History for its role as a historic lifesaving station and under Criterion C as an example of the Tolman's 1893 Duluth Design for lifesaving stations (COP Volume III, Appendix F-3, page 113; Ocean Wind 2023).

Although originally on the ocean front, the property is now one block from the ocean front due to the dense residential infill and sand deposits to the east along the shoreline. The Project would be minimally visible at ground level, as the Wind Farm Area would be partially obscured by intervening development and planted trees within the center median of 2nd Avenue. The building's tower projects slightly above the infill buildings to the east and would have views of the of Wind Farm Area from its upper section. A finding of No Adverse Effect was recommended for U.S. Lifesaving Station #35, as its integrity of setting and association have already been diminished since its construction and later decommissioning in 1948 and views of the Project from the property would be limited to only the upper sections of the tower. However, through consultation BOEM determined that the Project would result in an Adverse Effect on U.S. Lifesaving Station #35 (COP Volume III, Appendix F-3, pages 113–114; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the U.S. Lifesaving Station #35 is 21.9 miles from the nearest WTG associated with the Project and 14.5 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from U.S. Lifesaving Station #35 is 561 WTGs. Of these, 98 theoretically visible WTGs (18 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on U.S. Lifesaving Station #35 when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.1.3.17 Little Egg Harbor U.S. Lifesaving Station #23, Little Egg Harbor Township, Ocean County

This property is at 800 Great Bay Boulevard in Little Egg Harbor Township and is approximately 21.3 miles from the Wind Farm Area. The Little Egg Harbor U.S. Lifesaving Station #23 was built in 1937 to replace the original station in this area, which was first constructed on Tucker Island in 1869 and moved several times due to beach erosion. The building is an example of the 1934 Roosevelt Design for Coast Guard stations. The station consists of a two-story rectangular building with a central cupola and features Colonial Revival elements. The building and its associated boathouses are constructed on elevated piers to accommodate the tides and are accessed by a long pedestrian boardwalk from Great Bay Boulevard. It remained a USCG station until the 1960s and was then purchased by Rutgers University in 1972 for use as a marine field station. The property was surveyed in January 2021 and determined individually eligible for listing in the NRHP by New Jersey SHPO in 2014. While New Jersey SHPO records do not include information on the building's significance, it is likely significant under Criterion A for Maritime History and under Criterion C as an example of the 1934 Roosevelt Design for Coast Guard stations (COP Volume III, Appendix F-3, page 44; Ocean Wind 2023).

The property is situated on southern point of Little Egg Harbor's salt marsh peninsula within the Great Bay Boulevard Wildlife Management Area, in the vicinity of the Little Egg Inlet. The Wind Farm Area would be partially visible from the property, with the northern reach visible across Little Egg Inlet and the southern three quarters obscured by Dog Island. A finding of No Adverse Effect was recommended for Little Egg Harbor U.S. Lifesaving Station #23 because its sea view to open ocean beyond Little Egg Inlet is a consequence of its location and not related to its historical function, which was primarily concerned with views and expeditious access to the channels within the bay and Little Egg Inlet. Furthermore, its integrity would not be affected, as views of the Wind Farm Area would be limited and therefore do not qualify as a substantial alteration of the property's setting. However, through consultation BOEM determined that the Project would result in an Adverse Effect on Little Egg Harbor U.S. Lifesaving Station #23. (COP Volume III, Appendix F-3, pages 44 and 46; Ocean Wind 2023).

As described in the *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*, the Little Egg Harbor U.S. Lifesaving Station #23 is 21.9 miles from the nearest WTG associated with the Project and 11.6 miles from the nearest potential WTG location for other wind energy development activities. The total number of potentially visible turbines from Little Egg Harbor U.S. Lifesaving Station #23 is 575 WTGs. Of these, 98 theoretically visible WTGs (17 percent) would be from the proposed Project. As such, BOEM determined the Project would incrementally add to the cumulative visual effects on the Little Egg Harbor U.S. Lifesaving Station #23 when combined with the effects of other past, present, or reasonably foreseeable future actions (BOEM 2022).

N.3.2 Summary of Adversely Affected Historic Properties

N.3.2.1. Adverse Effects on Historic Properties in the Marine APE

Ocean Wind 1 will avoid effects on all 19 submerged archaeological resources and their associated avoidance buffers. Ocean Wind 1 also commits to avoiding the defined spatial extent of 3 of 16 ancient submerged landforms. Thirteen of the 16 ancient submerged landforms within the Lease Area cannot be avoided by the Project, as WTGs, OSS, cables, and associated work zones are proposed for locations within the defined areas of these resources. Therefore, BOEM has determined the undertaking would have adverse effects on historic properties within the marine APE.

N.3.2.2. Adverse Effects on Historic Properties in the Terrestrial APE

The Project has been sited to avoid adverse effects on terrestrial archaeological resources by siting onshore facilities within previously disturbed areas and existing road right-of-way to the extent practicable. Archaeological survey of these areas revealed six archaeological sites within the terrestrial APE, including previously disturbed areas. Two are expansions of previously reported sites, one is an adjacent previously reported site for which additional data are lacking, and three are newly reported. All six archaeological sites would be avoided by all Project activities that are part of the undertaking. Therefore, BOEM finds no adverse effect on these historic properties.

N.3.2.3. Adverse Effects on Historic Properties within the Visual APE

Based on the information BOEM has available from the studies conducted to identify historic properties within the visual APE of the Project and the assessment of effects upon those properties determined in consultation with the consulting parties, BOEM has determined that the Project would have adverse visual effects on the following historic properties:

- Brigantine Hotel, Brigantine City
- Absecon Lighthouse, Atlantic City
- Atlantic City Boardwalk, Atlantic City
- Atlantic City Convention Hall, Atlantic City

- Ritz-Carlton Hotel, Atlantic City
- Riviera Apartments, Atlantic City
- Vassar Square Condominiums, Ventnor City
- House at 114 South Harvard Avenue, Ventnor City
- Lucy the Margate Elephant in Margate City
- Great Egg Coast Guard Station, Longport Borough
- Ocean City Boardwalk, Ocean City
- Ocean City Music Pier, Ocean City
- The Flanders Hotel, Ocean City
- Hereford Lighthouse, North Wildwood
- North Wildwood Lifesaving Station, North Wildwood
- U.S. Lifesaving Station #35, Stone Harbor Borough
- Little Egg Harbor U.S. Lifesaving Station #23, Little Egg Harbor Township

The undertaking would affect the character of the properties' settings that contributes to their historic significance by introducing visual elements that are out of character with the historic setting of the properties. BOEM did, however, determine that, due to the distance and open viewshed, the integrity of the properties would not be so diminished as to disqualify any of them for NRHP eligibility.

The adverse effects on the viewshed of the above-ground historic properties would occupy the space for approximately 35 years, but they are unavoidable for reasons discussed in Section N.3.1.3. This application of the criteria of adverse effect and determination that the effects are direct are based on pertinent NRHP bulletins, subsequent clarification and guidance by the National Park Service and ACHP, and other documentation, including professionally prepared viewshed assessments and computer-simulated photographs.

While the historic resources visual affects assessment distributed to consulting parties on March 21, 2022, recommended a finding of adverse effect on the six historic properties, the historic resources visual affects assessment was revised in November 2022 to incorporate consulting party input and new data. Two of the properties (Villa Maria by the Sea in Stone Harbor, New Jersey, and Charles Fischer House at 115 S. Princeton Avenue, Ventnor City, New Jersey) were demolished and six properties were newly recommended as being adversely affected (COP Volume III, Appendix F-3; Ocean Wind 2023). The finding of adverse effect has been further revised in February 2023 to incorporate consulting party input. BOEM finds seven additional properties are adversely affected.

N.4. Actions to Avoid, Minimize, or Mitigate Adverse Effects

BOEM will stipulate measures to avoid, minimize, and mitigate adverse effects for certain historic properties identified in the APE as adversely affected by the Project, as well as cumulative adverse visual effects caused by the Project. Specifically, BOEM will stipulate measures to avoid known terrestrial archaeological resources and submerged archaeological and ancient submerged landforms, minimize visual effects on historic properties, and stipulate implementation of an terrestrial archaeological monitoring plan. BOEM will also stipulate mitigation measures to resolve adverse effects for 13 adversely effected ancient submerged landforms that cannot be avoided, or in cases where there is post-review discovery of previously unknown terrestrial or marine archaeology that are not currently found to be subject to adverse effects from the Project. BOEM, with the assistance of Ocean Wind, will develop and implement two Historic Property Treatment Plans in consultation with consulting parties who have demonstrated interest in specific historic properties and property owners. This will include a treatment plan to address impacts on ancient submerged landforms and a treatment plan that will provide details and specifications for actions consisting of mitigation measures to resolve adverse visual effects and cumulative adverse visual effects. The terrestrial archaeological monitoring plan and two treatment plans are included as attachments to the Memorandum of Agreement (Attachment A).

As part of the NRHP Section 106 process, Ocean Wind has committed to APMs as conditions for approval of issuance of BOEM's permit (COP Volume III, Appendix F-4), including:

1. Ocean Wind would apply a paint color to the WTGs no lighter than RAL 9010 pure white and no darker than RAL 7035 light gray to help reduce potential visibility of the turbines against the horizon during daylight hours.
2. Ocean Wind would implement an ADLS to automatically activate lights when aircraft approach. The WTGs and OSS would be lit and marked in accordance with FAA and USCG lighting standards and consistent with BOEM best practices.
3. Implementation of the terrestrial archaeological monitoring plan, terrestrial post-review discovery plan, and marine post-review discovery plan would reduce potential impacts on any previously undiscovered archaeological resources (if present) encountered during construction and operation. Archaeological monitoring and the implementation of a post-review discoveries plan would reduce potential impacts on undiscovered archaeological resources to a negligible level by preventing further physical impacts on the archaeological resources encountered during construction.
4. Ocean Wind cannot avoid 13 of the 16 ancient submerged landforms (Targets 21–26, 28–31, and 33–35) and will complete the mitigation measures as outlined in COP Volume III, Appendix F-4 for the purposes of resolving adverse effects per 36 CFR 800.6, including:
    a. Geoarchaeological analysis consisting of archaeological core processing and artifact screening, tribal participation in lab processing of core samples, data analysis, update to paleolandscape reconstruction model, and public or professional presentations summarizing the results of the investigations, developed with the consent of the consulting tribes/tribal nations
    b. Tribal outreach and preparation of educational materials developed with participating tribes in the form of open-source geographic information system and story maps or equivalent digital/media presentations that address traditional past land uses associated with the submerged landforms
    c. In consultation with BOEM, ancient submerged landform post-construction seafloor impact inspection, including development of a 3D model throughout ancient submerged landforms designated for review; development of the remotely operated vehicle investigation methodology to conduct seafloor inspections along affected portions of the selected ancient submerged landforms; review of candidate datasets and attributes for inclusion in the geographic information system; delivery of data interpretive technical report draft; and delivery of final technical report
    d. Conducting an ethnographic study consisting of funding an ethnographic researcher and researcher travel; funding for Delaware Tribe of Indians, Delaware Nation, and Stockbridge Munsee technology upgrades associated with analysis of geographic information system data; funding for Delaware Tribe of Indians historic preservation oversight and indirect costs; funding for Stockbridge-Munsee Community Band of Mohican Indians Tribal Historic Preservation Officer collaboration; providing relevant ancient submerged landform geographic information system data layers to Delaware Tribe of Indians for use in this study as well as providing a

tutorial on the data; progress calls and report development; and funding for a presentation to highlight the results of the study to be coordinated and executed by Delaware Tribe of Indians

5. Ocean Wind would fund documentation preparation and public education material development, as outlined in COP Volume III, Appendix F-4, for properties adversely affected by visual impacts to resolve adverse effects per 36 CFR 800.6 including:

    I. National Historic Landmarks Mitigation

        A. Lucy the Margate Elephant

            1. Funding for Visitor Experience and Public Access for Lucy the Margate Elephant

    II. Multi-property and Multi-county Mitigation

        A. Historic Context addressing early 20th century New Jersey Shore Hotels

        B. Historic Context addressing mid-century High-rise residential buildings at the New Jersey Shore

        C. Historic Context addressing Boardwalks of the New Jersey Shore, with Surveys and Evaluations of Atlantic City Boardwalk, Ocean City Boardwalk, and Wildwood Boardwalk

    III. Atlantic County Historic Properties Mitigation

        A. Absecon Lighthouse, Atlantic City, Atlantic County

            1. Funding for Visitor Experience and Public Access for Absecon Lighthouse

        B. Atlantic City Boardwalk, Atlantic City, Atlantic County

            1. Funding for Visitor Experience and Public Access for Atlantic City Boardwalk

6. Ocean Wind will contribute funding to a Mitigation Fund, as outlined in the Memorandum of Agreement (Attachment A), for properties adversely affected by visual impacts to resolve adverse effects per 36 CFR 800.6 including:

    A. Funding to resolve adverse effects on 14 historic properties: Brigantine Hotel, Brigantine City; Atlantic City Convention Hall, Atlantic City; Ritz-Carlton Hotel, Atlantic City; Riviera Apartments, Atlantic City; Vassar Square Condominiums, Ventnor City; House at 114 South Harvard Avenue, Ventnor City; Great Egg Coast Guard Station, Longport Borough; Ocean City Boardwalk, Ocean City; Ocean City Music Pier, Ocean City; Hereford Lighthouse, North Wildwood; North Wildwood Life Saving Station, North Wildwood; U.S. Lifesaving Station #35, Stone Harbor Borough; Flanders Hotel, Ocean City; and Little Egg Harbor U.S. Life Saving Station #23 (U.S. Coast Guard Station #119), Little Egg Harbor Township.

    B. Mitigation measures to be developed in consultation with consulting parties but could include activities such as HABS documentation and HABS-like documentation, Historic Structure Reports, and funding for visitor experience, public access, and climate resiliency.

Ocean Wind has not identified the 5th Street cable route option for BL England interconnection as the preferred cable route. However, in the event that the 5th Street cable route option is selected by Ocean Wind, BOEM will require Ocean Wind to use construction approaches to avoid or minimize vibration impacts on foundations of historic properties adjacent to right-of-way construction areas, to prepare and implement a vibration monitoring plan, and to avoid instances of slate sidewalk remnants if feasible, or remove and replace them prior to and following construction activities.

The NHPA Section 106 consultation process is ongoing for the Project, and will culminate in a Memorandum of Agreement detailing avoidance, minimization, and mitigation measures to resolve adverse effects on historic properties, including cumulative adverse visual effects caused by the Project. See Attachment A. BOEM will continue to consult in good faith with the New Jersey SHPO and other consulting parties to resolve adverse effects.

N.5. Phased Identification

Information pertaining to identification of historic properties within certain portions of the marine APE related to Alternatives B-1, B-2, C-1, C-2, and D will not be available until after the ROD is issued and the COP is approved. If Alternative B-1, B-2, C-1, C-2, or D is selected, BOEM will use the Memorandum of Agreement to establish commitments for phased identification and evaluation of historic properties within the marine APE in accordance with BOEM's existing *Guidelines for Providing Archaeological and Historic Property Information Pursuant to Title 30 Code of Federal Regulations Part 585*, ensuring potential historic properties are identified, effects assessed, and adverse effects resolved prior to construction (Memorandum of Agreement Stipulation IV). If Alternative C-1 is selected, previously unsurveyed areas associated with one WTG and potentially the inter-array cable routing will need to be surveyed for marine archaeology. If Alternative C-2 is selected, previously unsurveyed areas associated with 22 WTG positions and potentially the inter-array cable routing will need to be surveyed for marine archaeology. If Alternative B-1, B-2, or D is selected, previously unsurveyed areas associated with the inter-array cable may need to be surveyed for marine archaeology.

The Memorandum of Agreement will specify the Section 106 consultation process in the event one of these alternatives is selected (Alternative B-1, B-2, C-1, C-2, or D). If one of these alternatives is selected, Ocean Wind will be required to complete underwater archaeology surveys for portions of the marine APE that have not been surveyed in accordance with BOEM's existing *Guidelines for Providing Archaeological and Historic Property Information Pursuant to Title 30 Code of Federal Regulations Part 585*. BOEM will review the results of these surveys and, after its final agreement that these surveys and survey results are sufficient, BOEM will making a finding of effect if any historic properties could potentially be affected by one of these selected alternatives. If BOEM identifies no additional historic properties or determines that no historic properties are adversely affected due to the selection of one of these alternatives, BOEM, with the assistance of Ocean Wind, will notify and consult with the signatories, invited signatories, and consulting parties by providing a written summary of the surveyed area including any maps, a summary of any additional surveys and research conducted to identify historic properties and assess effects, and copies of the surveys. BOEM and Ocean Wind will allow the signatories, invited signatories, and consulting parties 30 calendar days to review and comment on the proposed change, BOEM's determination, and the documents. After the 30-calendar-day review period has concluded and no comments require additional consultation, Ocean Wind will notify the signatories and consulting parties that BOEM has received concurrence from the New Jersey SHPO regarding the finding of effect and, if i received any comments, provide a summary of the comments and BOEM's responses. BOEM, with the assistance of Ocean Wind, will conduct any consultation meetings if requested by the signatories or consulting parties.

If BOEM determines new adverse effects on historic properties will occur due to the selection of one of these alternatives and based on the results of the underwater archaeology surveys, BOEM with the assistance of Ocean Wind, will notify and consult with the signatories, invited signatories, and consulting parties regarding BOEM's finding and the proposed measures to resolve the adverse effect(s) including the development of a new treatment plan(s) following the consultation process set forth in the Memorandum of Agreement. Ocean Wind will notify all signatories, invited signatories, and consulting parties about the selection of one of these alternatives, the results of the surveys and copies of the survey reports, BOEM's determination, and the proposed resolution measures for the adverse effect(s). The signatories, invited signatories, and consulting parties will have 30 calendar days to review and comment on the survey reports, the results of the survey reports, the adverse effect finding, and the proposed resolution of adverse effect(s), including a draft treatment plan(s). BOEM, with the assistance of Ocean Wind, will conduct additional consultation meetings, if necessary, during consultation on the adverse effect finding and during drafting and finalization of the treatment plan(s). BOEM, with the assistance of Ocean Wind, will respond to the comments and make necessary edits to the documents. Ocean Wind will send the revised draft final documents to the other signatories, invited signatories, and consulting parties for review and comment during a 30-calendar-day review and comment period. With this same submittal of draft final documents, Ocean Wind will provide a summary of all the comments received on the documents and BOEM's responses. BOEM, with the assistance of Ocean Wind, will respond to the comments on the draft final documents and make necessary edits to the documents. Ocean Wind will notify all the signatories, invited signatories, and consulting parties and will provide the final document(s) including the final treatment plan(s) and a summary of comments and BOEM's responses to comments, if it receives any on the draft final documents, after BOEM has received concurrence from the New Jersey SHPO on the finding of new adverse effect(s), and BOEM has accepted the final treatment plan(s).

N.6. National Historic Landmarks and the NHPA Section 106 Process

The National Park Service, which administers the NHL program for the Secretary of the Interior, describes NHLs and requirements for NHLs as follows:

> National Historic Landmarks (NHL) are designated by the Secretary under the authority of the Historic Sites Act of 1935, which authorizes the Secretary to identify historic and archaeological sites, buildings, and objects which "possess exceptional value as commemorating or illustrating the history of the United States" Section 110(f) of the NHPA requires that Federal agencies exercise a higher standard of care when considering undertakings that may directly and adversely affect NHLs. The law requires that agencies, "to the maximum extent possible, undertake such planning and actions as may be necessary to minimize harm to such landmark." In those cases when an agency's undertaking directly and adversely affects an NHL, or when Federal permits, licenses, grants, and other programs and projects under its jurisdiction or carried out by a state or local government pursuant to a Federal delegation or approval so affect an NHL, the agency should consider all prudent and feasible alternatives to avoid an adverse effect on the NHL.

NHPA Section 110(f) applies specifically to NHLs. BOEM is implementing the special set of requirements for protecting NHLs and for compliance with NHPA Section 110(f) at 36 CFR 800.10, which, in summary:

- requires the agency official, to the maximum extent possible, to undertake such planning and actions as may be necessary to minimize harm to any NHL that may be directly and adversely affected by an undertaking;
- requires the agency official to request the participation of ACHP in any consultation conducted under 36 CFR 800.6 to resolve adverse effects on NHLs; and
- further directs the agency to notify the Secretary of the Interior of any consultation involving an NHL and to invite the Secretary of the Interior to participate in consultation where there may be an adverse effect.

The Historic Resources Visual Effects Assessment identified two NHLs in the visual APE for the Project: the Atlantic City Convention Hall and Lucy the Margate Elephant.

Atlantic City Convention Hall (Jim Whelan Boardwalk Hall), built in 1929, was a focal point of the Atlantic City Boardwalk in the early 20th century. The building features a massive barrel-roofed auditorium behind the two-story entrance loggia and a one-story curved limestone exedra (arcade) along the Boardwalk. The convention hall was used as a recreational venue, hosting concerts, sporting and political events, and pageants in its large auditorium. A smaller auditorium above the building's Boardwalk entrance was historically used as a ballroom and now serves as a multi-function space for gatherings and small events. The Atlantic City Convention Hall was listed in the NRHP and designated as an NHL in 1987; it was listed in the New Jersey Register of Historic Places in 1993. The convention hall is listed under Criterion A, in the area of recreation and culture, as a recreational venue associated with social and civic events in Atlantic City in the early and mid-20th century. The building is listed under Criterion C, in the area of engineering, for the design of the main auditorium's massive barrel roof, entrance loggia, and Boardwalk exedra. In a 2021 review of the property, it was noted that:

> The Project will have a visual effect on the Atlantic City Convention Hall, largely borne by the exedra walkway, a contributing structure of the site, located across the Boardwalk from the Convention Hall. While the Project would not alter any characteristics or physical features within the Convention Hall that contribute to its historic significance, BOEM determined that the Project would diminish its integrity of setting, an aspect of its historic integrity that relates to its significance. The Atlantic City Convention Hall is significant under Criterion A for Recreation and Criterion C for Engineering. The building's location on Atlantic City's Boardwalk is paramount to its history and associated significance…To the extent that the [Wind Farm Area] would be visible along the horizon approximately 15.5 mi from the historic property, BOEM has determined that the impact to setting rises to the level of adverse effect. (COP Volume III, Appendix F, page 64; Ocean Wind 2023).

Lucy the Margate Elephant was built in 1881 to promote real estate development in what is now Margate City. In 1970, the building was moved a few blocks from its original location to its current location at 9200 Atlantic Avenue. The building's original location was two blocks northeast, near the intersection of present-day Atlantic Avenue and South Cedar Grove Avenue. The building was listed in the NRHP in 1971 and designated an NHL in 1976 under Criteria A and C. Modifications to Lucy include the partitioning of the domed interior space in 1902 and replacement of the original howdah (canopied seat) after it was destroyed in a storm in 1928. Both alterations occurred prior to the building being listed in the NRHP. In a 2021 review of the property, it was noted that:

> At a distance of 15.3 mi, characterized in the VIA as apparent, the [Wind Farm Area] will be visible on the horizon, altering the property's setting and potentially, the experience of visitors to the site. Lucy's significance as an architectural folly and sculpture, while not specified in its NRHP nomination, likely falls under Criteria A and C. Sea views are a key component of the building's property type and contribute to its significance. Therefore, a finding of Adverse Effect is recommended for Lucy the Margate Elephant. (COP Volume III, Appendix F-3, page 85; Ocean Wind 2023).

BOEM has determined these two properties would be adversely affected by the Project, as both properties have seaside locations and these ocean views that are considered a character-defining feature of their significance (COP Volume III, Appendix F-3, pages 64 and 85; Ocean Wind 2023).

N.7. References Cited

Bureau of Ocean Energy Management (BOEM). 2020. *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585*. May 27.

Bureau of Ocean Energy Management (BOEM). 2021. *Ocean Wind 1 Construction and Operations Plan Scoping Report*. June.

Bureau of Ocean Energy Management (BOEM). 2022. *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind 1 Offshore Wind Farm Project*. November.

Hartgen Archeological Associates, Inc. 2021. *Phase I Archaeological Investigation, Ocean Wind Offshore Wind Farm (Lease Area OCS-A 0498), Oyster Creek, Addendum - Terrestrial Archaeological Resources Assessment*. Prepared for HDR Engineering Inc. October.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Pitts, Carolyn. No date. *National Register of Historic Places Registration Form: Lucy Margate Elephant.* Available: https://npgallery.nps.gov/NRHP/GetAsset/f7dc55b9-da1e-452d-a05c-8896623782f5. Accessed: January 25, 2022.

SEARCH Inc. 2021. *Architectural Intensive Level Survey, Ocean Wind Offshore Wind Farm, New Jersey*. Prepared for HDR Engineering Inc. September.

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ATTACHMENT A
MEMORANDUM OF AGREEMENT

Version dated April 19, 2023

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DRAFT MEMORANDUM OF AGREEMENT AMONG THE BUREAU OF OCEAN ENERGY MANAGEMENT, THE NEW JERSEY STATE HISTORIC PRESERVATION OFFICER, AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION REGARDING THE OCEAN WIND 1 OFFSHORE WIND FARM PROJECT

WHEREAS, the Bureau of Ocean Energy Management (BOEM) plans to authorize construction and operation of the Ocean Wind 1 Offshore Wind Farm Project (Project) pursuant to Section 8(p)(1)(C) of the Outer Continental Shelf (OCS) Lands Act (43 U.S.C. 1337(p)(1)(C)), as amended by the Energy Policy Act of 2005 (Public Law No. 109-58) and in accordance with Renewable Energy Regulations at 30 Code of Federal Regulations (CFR) Part 585; and

WHEREAS, BOEM determined that the Project constitutes an undertaking subject to Section 106 of the National Historic Preservation Act (NHPA), as amended (54 USC 306108), and its implementing regulations (36 CFR 800), and consistent with the Programmatic Agreement (NJ-NY PA) regarding the review of OCS renewable energy activities offshore New Jersey and New York (*Programmatic Agreement Among The U.S. Department of the Interior, Bureau of Ocean Energy Management, The State Historic Preservation Officers of New Jersey and New York, The Shinnecock Indian Nation, and The Advisory Council on Historic Preservation Regarding Review of Outer Continental Shelf Renewable Energy Activities Offshore New Jersey and New York Under Section 106 of the National Historic Preservation Act*); and

WHEREAS, BOEM plans to approve with conditions the Construction and Operations Plan (COP) submitted by Ocean Wind LLC (Ocean Wind) hereafter referred to as the lessee; and

WHEREAS, BOEM determined the construction, operation, maintenance, and eventual decommissioning of the Project, planned for up to 98 offshore Wind Turbine Generators (WTGs), up to three offshore substations, two onshore substations, offshore and onshore export cables, could potentially adversely affect historic properties as defined under 36 CFR 800.16(l); and

WHEREAS, BOEM is preparing an Environmental Impact Statement (EIS) for the Project pursuant to the National Environmental Policy Act (42 USC 4321 et seq.) (NEPA) and elected to use the NEPA substitution process with its Section 106 consultation pursuant to 36 CFR 800.8(c); and

WHEREAS, BOEM notified in advance the New Jersey State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP) on March 8, 2021, of their decision to use NEPA substitution and followed the standards for developing environmental documents to comply with the Section 106 consultation for this Project pursuant to 36 CFR 800.8(c), and ACHP responded with acknowledgement and guidance regarding NEPA substitution on March 23, 2021; and

WHEREAS, in accordance with 36 CFR 800.3, BOEM invited New Jersey SHPO to consult on the Project on March 30, 2021, and New Jersey SHPO accepted on April 21, 2021; and

WHEREAS, in accordance with 36 CFR 800.3, BOEM invited ACHP to consult on the Project on March 30, 2021; and

WHEREAS, the Project is within a commercial lease area that was subject to previous NHPA Section 106 review by BOEM regarding the issuance of the commercial lease and approval of site assessment activities, which underwent Section 106 review pursuant to the NJ-NY PA and concluded with No Historic Properties Affected on October 18, 2017.

WHEREAS, consistent with 36 CFR 800.16(d) and BOEM's *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* (May 27, 2020), BOEM defined the area of potential effects (APE) for the undertaking as the depth and breadth of the seabed potentially impacted by any bottom-disturbing activities, constituting the marine archaeological resources portion of the APE (marine APE); the depth and breadth of terrestrial areas potentially impacted by any ground disturbing activities, constituting the terrestrial archaeological resources portion of the APE (terrestrial APE); the viewshed from which offshore or onshore renewable energy structures would be visible, constituting the visual portion of the APE (visual APE); and any temporary or permanent construction or staging areas that may fall into any of the aforementioned offshore or onshore portions of the APE (see Attachment 1 APE Maps); and

WHEREAS, BOEM identified 19 submerged historic properties and 16 ancient submerged landforms features (ASLFs) in the marine APE; six historic properties, all archaeological sites, in the terrestrial APE; and nine historic districts and 40 aboveground historic properties in the offshore Project components' portion of the visual APE and three historic properties in the onshore Project components' portion of the visual APE; and

WHEREAS, BOEM identified two National Historic Landmarks (NHLs) in the offshore Project components' portion of the visual APE, Lucy the Margate Elephant and Atlantic City Convention Hall, and BOEM determined the Project could potentially visually adversely affect these two NHLs due to their seaside locations and their character-defining ocean views will be altered and diminished; and

WHEREAS, BOEM has determined that the undertaking will adversely affect 13 ASLFs (Targets 21–26, 28–31, and 33–35) from physical disturbance in the lease area and export cable construction; and will visually adversely affect aboveground historic properties: Atlantic City Convention Hall, Atlantic City; Lucy the Margate Elephant, Margate City; Absecon Lighthouse, Atlantic City; Great Egg Coast Guard Station, Longport Borough; Hereford Lighthouse, North Wildwood; U.S. Lifesaving Station #35, Stone Harbor Borough; Flanders Hotel, Ocean City, which are listed in the National Register of Historic Places (NRHP); and Brigantine Hotel, Brigantine City; Atlantic City Boardwalk, Atlantic City; Ritz-Carlton Hotel, Atlantic City; Riviera Apartments, Atlantic City; Vassar Square Condominiums, Ventnor City; House at 114 South Harvard Avenue, Ventnor City; Ocean City Boardwalk, Ocean City; and Ocean City Music Pier, Ocean City; North Wildwood Life Saving Station, North Wildwood; Little Egg Harbor U.S. Life Saving Station #23 (U.S. Coast Guard Station #119), Little Egg Harbor Township, which are eligible for listing in the NRHP; and

WHEREAS, BOEM determined that the implementation of the avoidance measures identified in this MOA will avoid adversely affecting all nineteen submerged cultural resources (Targets 01–19) and three ASLFs in the marine APE (Targets 20, 27, and 32), all six historic properties in the terrestrial APE, nine historic districts and 23 aboveground historic properties in the offshore visual APE, and three historic properties in the onshore visual APE; and

WHEREAS, BOEM determined all of the ASLFs identified in the marine APE are eligible for the National Register of Historic Places (NRHP) under Criteria A and D and determined, under each of the Project alternatives analyzed in the EIS, that the undertaking will adversely affect the following 13 ASLFs: Targets 21 through 26, 28 through 31, and 33 through 35; and

WHEREAS, under each of the Project alternatives analyzed in the EIS, BOEM determined the Project would visually adversely affect these 17 aboveground historic properties in New Jersey: Brigantine Hotel, Brigantine City, Atlantic County; Absecon Lighthouse, Atlantic City, Atlantic County; Atlantic City Boardwalk, Atlantic City, Atlantic County; Atlantic City Convention Hall, Atlantic City, Atlantic County; Ritz-Carlton Hotel, Atlantic City, Atlantic County; Riviera Apartments, Atlantic City, Atlantic County; Vassar Square Condominiums, Ventnor City, Atlantic County; House at 114 South Harvard Avenue, Ventnor City, Atlantic County; Lucy the Margate Elephant, Margate City, Atlantic County; Great Egg Coast Guard Station, Longport Borough, Atlantic County; Ocean City Boardwalk, Ocean City, Cape May County; Ocean City Music Pier, Ocean City, Cape May County; Hereford Lighthouse, North Wildwood, Cape May County; North Wildwood Life Saving Station, North Wildwood, Cape May County; U.S. Lifesaving Station #35, Stone Harbor Borough, Cape May County; Flanders Hotel, Ocean City, Cape May County; and Little Egg Harbor U.S. Life Saving Station #23 (U.S. Coast Guard Station #119), Little Egg Harbor Township, Ocean County; and

WHEREAS, upon receiving the Draft EIS, including Appendix N. Finding of Adverse Effects, ACHP notified BOEM that it will formally participate in this Section 106 consultation via letter sent on August 15, 2022; and

WHEREAS, New Jersey SHPO concurred with BOEM's finding of adverse effect on March 30, 2023; and

WHEREAS, throughout this document the term 'Tribe,' has the same meaning as 'Indian Tribe,' as defined at 36 CFR 800.16(m); and

WHEREAS, BOEM invited the following federally recognized Tribes to consult on this Project: Absentee-Shawnee Tribe of Indians of Oklahoma, Eastern Shawnee Tribe of Oklahoma, Shawnee Tribe, Mashantucket Pequot Tribal Nation, the Narragansett Indian Tribe, the Rappahannock Tribe, and the Shinnecock Indian Nation; the Delaware Tribe of Indians, Delaware Nation, the Stockbridge-Munsee Community Band of Mohican Indians, and the Wampanoag Tribe of Gay Head (Aquinnah); and

WHEREAS, the Delaware Tribe of Indians, Delaware Nation, the Stockbridge-Munsee Community Band of Mohican Indians, and the Wampanoag Tribe of Gay Head (Aquinnah) accepted BOEM's invitation to consult and BOEM invited these Tribes to sign this MOA as concurring parties; and

WHEREAS, in accordance with 36 CFR 800.3, BOEM invited other federal agencies, state and local governments, and consulting parties with a demonstrated interest in the undertaking to participate in this consultation, the list of those accepting participation and declining to participate by either written response or no response to direct invitations are listed in Attachment 2; and

WHEREAS, BOEM has consulted with the lessee in its capacity as applicant seeking federal approval of the COP, and, because the lessee has responsibilities under the MOA, BOEM has invited the applicant to be an invited signatory to this MOA; and

WHEREAS, construction of the Project requires a Department of the Army permit from the United States Army Corps of Engineers (USACE) for activities which result in the discharge of dredged or fill material into jurisdictional wetlands and/or other waters of the United States pursuant to Section 404 of the Clean Water Act, and activities occurring in or affecting navigable waters of the United States pursuant to Section 10 of the Rivers and Harbors Act; and

WHEREAS, BOEM invited USACE to consult since USACE has authority to issue any needed permits for this Project under Section 404 of the Clean Water Act (33 USC 1344) and Section 10 of the Rivers and Harbors Act (33 USC 403); and

WHEREAS, the USACE designated BOEM as the Lead Federal Agency pursuant to 36 CFR 800.2(a)(2) to act on its behalf for purposes of compliance with Section 106 for this Project (in a letter dated October 17, 2022), BOEM invited the USACE to sign this MOA as a concurring party; and

WHEREAS, BOEM notified and invited the Secretary of the Interior (represented by the National Park Service (NPS) to consult regarding this Project pursuant to the Section 106 regulations, including consideration of the potential effects to the NHLs as required under NHPA Section 110(f) (54 USC

306107) and 36 CFR 800.10, the NPS accepted BOEM's invitation to consult, and BOEM invited the NPS to sign this MOA as a concurring party; and

WHEREAS, BOEM has consulted with the signatories, invited signatories, and consulting parties participating in the development of this MOA regarding the definition of the undertaking, the delineation of the APEs, the identification and evaluation of historic properties, the assessment of potential effects to the historic properties, and on measures to avoid, minimize, and mitigate adverse effects to historic properties; and

WHEREAS, pursuant to 36 CFR 800.6, BOEM invited the lessee to sign as invited signatory and the consulting parties as listed in Attachment 2 to sign as concurring parties; however, the refusal of any consulting party to sign this MOA or otherwise concur does not invalidate or affect the effective date of this MOA, and consulting parties who choose not to sign this MOA will continue to receive information if requested and have an opportunity to participate in consultation as specified in this MOA; and

WHEREAS, the signatories (required signatories and invited signatories) agree, consistent with 36 CFR 800.6(b)(2), that adverse effects will be resolved in the manner set forth in this MOA; and

WHEREAS, BOEM sought and considered the views of the public regarding Section 106 for this Project through the NEPA process by holding virtual public scoping meetings when initiating the NEPA and NHPA Section 106 review on April 13, 15, and 20, 2021 and virtual public hearings related to the Draft EIS on July 14, 20, and 26, 2022; and

WHEREAS, BOEM made the first Draft MOA available to the public for review and comment from June 24, 2022, to August 23, 2022, and provided updated versions of the Draft MOA to the public using BOEM's Project website; and

NOW, THEREFORE, BOEM, the New Jersey SHPO, and the ACHP agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

BOEM, with the assistance of the lessee, shall ensure that the following measures are carried out as conditions of its approval of the undertaking:

I. MEASURES TO AVOID ADVERSE EFFECTS TO IDENTIFIED HISTORIC PROPERTIES

A. Marine APE

1. BOEM will include the following avoidance measures for adverse effects within the marine APE as conditions of approval of the Ocean Wind 1 COP:

    i. The lessee will avoid known shipwrecks (Targets [Targets 1, 9, 12-14, 17, 18]) previously identified during marine archaeological surveys by a distance of no less than 50 meters from the known extent of the resource for placement of Project structures and when conducting seafloor-disturbing activities.

    ii. The lessee will avoid potential shipwrecks (Targets 2-8, 10, 11, 15, 16, 19) and potentially significant debris fields previously identified during marine archaeological surveys by a distance of no less than 50 meters from the known extent of the resource, unless the buffer would preclude the installation of facilities at their engineered locations, but in no event would the buffer be less than 50 meters from the known extent of the resource.

iii. The lessee will avoid three ASLFs (Targets 20, 27, and 32). No additional avoidance buffer is required for these ASLFs given avoidance of the ASLFs is based on the defined spatial extent of each ASLF, which has been determined based on the maximum observed presence of the seismic reflector and unique buffer area designed to account for minimal positioning errors or lack of resolution.

B. Visual APE

1. BOEM will include the following avoidance measures for adverse effects within the visual APE as conditions of approval of the Ocean Wind 1 COP:

i. To maintain avoidance of adverse effects to historic properties in the visual APE where BOEM determined no adverse effects or where no effects would occur, BOEM will require the lessee to ensure Project structures are within the design envelope, sizes, scale, locations, lighting prescriptions, and distances that were used by BOEM to inform the definition of the APE for the Project and for determining effects in the Finding of Effect (see the Construction & Operations Plan: Ocean Wind 1 Offshore Wind Farm Project, October, 2022).

II. MEASURES TO MINIMIZE ADVERSE EFFECTS TO IDENTIFIED HISTORIC PROPERTIES

A. Visual APE

1. BOEM has undertaken planning and actions to minimize adverse effects to aboveground historic properties in the visual APE. BOEM will include these minimization measures for adverse effects within the visual APE as conditions of approval of the Ocean Wind 1 COP:

i. The lessee will use uniform WTG design, speed, height, and rotor diameter to reduce visual contrast and decrease visual clutter.

ii. The lessee will use uniform spacing of 1 NM (1.15 mile) by 0.8 NM (0.92 mile) to decrease visual clutter, aligning WTGs to allow for safe transit corridors.

iii. The lessee will apply a paint color to the WTGs no lighter than RAL 9010 pure white and no darker than RAL 7035 light gray to help reduce potential visibility of the turbines against the horizon during daylight hours.

iv. The lessee will implement an aircraft detection lighting system (ADLS) to automatically activate lights when aircraft approach. The WTGs and OSS would be lit and marked in accordance with FAA and USCG lighting standards and consistent with BOEM's *Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development* (April 28, 2021) to reduce light intrusion.

III. MEASURES TO MITIGATE ADVERSE EFFECTS TO IDENTIFIED HISTORIC PROPERTIES

A. Marine APE

1. The lessee cannot avoid 13 ASLFs (Targets 21–26, 28–31, and 33–35). To resolve the adverse effects to the 13 ASLFs, BOEM will include the following as conditions of approval

of the Ocean Wind 1 COP. The lessee will fund mitigation measures in accordance with Attachment 3 (Historic Property Treatment Plan for the Ocean Wind 1 Farm Ancient Submerged Landform Features, Federal Waters on the Outer Continental Shelf). See Attachment 8 for proposed budgets for each mitigation effort, reflecting good faith estimates, based on the experience of qualified consultants with similar activities and comparable historic properties. The lessee agrees to the following measures:

i. Preconstruction Geoarchaeology. The lessee will fulfill the following commitments in accordance with Attachment 3: collaborative review of existing geophysical and geotechnical data with consulting Tribes; selection of coring locations in consultation with consulting Tribes; collection of two to three vibracores within each affected ASLF that has not been previously sampled, with a sampling focus on areas that will be disturbed by Project construction activities; written verification to BOEM that the samples collected are sufficient for the planned analyses and consistent with the agreed scope of work; collaborative laboratory analyses at a laboratory located in Rhode Island or New Jersey; screening of recovered sediments for debitage or micro-debitage associated with indigenous land uses; third-party laboratory analyses, including micro- and macro-faunal analyses, micro- and macro-botanical analyses, radiocarbon dating of organic subsamples, and chemical analyses for potential indirect evidence of indigenous occupations; temporary curation of archival core sections; draft reports for review by consulting Tribes; and final reporting. Signatories will be notified of completion of this measure. The collection of vibracores must be completed prior to commencing seabed disturbing activities.

ii. Open-Source GIS and Story Maps. The lessee will fulfill the following commitments in accordance with Attachment 3: consultation with the Tribes to determine the appropriate open-source GIS platform; review of candidate datasets and attributes for inclusion in the GIS; data integration; development of custom reports or queries to assist in future research or tribal maintenance of the GIS; work Sessions with consulting Tribes to develop Story Maps content, and inclusion of stories associated with other federally recognized Tribes; training session with Tribes to review GIS functionality; review of Draft Story Maps with Tribes; delivery of GIS to Tribes; and delivery of Final Story Maps. Signatories will be notified of completion of this measure. This measure may be completed during or post-construction.

iii. ASLF Post-Construction Seafloor Impact Inspection. The lessee will fulfill the following commitments in accordance with Attachment 3: development of a 3D model throughout ASLFs designated for review; development of the remotely operated vehicle (ROV) investigation methodology, including consultation with BOEM; ROV inspection of the seafloor along impacted portions of the selected ASLFs; review of candidate datasets and attributes for inclusion in the GIS; delivery of data interpretive technical report draft; delivery of final technical report. The lessee will provide consulting Tribes and BOEM, draft and final technical reports including 3D models and resulting seafloor impact assessments. Signatories will be notified of completion of this measure. This measure must be completed as early as possible and no later than one-month post-construction. If unanticipated issues arise during the course of offshore construction that prevent this measure from being completed within one-month post-construction, the lessee must notify BOEM and propose an alternate completion timeframe for consulting Tribes and BOEM approval.

iv. Ethnographic Study. The lessee will fulfill the following commitments in accordance with Attachment 3: funding ethnographic researcher selected by DTI for 2-year period;

funding for researcher travel to New Jersey for research and site visits; funding for Delaware Tribe of Indians, Delaware Nation, and Stockbridge Munsee technology upgrades associated with analysis of GIS data; funding for Delaware Tribe of Indians historic preservation oversight and indirect costs; funding for Stockbridge-Munsee Community Band of Mohican Indians THPO collaboration; provide relevant ASLF GIS data layers to Delaware Tribe of Indians for use in this study as well as provide a tutorial on the data; hold quarterly progress update calls lasting approximately one-half hour with Delaware Tribe of Indians until the final technical reports are issued; delivery of Final deliverables consisting of one confidential report that may contain sensitive resource information and one report that could be made available to the public (both reports will be distributed by the Tribes, at their discretion); and funding for a presentation to highlight the results of the study to be coordinated and executed by Delaware Tribe of Indians. Other consulting parties will be notified of completion of this measure. This measure may be completed pre, during or post-construction.

B. Visual APE

1. BOEM will include the following as conditions of approval of the Ocean Wind 1 COP and as mitigation measures to resolve the adverse effects, including direct, indirect, and cumulative effects, to the 17 historic properties that will be visually adversely affected (Brigantine Hotel, Brigantine City, Atlantic County; Absecon Lighthouse, Atlantic City, Atlantic County; Atlantic City Boardwalk, Atlantic City, Atlantic County; Atlantic City Convention Hall, Atlantic City, Atlantic County; Ritz-Carlton Hotel, Atlantic City, Atlantic County; Riviera Apartments, Atlantic City, Atlantic County; Vassar Square Condominiums, Ventnor City, Atlantic County; House at 114 South Harvard Avenue, Ventnor City, Atlantic County; Lucy the Margate Elephant, Margate City, Atlantic County; Great Egg Coast Guard Station, Longport Borough, Atlantic County; Ocean City Boardwalk, Ocean City, Cape May County; Ocean City Music Pier, Ocean City, Cape May County; Hereford Lighthouse, North Wildwood, Cape May County; North Wildwood Life Saving Station, North Wildwood, Cape May County; U.S. Lifesaving Station #35, Stone Harbor Borough, Cape May County; Flanders Hotel, Ocean City, Cape May County; and Little Egg Harbor U.S. Life Saving Station #23 (U.S. Coast Guard Station #119), Little Egg Harbor Township, Ocean County). See Attachment 8 for proposed budgets for each mitigation effort, reflecting good faith estimates, based on the experience of qualified consultants with similar activities and comparable historic properties. Tasks associated with the Historic Context Mitigation Measures can occur during and/or after construction. Mitigation measures under III.B.1 must be completed within four years of MOA execution, unless a different timeline is agreed upon by Participating Parties and accepted by BOEM and may be completed simultaneously, as applicable. The lessee will fund mitigation measures in accordance with Attachment 4 (Historic Properties Treatment Plan for the Ocean Wind 1 Offshore Wind Farm Project Historic Properties Subject to Adverse Effects Cape May and Atlantic Counties, New Jersey) and the following:

   i. Multi-property and Multi-county Mitigation Measures

      a. Historic Context addressing early 20th century New Jersey Shore Hotels. To resolve adverse effects to Brigantine Hotel, Atlantic County, Ritz-Carlton Hotel, Atlantic County, and Flanders Hotel, Cape May County, the lessee will coordinate with BOEM to consult with New Jersey SHPO and interested Consulting Parties and property owners to determine what properties or areas will be the subject of the historic context and appropriate information to include.

b. Historic Context addressing Mid-century High-rise residential buildings at the New Jersey shore. To resolve adverse effects on Riviera Apartments, Atlantic City, Atlantic County and Vassar Square Condominiums, Ventnor City, Atlantic County, the lessee will coordinate with BOEM to consult with New Jersey SHPO and interested Consulting Parties and property owners to determine what properties or areas will be the subject of the historic context and appropriate information to include.

c. Historic Context addressing Boardwalks of the New Jersey Shore, with Surveys and Evaluations of Atlantic City Boardwalk, Ocean City Boardwalk, and Wildwood Boardwalk. To resolve adverse effects on Atlantic City Boardwalk, and Ocean City Boardwalk, the lessee will prepare a historic context and complete surveys and evaluations of Atlantic City boardwalk, Ocean City boardwalk, and Wildwood boardwalk. The historic context will consider significance of historic boardwalks as potential cultural landscapes. the lessee, in coordination with BOEM, will consult with New Jersey SHPO and interested Consulting Parties and property owners to determine what properties or areas will be the subject of survey and evaluation, and appropriate information to include.

ii. Lucy the Margate Elephant. The lessee agrees to the following measures:

1) Funding for Visitor Experience and Public Access for Lucy the Margate Elephant. The lessee will: determine priority projects in collaboration with the representatives for the property owner; use already available plans or develop plans appropriate to the identified project, and submit plans for review by BOEM and representatives of the property owner; take necessary steps to ensure the project is carried out by qualified contractors, including staff who meet SOI Professional Qualifications for Architecture or Architectural History, who will execute plans; and take necessary steps to ensure planned work is completed. The lessee will fund these activities consistent with Attachment 8.

iii. Atlantic County Historic Properties Mitigation

a. Absecon Lighthouse, Atlantic City, Atlantic County.

1) Funding for Visitor Experience and Public Access for Absecon Lighthouse. The lessee will: determine priority projects in collaboration with the representatives for the property owner; use already available plans or develop plans appropriate to the identified project, and submit plans for review by BOEM and representatives of the property owner; take necessary steps to ensure the project is carried out by qualified contractors, including staff who meet SOI Professional Qualifications for Architecture or Architectural History, who will execute plans; and take necessary steps to ensure planned work is completed. The lessee will fund these activities consistent with Attachment 8.

b. Atlantic City Boardwalk, Atlantic City, Atlantic County.

1) Funding for Visitor Experience and Public Access for Atlantic City Boardwalk. The lessee will: determine priority projects in collaboration with the representatives for the property owner; use already available plans or develop plans appropriate to the identified project, and submit plans for review by BOEM and representatives of the property owner; take necessary steps to ensure the project is carried out by qualified contractors, including staff who meet SOI Professional Qualifications for Architecture or Architectural History, who will execute plans; and take necessary steps to ensure planned work is completed. The lessee will fund these activities consistent with Attachment 8.

C. Mitigation Fund

1. The lessee will contribute funding to the mitigation fund to resolve visual adverse effects to the following 14 historic properties: Brigantine Hotel, Brigantine City, Atlantic County; Atlantic City Convention Hall, Atlantic City, Atlantic County; Ritz-Carlton Hotel, Atlantic City, Atlantic County; Riviera Apartments, Atlantic City, Atlantic County; Vassar Square Condominiums, Ventnor City, Atlantic County; House at 114 South Harvard Avenue, Ventnor City, Atlantic County; Great Egg Coast Guard Station, Longport Borough, Atlantic County; Ocean City Boardwalk, Ocean City, Cape May County; Ocean City Music Pier, Ocean City, Cape May County; Hereford Lighthouse, North Wildwood, Cape May County; North Wildwood Life Saving Station, North Wildwood, Cape May County; U.S. Lifesaving Station #35, Stone Harbor Borough, Cape May County; Flanders Hotel, Ocean City, Cape May County; and Little Egg Harbor U.S. Life Saving Station #23 (U.S. Coast Guard Station #119), Little Egg Harbor Township, Ocean County). See Attachment 8 for funding amounts, based on input of qualified consultants with experience fulfilling activities similar to those that can be funded through the mitigation fund and for historic properties comparable to those adversely effected by the Project.

2. In order to mitigate the undertaking's adverse visual impacts to historic properties, the lessee must provide the amount of $1,080,000 in support of historic preservation and public interpretive and commemorative activities, which is the total amount of the cost estimates in Attachment 8 of this MOA for visually adversely affected historic properties other than the historic properties mentioned in Stipulations III.B.1.ii and III.B.1.iii. The measures listed in Attachment 8 were proposed by the lessee and included in draft documents BOEM circulated to consulting parties and included in the appendix to the Ocean Wind 1 Draft EIS. These measures are appropriate to fully address the nature, scope, size, and magnitude of adverse effects including cumulative effects caused by the Project, NRHP-qualifying characteristics of each historic property that would be affected, and the heightened significance and concerns of the NHLs. In the specific context of this undertaking, including the numerous privately owned properties involved, the signatories agree that it is appropriate to provide flexibility to implement these or other specific activities for preservation, interpretation, and commemoration to mitigate adverse effects to historic properties, and the signatories agree that the level of funding identified in Attachment 8 is appropriate.

3. Within 90 days of initiating offshore construction of wind turbines the lessee must pay this amount to an escrow account. Those funds will be deposited into a fund which will be managed by a third-party administrator for the purpose of providing grants until the fund balance is expended. The lessee's deposit of such funds into this fund will satisfy the lessee's

obligations as it relates to mitigation for adverse visual impacts to the historic properties listed in Stipulation III.C.1, unless additional consultation is required in the event of unallocated funds, as described below. These grants are to support mitigation activities for the preservation, interpretation, or commemoration of historic sites, buildings, or events. Grants will be awarded for the long-term protection, preservation, and commemoration of adversely affected historical properties in the following order of preference. Grants must first be awarded to the historic properties listed in Stipulation III.C.1. If after 2 years from the date the administrator begins accepting grant applications there are funds still unapplied, then grants should be awarded for activities for any adversely affected historic property identified in Appendix N, Finding of Effect.

4. If after five years from the date the administrator begins accepting applications any funds are unallocated, then BOEM will consult with the consulting parties on appropriate use of the remaining funds to resolve adverse effects. The signatories agree that the existence of unapplied funds does not constitute a breach of this agreement.

5. BOEM and the lessee will identify an appropriate non-profit or governmental historic preservation organization, such as New Jersey Historic Trust or another similarly situated entity, to administer the fund and the funded activities, to ensure the effectiveness of these activities as mitigation for the undertaking's adverse effect to the historic properties. The 3rd party administrator shall consult with BOEM and the NJHPO prior to making any grants. The 3rd party administrator's fees and administrative costs will be paid from the fund and must not exceed 6% of the fund amount. The 3rd party administrator must ensure that all granted funds are used exclusively for the purposes described in Stipulation III.C for direct costs of preservation, interpretation, or commemoration of the historic properties adversely affected by the undertaking and the mitigation fund administrative must prohibit the use of grant funds for indirect costs, such as accountant fees, employee salary or benefits or legal fees. BOEM and the lessee will consult on the selection of this fund administrator with the consulting parties and must be acceptable to BOEM. The same consultation process would be followed in the case of replacement of a fund administrator, if needed. BOEM will consult with the third-party administrator to develop operating procedures for the mitigation fund, and BOEM will review and approve the final operating procedures. BOEM will ensure that the 3rd party administrator has procedures under which it will provide a copy of all grants made and an annual report on expenditure of funds and activities to BOEM, HPO and the lessee. Funded mitigation activities, progress, completion, and outcomes will also be provided in the annual report per Stipulation XV, with sufficient detail for BOEM to ensure that the mitigation is being implemented according to this section.

6. BOEM will ensure that the operating procedures include the following: Where Historic Architectural Building Survey documentation and HABS-like documentation mitigation is implemented, the grantee shall first consult with historic property owner to identify photographic documentation specifications. Where Historic Structure Report mitigation is implemented, the documentation shall be prepared in accordance with the Historic Structure Reports and Preservation Plans: A Preparation Guide – Second Edition, as may be amended, and the project team must include an individual meeting the Secretary of Interior's qualifications standards for Historic Architecture. Where applicable, such as funding for visitor experience, public access and climate resiliency is implemented all projects must meeting the Secretary of Interior standards for the Treatment of Historic Properties and these projects should not constitute adverse effects themselves on the historic properties.

7. Consistent with NHPA Sec. 110(f) and as described in Appendix N, Finding of Effect, BOEM has undertaking planning and actions as may be necessary to minimize harm to

NHLs. The mitigation funding for NHLs under this MOA does not replace BOEM's any other planning and actions BOEM has taken to comply with that statutory requirement.

IV. PHASED IDENTIFICATION

A. Information pertaining to identification of historic properties within certain portions of the Marine APE related to Alternatives B-1, B-2, C-1, C-2, and D will not be available until after the ROD is issued and the COP is approved. If Alternative B-1, B-2, C-1, C-2, or D is selected, BOEM will implement the following consultation steps for phased identification and evaluation of historic properties within the Marine APE in accordance with BOEM's existing *Guidelines for Providing Archaeological and Historic Property Information Pursuant to Title 30 Code of Federal Regulations Part 585*. Survey efforts shall comply with the New Jersey Historic Preservation Office Requirements for Phase I Archaeological Survey at N.J.A.C. 7:4-8.4. Reports of archaeological survey results shall conform to the Requirements for Archaeological Survey Reports - Standards for Report Sufficiency at N.J.A.C. 7:4-8.5. The final identification and evaluation of historic properties within the APE may occur after publication of the Draft EIS, but prior to the initiation of construction. In this circumstance, the Signatories agree that the following describes how BOEM will conduct phased identification and of historic properties, pursuant to 36 CFR § 800.4(b)(2).

1. If Alternative C-1 is selected, previously un-surveyed areas associated with one WTG and potentially the inter-array cable routing may need to be surveyed for marine archaeology. If Alternative C-2 is selected, previously un-surveyed areas associated with 22 WTG positions and potentially the inter-array cable routing may need to be surveyed for marine archaeology. If Alternative B-1, B-2, or D is selected, previously un-surveyed areas associated with the inter-array cable may need to be surveyed for marine archaeology.

2. For identification of historic properties within the marine archaeological, portions of the APE, supplemental technical studies will be conducted by the lessee in accordance with state guidelines and recommendations presented in BOEM's most recent *Guidelines*. The developer will coordinate with the SHPO prior to the initiation of any such identification efforts.

    i. BOEM will require that identification efforts for historic properties associated with marine archaeology be documented in a technical report that addresses the identification of historic properties and includes an evaluation of effects due to the Project.

3. BOEM will consult on the results of historic property identification surveys for any portions of the APE that were not addressed in the pre-COP approval consultations.

4. BOEM will treat all identified potential historic properties as eligible for inclusion in the NRHP unless BOEM determines, and the SHPO agrees, that a property is ineligible, pursuant to 36 CFR § 800.4I.

5. If effects on identified historic properties cannot be avoided, BOEM will evaluate the NRHP eligibility of the potentially affected properties, in accordance with 36 CFR § 800.4(c).

6. If BOEM identifies no additional historic properties or determines that no historic properties are adversely affected due to the selection of one of these alternatives, BOEM, with the assistance of the lessee, will notify and consult with the signatories, invited signatories, and consulting parties following the consultation process set forth here in this stipulation.

    a. BOEM, with the assistance of the lessee, will notify all the signatories, invited signatories, and consulting parties about the selected alternative and BOEM's determination by providing a written summary of the alternative including any maps, a summary of the surveys and/or research conducted to identify historic properties and assess effects, and copies of the surveys.

    b. BOEM, with the assistance of the lessee, will allow the signatories, invited signatories, and consulting parties 30 calendar days to review and comment on the survey reports, the results of the surveys, BOEM's determination, and the documents.

    c. After the 30-calendar review period has concluded and no comments require additional consultation, BOEM with the assistance of the lessee, will notify the signatories and consulting parties that the NJHPO has concurred with BOEM's determination, if they received any comments, provide a summary of the comments and BOEM's responses.

    d. BOEM, with the assistance of the lessee, will conduct any consultation meetings if requested by the signatories or consulting parties.

    e. This MOA will not need to be amended if no additional historic properties are identified and/or adversely affected.

7. If BOEM determines new adverse effects to historic properties will occur due to the selection of one of these alternatives, BOEM with the assistance of the lessee will notify and consult with the signatories, invited signatories, and consulting parties regarding BOEM's finding and the proposed measures to resolve the adverse effect(s) including the development of a new treatment plan(s) following the consultation process set forth here in this stipulation.

    i. BOEM, with the assistance of the lessee, will notify all signatories, invited signatories, and consulting parties about the selected alternative and BOEM's determination by providing a written summary of the alternative including any maps, a summary of the surveys and/or research conducted to identify historic properties and assess effects, copies of the surveys, BOEM's determination, and the proposed resolution measures for the adverse effect(s).

    ii. The signatories, invited signatories, and consulting parties will have 30 calendar days to review and comment on the documents including the adverse effect finding and the proposed resolution of adverse effect(s), including a draft treatment plan(s).

    iii. BOEM, with the assistance of the lessee, will conduct additional consultation meetings, if necessary, during consultation on the adverse effect finding and during drafting and finalization of the treatment plan(s).

    iv. BOEM, with the assistance of the lessee, will respond to the comments and make necessary edits to the documents.

    v. BOEM, with the assistance of the lessee, will send the revised draft final documents to the other signatories, invited signatories, and consulting parties for review and comment during a 30-calendar day review and comment period. With this same submittal of draft final documents, the lessee will provide a summary of all the comments received on the documents and BOEM's responses.

vi. BOEM, with the assistance of the lessee, will respond to the comments on the draft final documents and make necessary edits to the documents.

vii. BOEM, with the assistance of the lessee, will notify all the signatories, invited signatories, and consulting parties and provide the final document(s) including the final treatment plan(s) and a summary of comments and BOEM's responses to comments, if they receive any on the draft final documents, after BOEM has received concurrence from the New Jersey SHPO on the finding of new adverse effect(s), and BOEM has accepted the final treatment plan(s).

viii. The MOA will not need to be amended after the treatment plan(s) is accepted by BOEM.

8. If a SHPO disagrees with BOEM's determination regarding whether an affected property is eligible for inclusion in the NRHP, or if the ACHP or the Secretary so request, the agency official will obtain a determination of eligibility from the Secretary pursuant to 36 CFR Part 63 (36 CFR § 800.4(c)(2)).

V. VIBRATION MONITORING

A. If the 5th Street cable route option for BL England interconnection is selected by the lessee as the preferred cable route, BOEM will require the lessee to:

1. Employ the expertise of a qualified vibration expert to identify construction approaches to avoid or minimize vibration impacts to foundations of historic properties adjacent to right-of-way construction areas for the 5th Street cable route option. BOEM and the lessee will offer SHPO an opportunity to review and comment on these construction approaches.

2. Avoid instances of slate sidewalk remnants in the Ocean City Historic District, or remove them prior to construction activities and replace them following completion of construction activities.

3. Prepare and implement a Vibration Monitoring Plan that will identify:

i. Construction means and methods to avoid or minimize vibration impacts and how they will be carried out in such a way as to ensure vibrations do not reach a level that causes structural or architectural damage to historic properties.

ii. Process for identification of historic properties adjacent to the 5th Street cable route option that are potentially vulnerable to vibration, as well as required qualifications for vibration expert conducting vulnerability assessment, process for describing the results of this assessment, and process for making the findings of this assessment available to consulting parties.

iii. Approach to perform a condition assessment on potentially vulnerable properties adjacent to the cable route prior to construction and again when construction of the cable route is complete.

iv. If damage is identified by the owner of a potentially vulnerable property during construction, the process for how property owners will be able to notify the lessee, including establishment of a reasonable period within which the lessee will respond. If onshore cable route construction activities are resulting in structure or architectural damage to historic properties, the lessee will stop construction until appropriate safeguards can be put in place.

v. Process for temporary removal of slate sidewalk remnants prior to construction and replacement of slate sidewalk remnants after construction and how the process will be carried out in such a way as to ensure construction activities will not damage these features of the Ocean City Historic District.

B. If any structural or architectural damage to historic properties occurs during cable route construction, the lessee will be required to assess the cause of the damage, identify and provide for any necessary repairs, consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties. BOEM with the assistance of the lessee will notify and consult with the signatories, invited signatories, and consulting parties regarding instances of damage and repair. BOEM will offer SHPO the opportunity to review and comment on the consistency of any repairs with the Standards.

VI. REVIEW PROCESS FOR DOCUMENTS

A. The following process will be used for any document, report, or plan produced in accordance with Stipulations I–XIII of this MOA:

1. Draft Document

i. The lessee shall provide the document to BOEM for technical review and approval.

a. BOEM has 15 calendar days to complete its technical review.

b. If BOEM does not provide approval, it shall submit its comments back to the lessee, who will have 15 calendar days to address the comments.

ii. BOEM, with the assistance of the lessee, shall provide the draft document to consulting parties, except the ACHP, for review and comment.

a. Consulting parties shall have 30 calendar days to review and comment.

b. BOEM, with the assistance of the lessee, shall coordinate a meeting with consulting parties to facilitate comments on the document if requested by a consulting party.

c. BOEM shall consolidate comments received and provide them to the lessee within 15 calendar days of receiving comments from consulting parties.

d. BOEM, with the assistance of the lessee, will respond to the comments and make necessary edits to the documents.

2. Draft Final Document

i. The lessee shall provide BOEM with the draft final document for technical review and approval.

a. BOEM has 15 calendar days to complete its technical review.

b. If BOEM does not provide approval, it shall submit its comments back to the lessee, who will have 15 calendar days to address the comments.

ii. BOEM, with the assistance of the lessee, shall provide the draft final document to consulting parties, except the ACHP, for review and comment. With this same submittal of draft final documents, the lessee will provide a summary of all the comments received on the documents and BOEM's responses.

a. Consulting parties have 30 calendar days to review and comment.

b. BOEM, with the assistance of the lessee, shall coordinate a meeting with consulting parties to facilitate comments on the document if requested by a consulting party.

c. BOEM shall consolidate comments received and provide them to the lessee within 15 calendar days of receiving comments from consulting parties.

d. BOEM, with the assistance of the lessee, will respond to the comments and make necessary edits to the documents.

3. Final Document

i. The lessee shall provide BOEM with the final document for approval.

a. BOEM has 15 calendar days to complete its technical review.

b. If BOEM does not provide approval, it shall submit its comments back to the lessee, who will have 15 calendar days to address the comments.

c. BOEM, with the assistance of the lessee, shall provide the final document to consulting parties, except the ACHP, within 30 calendar days of approving the final document. With this same submittal of final documents, the lessee will provide a summary of all the comments received on the documents and BOEM's responses.

VII. SUBMISSION OF DOCUMENTS

A. New Jersey SHPO, ACHP, NPS, Tribes, and Consulting Parties

1. All submittals to the New Jersey SHPO, ACHP, NPS, Tribes, and consulting parties will be submitted electronically unless a specific request is made for the submittal be provided in paper format.

VIII. PROJECT MODIFICATIONS

A. If the lessee proposes any modifications to the Project that expands the Project beyond the Project Design Envelope included in the COP and/or occurs outside the defined APEs or the proposed modifications change BOEM's final Section 106 determinations and findings for this Project, the lessee shall notify and provide BOEM with information concerning the proposed modifications. BOEM will determine if these modifications require alteration of the conclusions reached in the Finding of Effect and, thus, will require additional consultation with the signatories, invited signatories and consulting parties. If BOEM determines additional consultation is required, the lessee will provide the signatories, invited signatories, and consulting parties with the information concerning the proposed changes, and they will have 30 calendar days from receipt of this information to comment on the proposed changes. BOEM shall take into account any comments from signatories, invited signatories, and consulting parties prior to agreeing to any proposed changes. Using the procedure below, BOEM will, as necessary, consult with the signatories, invited signatories, and consulting parties to identify and evaluate historic properties in any newly affected areas, assess the effects of the modification, and resolve any adverse effects.

1. If the Project is modified and BOEM identifies no additional historic properties or determines that no historic properties are adversely affected due to the modification, BOEM, with the assistance of the lessee, will notify and consult with the signatories, invited signatories, and consulting parties following the consultation process set forth in this Stipulation VII.A.1.

   i. The lessee will notify all the signatories, invited signatories, and consulting parties about this proposed change and BOEM's determination by providing a written summary of the project modification including any maps, a summary of any additional surveys and/or research conducted to identify historic properties and assess effects, and copies of the surveys.

   ii. BOEM and the lessee will allow the signatories, invited signatories, and consulting parties 30 calendar days to review and comment on the proposed change, BOEM's determination, and the documents.

   iii. After the 30-calendar review period has concluded and no comments require additional consultation, the lessee will notify the signatories and consulting parties that BOEM has approved the project modification and, if they received any comments, provide a summary of the comments and BOEM's responses.

   iv. BOEM, with the assistance of the lessee, will conduct any consultation meetings if requested by the signatories or consulting parties.

   v. This MOA will not need to be amended if no additional historic properties are identified and/or adversely affected.

2. If BOEM determines new adverse effects to historic properties will occur due to a Project modification, BOEM with the assistance of the lessee will notify and consult with the signatories, invited signatories, and consulting parties regarding BOEM's finding and the proposed measures to resolve the adverse effect(s) including the development of a new treatment plan(s) following the consultation process set forth in this Stipulation VII.A.2.

   i. The lessee will notify all signatories, invited signatories, and consulting parties about this proposed modification, BOEM's determination, and the proposed resolution measures for the adverse effect(s).

   ii. The signatories, invited signatories, and consulting parties will have 30 calendar days to review and comment on the adverse effect finding and the proposed resolution of adverse effect(s), including a draft treatment plan(s).

   iii. BOEM, with the assistance of the lessee, will conduct additional consultation meetings, if necessary, during consultation on the adverse effect finding and during drafting and finalization of the treatment plan(s).

   iv. BOEM, with the assistance of the lessee, will respond to the comments and make necessary edits to the documents.

   v. The lessee will send the revised draft final documents to the other signatories, invited signatories, and consulting parties for review and comment during a 30-calendar day review and comment period. With this same submittal of draft final documents, the lessee will provide a summary of all the comments received on the documents and BOEM's responses.

vi. BOEM, with the assistance of the lessee, will respond to the comments on the draft final documents and make necessary edits to the documents.

vii. The lessee will notify all the signatories, invited signatories, and consulting parties that BOEM has approved the project modification and will provide the final document(s) including the final treatment plan(s) and a summary of comments and BOEM's responses to comments, if they receive any on the draft final documents, after BOEM has received concurrence from the New Jersey SHPO on the finding of new adverse effect(s), BOEM has accepted the final treatment plan(s), and BOEM has approved the Project modification.

viii. The MOA will not need to be amended after the treatment plan(s) is accepted by BOEM.

3. If any of the signatories, invited signatories, or consulting parties object to determinations, findings, or resolutions made pursuant to these measures (Stipulation VII.A.1 and 2), BOEM will resolve any such objections pursuant to the dispute resolution process set forth Stipulation XIII.

IX. CURATION

A. Collections from federal lands or the OCS:

1. Any archaeological materials removed from federal lands or the OCS as a result of the actions required by this MOA shall be curated in accordance with 36 CFR 79, "Curation of Federally Owned and Administered Archaeological Collections," ACHP's "Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites" published in the Federal Register (64 Fed. Reg. 27085-27087 (May 18, 1999)), or other provisions agreed to by the consulting parties and following applicable State guidelines. No excavation should be initiated before acceptance and approval of a curation plan.

B. Collections from state, local government, and private lands:

1. Archaeological materials from state or local government lands in the APE and the records and documentation associated with these materials shall be curated within the state of their origin at a repository preferred by the NJHPO, or an approved and certified repository, in accordance with the standards and guidelines required by the NJHPO. Lands as described here may include the seafloor in state waters. No excavation should be initiated before acceptance and approval of a curation plan.

2. Collections from private lands that would remain private property: In cases where archaeological survey and testing are conducted on private land, any recovered collections remain the property of the land owner. In such instances, BOEM and the lessee, in coordination with the SHPO, and affected Tribe(s), will encourage land owners to donate the collection(s) to an appropriate public or Tribal entity. To the extent a private landowner requests that the materials be removed from the site, the lessee will seek to have the materials donated to the repository identified under Stipulation VII.B.1 through a written donation agreement developed in consultation with the consulting parties. BOEM, assisted by the lessee, will seek to have all materials from each state curated together in the same curation facility within the state of origin. In cases where the property owner wishes to transfer ownership of the collection(s) to a public or Tribal entity, BOEM and the lessee will ensure

that recovered artifacts and related documentation are curated in a suitable repository as agreed to by BOEM, NJHPO, and affected Tribe(s), and following applicable State guidelines. To the extent feasible, the materials and records resulting from the actions required by this MOA for private lands, shall be curated in accordance with 36 CFR 79. No excavation should be initiated before acceptance and approval of a curation plan.

X. PROFESSIONAL STANDARDS AND QUALIFICATIONS

A. Secretary's Standards for Archaeology and Historic Preservation. The lessee will ensure that all work carried out pursuant to this MOA will meet the SOI Standards for Archaeology and Historic Preservation, 48 FR 44716 (September 29, 1983), taking into account the suggested approaches to new construction in the SOI's Standards for Rehabilitation.

B. SOI Professional Qualifications Standards. The lessee will ensure that all work carried out pursuant to this MOA is performed by or under the direction supervision of historic preservation professionals who meet the SOI's Professional Qualifications Standards (48 FR 44738-44739). A "qualified professional" is a person who meets the relevant standards outlined in such SOI's Standards. BOEM, or its designee, will ensure that consultants retained for services pursuant to the MOA meet these standards.

C. Investigations of ASLFs. The lessee will ensure that the additional investigations of ASLFs will be conducted and reports and other materials produced by one or more qualified marine archaeologists and geological specialists who meet the SOI's Professional Qualifications Standards and has experience both in conducting High Resolution Geophysical (HRG) surveys and processing and interpreting the resulting data for archaeological potential, as well as collecting, subsampling, and analyzing cores.

D. Tribal Consultation Experience. The lessee will ensure that all work carried out pursuant to this MOA that requires consultation with Tribes is performed by professionals who have demonstrated professional experience consulting with federally recognized Tribes.

XI. DURATION

A. This MOA will expire at (1) the decommissioning of the Project in the lease area, as defined in the lessee's lease with BOEM (Lease Number OCS-A 0498) or (2) 25-years from the date of COP approval, whichever occurs first. Prior to such time, BOEM may consult with the other signatories and invited signatories to reconsider the terms of the MOA and amend it in accordance with Amendment Stipulation (Stipulation XIV).

XII. TERRESTRIAL ARCHAEOLOGICAL MONITORING

A. Implementation of Terrestrial Archaeological Monitoring Plan. The lessee will implement the archaeological monitoring plan found in Attachment 5 (Terrestrial Archaeological Monitoring Plan), which applies to areas identified for archaeological monitoring.

B. In the event of a post-review discovery during archaeological monitoring, the process identified under Stipulation XII. Post-Review Discoveries will apply.

XIII. POST-REVIEW DISCOVERIES

A. Implementation of Post-Review Discovery Plans. If properties are discovered that may be historically significant or unanticipated effects on historic properties found, BOEM with the assistance of the lessee shall implement the post-review discovery plans found in Attachment 6

(Post-Review Discovery Plan for Submerged Cultural Resources for the Ocean Wind 1 Offshore Wind Farm for Lease OCF A-0498 Construction and Operations Plan) and Attachment 7 (Post-Review Discovery Plan for Terrestrial Cultural Resources for the Ocean Wind 1 Offshore Wind Farm for Lease OCF A-0498 Construction and Operations Plan).

1. The signatories acknowledge and agree that it is possible that additional historic properties may be discovered during implementation of the Project, despite the completion of a good faith effort to identify historic properties throughout the APEs.

B. <u>All Post-Review Discoveries</u>. In the event of a post-review discovery of a property or unanticipated effects to a historic property prior to or during construction, operation, maintenance, or decommissioning of the Project, the lessee will implement the following actions which are consistent with the post-review discovery plan:

1. Immediately halt all ground- or seafloor-disturbing activities within the area of discovery;

2. Notify BOEM in writing via report within 72 hours of the discovery;

3. Keep the location of the discovery confidential and take no action that may adversely affect the discovered property until BOEM or its designee has made an evaluation and instructs the lessee on how to proceed; and

4. Conduct any additional investigations as directed by BOEM or its designee to determine if the resource is eligible for listing in the NRHP (30 CFR 585.702(b)). BOEM will direct the lessee to complete additional investigations, as BOEM deems appropriate, if:

   i. the site has been impacted by the lessee Project activities; or

   ii. impacts to the site from the lessee Project activities cannot be avoided.

5. If investigations indicate that the resource is eligible for the NRHP, BOEM, with the assistance of the lessee, will work with the other relevant signatories, invited signatories, and consulting parties to this MOA who have a demonstrated interest in the affected historic property and on the further avoidance, minimization or mitigation of adverse effects.

6. If there is any evidence that the discovery is from an indigenous society or appears to be a preserved burial site, the lessee will contact the Tribes as identified in the notification lists included in the post-review discovery plans within 72 hours of the discovery with details of what is known about the discovery, and consult with the Tribes pursuant to the post review discovery plan.

7. If BOEM incurs costs in addressing the discovery, under Section 110(g) of the NHPA, BOEM may charge the lessee reasonable costs for carrying out historic preservation responsibilities, pursuant to its delegated authority under the OCS Lands Act (30 CFR 585.702 (c-d)).

XIV. EMERGENCY SITUATIONS

A. In the event of an emergency or disaster that is declared by the President or the Governor of New Jersey, which represents an imminent threat to public health or safety, or creates a hazardous condition due to impacts from this Project's infrastructure damaged during the emergency and affecting historic properties in the APEs, BOEM with the assistance of the lessee will notify the consulting Tribes, SHPO, and the ACHP of the condition which has initiated the situation and the measures taken to respond to the emergency or hazardous condition. BOEM will make this notification as soon as reasonably possible, but no later than 48 hours from when it becomes aware of the emergency or disaster. Should the consulting Tribes, SHPO, or the ACHP desire to provide technical assistance to BOEM, they shall submit comments within seven calendar days from notification if the nature of the emergency or hazardous condition allows for such coordination.

XV. MONITORING AND REPORTING

At the beginning of each calendar year by January 31, following the execution of this MOA until it expires or is terminated, the lessee will prepare and, following BOEM's review and agreement to share this summary report, provide all signatories, invited signatories, and consulting parties to this MOA a summary report detailing work undertaken pursuant to the MOA. Such report shall include a description of how the stipulations relating to avoidance and minimization measures (Stipulations I and II) were implemented; any scheduling changes proposed; any problems encountered; and any disputes and objections received in BOEM's efforts to carry out the terms of this MOA. The lessee can satisfy its reporting requirement under this stipulation by providing the relevant portions of the annual compliance certification required under 30 CFR 285.633.If requested by the signatories, BOEM will convene an annual meeting with the other signatories, invited signatory, and consulting parties to discuss the annual report, the implementation of this MOA, and other requested topics.

XVI. DISPUTE RESOLUTION

A. Should any signatory, invited signatory, or consulting party to this MOA object at any time to any actions proposed or the manner in which the terms of this MOA are implemented, they must notify BOEM in writing of their objection. BOEM shall consult with such party to resolve the objection. If BOEM determines that such objection cannot be resolved, BOEM will:

1. Forward all documentation relevant to the dispute, including the BOEM's proposed resolution, to the ACHP. The ACHP shall provide BOEM with its advice on the resolution of the objection within 30 calendar days of receiving adequate documentation. Prior to reaching a final decision on the dispute, BOEM shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, signatories, invited signatories, and/or consulting parties, and provide them with a copy of this written response. BOEM will make a final decision and proceed accordingly.

2. If the ACHP does not provide its advice regarding the dispute within the 30 calendar-day time period, BOEM may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, BOEM shall prepare a written response that takes into account any timely comments regarding the dispute from the signatories, invited signatories, or consulting parties to the MOA, and provide them and the ACHP with a copy of such written response.

B. BOEM's responsibility to carry out all other actions subject to the terms of this MOA that are not the subject of the dispute remain unchanged.

C. At any time during the implementation of the measures stipulated in this MOA, should a member of the public object in writing to the signatories regarding the manner in which the measures stipulated in this MOA are being implemented, that signatory will notify BOEM. BOEM shall review the objection and may notify the other signatories as appropriate, and respond to the objector.

XVII. AMENDMENTS

A. This MOA may be amended when such an amendment is agreed to in writing by all signatories and invited signatories. The amendment will be effective on the date a copy signed by all of the signatories and invited signatories is filed with the ACHP.

B. Revisions to any attachment may be proposed by any signatory or invited signatory by submitting a draft of the proposed revisions to all signatories and invited signatories with a notification to the consulting parties. The signatories and invited signatories will consult for no more than 30 calendar days (or another time period agreed upon by all signatories and invited signatories) to consider the proposed revisions to the attachment. If the signatories and invited signatories unanimously agree to revise the attachment, BOEM will provide a copy of the revised attachment to the other signatories, invited signatories, and consulting parties. Revisions to any attachment to this MOA will not require an amendment to the MOA.

XVIII. TERMINATION

If any signatory or invited signatory to this MOA determines that its terms will not or cannot be carried out, that party shall immediately consult with the other signatories, invited signatories, and consulting parties to attempt to develop an amendment per Stipulation XIV. If within 30 calendar days (or another time period agreed to by all signatories) an amendment cannot be reached, any signatory or invited signatory may terminate the MOA upon written notification to the other signatories.

Once the MOA is terminated, and prior to work continuing on the undertaking, BOEM must either(a) execute an MOA pursuant to 36 CFR 800.6 or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR 800.7. BOEM shall notify the signatories and invited signatories as to the course of action it will pursue.

XIX. COORDINATION WITH OTHER FEDERAL AGENCIES

A. In the event that another federal agency not initially a party to or subject to this MOA receives an application for funding/license/permit for the undertaking as described in this MOA, that agency may fulfill its Section 106 responsibilities by stating in writing it concurs with the terms of this MOA and notifying the signatories and invited signatories that it intends to do so. Such federal agency may become a signatory, invited signatory, or a concurring party (collectively referred to as signing party) to the MOA as a means of complying with its responsibilities under Section 106 and based on its level of involvement in the undertaking. To become a signing party to the MOA, the agency official must provide written notice to the signatories and invited signatories that the agency agrees to the terms of the MOA, specifying the extent of the agency's intent to participate in the MOA. The participation of the agency is subject to approval by the signatories and invited signatories who must respond to the written notice within 30 calendar days or the approval will be considered implicit. Any necessary amendments to the MOA as a result will be considered in accordance with the Amendment Stipulation (Stipulation XIV).

B. Should the signatories and invited signatories approve the federal agency's request to be a signing party to this MOA, an amendment under Stipulation XIV will not be necessary if the federal agency's participation does not change the undertaking in a manner that would require any modifications to the stipulations set forth in this MOA. BOEM will document these conditions and involvement of the federal agency in a written notification to the signatories, invited signatories, and consulting parties, and include a copy of the federal agency's executed signature page, which will codify the addition of the federal agency as a signing party in lieu of an amendment.

XX. ANTI-DEFICIENCY ACT

Pursuant to 31 USC 1341(a)(1), nothing in this MOA will be construed as binding the United States to expend in any one fiscal year any sum in excess of appropriations made by Congress for this purpose, or to involve the United States in any contract or obligation for the further expenditure of money in excess of such appropriations.

Execution of this MOA by BOEM, the New Jersey SHPO, and the ACHP, and implementation of its terms evidence that BOEM has taken into account the effects of this undertaking on historic properties and afforded the ACHP an opportunity to comment.

[SIGNATURES COMMENCE ON FOLLOWING PAGE]

MEMORANDUM OF AGREEMENT
AMONG THE BUREAU OF OCEAN ENERGY MANAGEMENT,
THE NEW JERSEY STATE HISTORIC PRESERVATION OFFICER,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING THE OCEAN WIND OFFSHORE WIND FARM PROJECT

Signatory:

Bureau of Ocean Energy Management (BOEM)

_______________________________________ Date:_______________
Elizabeth A. Klein
Director
Bureau of Ocean Energy Management

MEMORANDUM OF AGREEMENT
AMONG THE BUREAU OF OCEAN ENERGY MANAGEMENT,
THE NEW JERSEY STATE HISTORIC PRESERVATION OFFICER,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING THE OCEAN WIND OFFSHORE WIND FARM PROJECT

Signatory:

New Jersey State Historic Preservation Officer (SHPO)

______________________________________ Date:_______________

Katherine J. Marcopul, Ph.D., CPM
Administrator and
Deputy State Historic Preservation Officer
New Jersey Department of Environmental Protection

**MEMORANDUM OF AGREEMENT
AMONG THE BUREAU OF OCEAN ENERGY MANAGEMENT,
THE NEW JERSEY STATE HISTORIC PRESERVATION OFFICER,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING THE OCEAN WIND OFFSHORE WIND FARM PROJECT**

Signatory:

Advisory Council on Historic Preservation (ACHP)

______________________________________ Date:_______________
Reid J. Nelson
Executive Director
Advisory Council on Historic Preservation

MEMORANDUM OF AGREEMENT
AMONG THE BUREAU OF OCEAN ENERGY MANAGEMENT,
THE NEW JERSEY STATE HISTORIC PRESERVATION OFFICER,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING THE OCEAN WIND OFFSHORE WIND FARM PROJECT

Invited Signatory:

Ocean Wind LLC (lessee)

_____________________________________ Date:_______________
Peter Allen
Head of Finance
Ocean Wind LLC

MEMORANDUM OF AGREEMENT
AMONG THE BUREAU OF OCEAN ENERGY MANAGEMENT,
THE NEW JERSEY STATE HISTORIC PRESERVATION OFFICER,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING THE OCEAN WIND OFFSHORE WIND FARM PROJECT

Concurring Party:

The Delaware Tribe of Indians

_____________________________________ Date:_______________
Brad KillsCrow
Chief
The Delaware Tribe of Indians

MEMORANDUM OF AGREEMENT
AMONG THE BUREAU OF OCEAN ENERGY MANAGEMENT,
THE NEW JERSEY STATE HISTORIC PRESERVATION OFFICER,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING THE OCEAN WIND OFFSHORE WIND FARM PROJECT

Concurring Party:

The Delaware Nation

_____________________________________ Date:_______________

Deborah Dotson
President of the Executive Committee
The Delaware Nation

MEMORANDUM OF AGREEMENT
AMONG THE BUREAU OF OCEAN ENERGY MANAGEMENT,
THE NEW JERSEY STATE HISTORIC PRESERVATION OFFICER,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING THE OCEAN WIND OFFSHORE WIND FARM PROJECT

Concurring Party:

The Stockbridge-Munsee Community Band of Mohican Indians

_____________________________________ Date:_______________

Shannon Holsey
President
The Stockbridge-Munsee Community Band of Mohican Indians

MEMORANDUM OF AGREEMENT
AMONG THE BUREAU OF OCEAN ENERGY MANAGEMENT,
THE NEW JERSEY STATE HISTORIC PRESERVATION OFFICER,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING THE OCEAN WIND OFFSHORE WIND FARM PROJECT

Concurring Party:

Organization

______________________________________ Date:_______________
Name
Title
Organization

MEMORANDUM OF AGREEMENT
AMONG THE BUREAU OF OCEAN ENERGY MANAGEMENT,
THE NEW JERSEY STATE HISTORIC PRESERVATION OFFICER,
AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING THE OCEAN WIND OFFSHORE WIND FARM PROJECT

LIST OF ATTACHMENTS TO THE MOA

ATTACHMENT 1 – APE MAPS

ATTACHMENT 2 – LISTS OF INVITED AND PARTICIPATING CONSULTING PARTIES

ATTACHMENT 3 – HISTORIC PROPERTY TREATMENT PLAN FOR THE OCEAN WIND 1 FARM ANCIENT SUBMERGED LANDFORM FEATURES, FEDERAL WATERS ON THE OUTER CONTINENTAL SHELF

ATTACHMENT 4 – HISTORIC PROPERTIES TREATMENT PLAN FOR THE OCEAN WIND 1 OFFSHORE WIND FARM PROJECT, HISTORIC PROPERTIES SUBJECT TO ADVERSE VISUAL EFFECT, CAPE MAY AND ATLANTIC COUNTIES, NEW JERSEY

ATTACHMENT 5 – TERRESTRIAL ARCHAEOLOGICAL MONITORING PLAN

ATTACHMENT 6 – POST-REVIEW DISCOVERY PLAN FOR SUBMERGED CULTURAL RESOURCES FOR THE OCEAN WIND 1 OFFSHORE WIND FARM FOR LEASE OCS A-0498 CONSTRUCTION AND OPERATIONS PLAN

ATTACHMENT 7 – POST-REVIEW DISCOVERY PLAN FOR TERRESTRIAL RESOURCES FOR THE OCEAN WIND 1 OFFSHORE WIND FARM FOR LEASE AREA OCS A-0498 CONSTRUCTION AND OPERATIONS PLAN

ATTACHMENT 8 – MITIGATION FUNDING AMOUNTS PROPOSED BY SIGNATORIES

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ATTACHMENT 1 – APE MAPS

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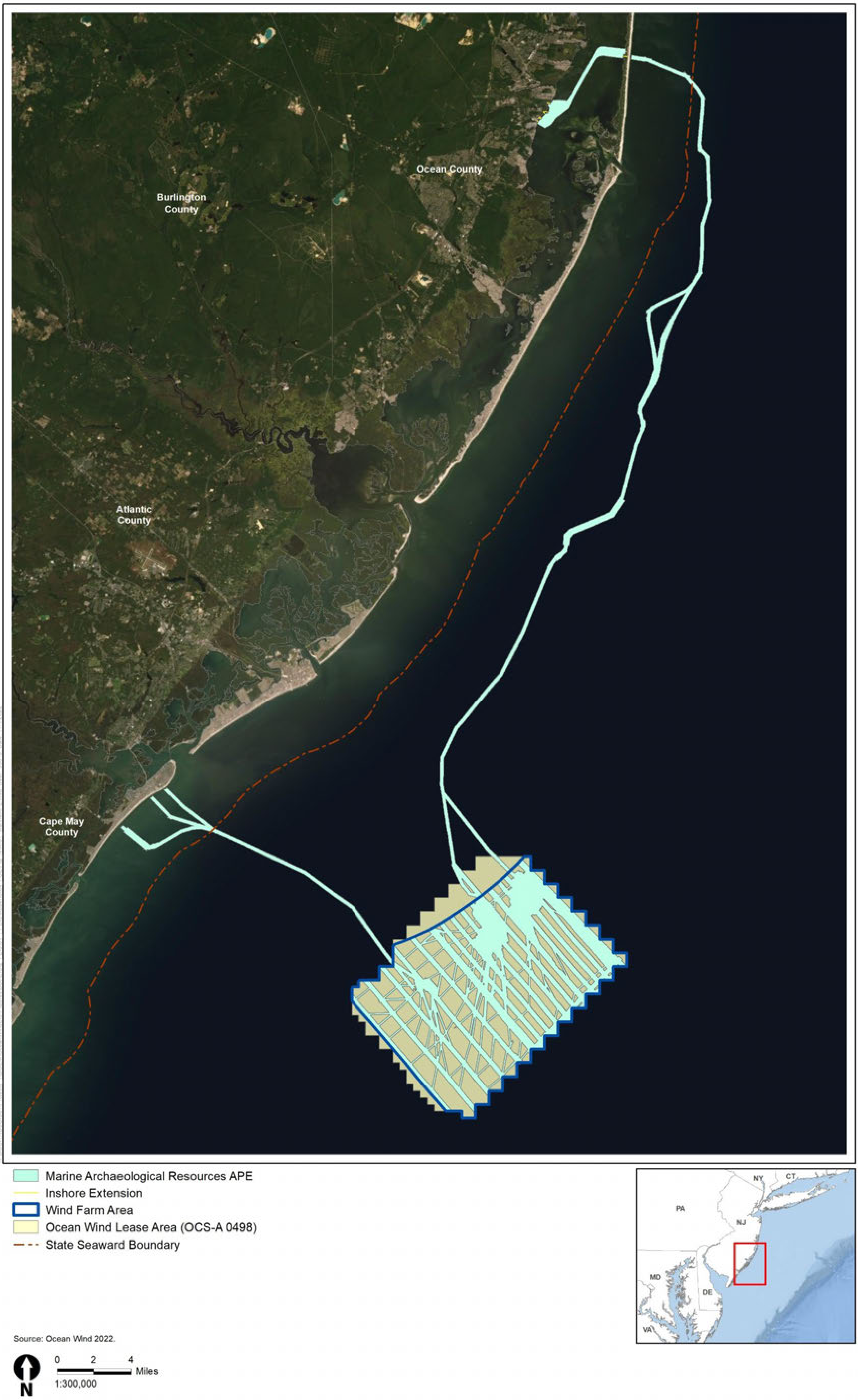

Figure 1 **Marine Archaeological Resources APE for Activities within the Lease Area**

Figure 2 **Marine Archaeological Resources APE for Activities within the Oyster Creek Export Cable Route Corridor**

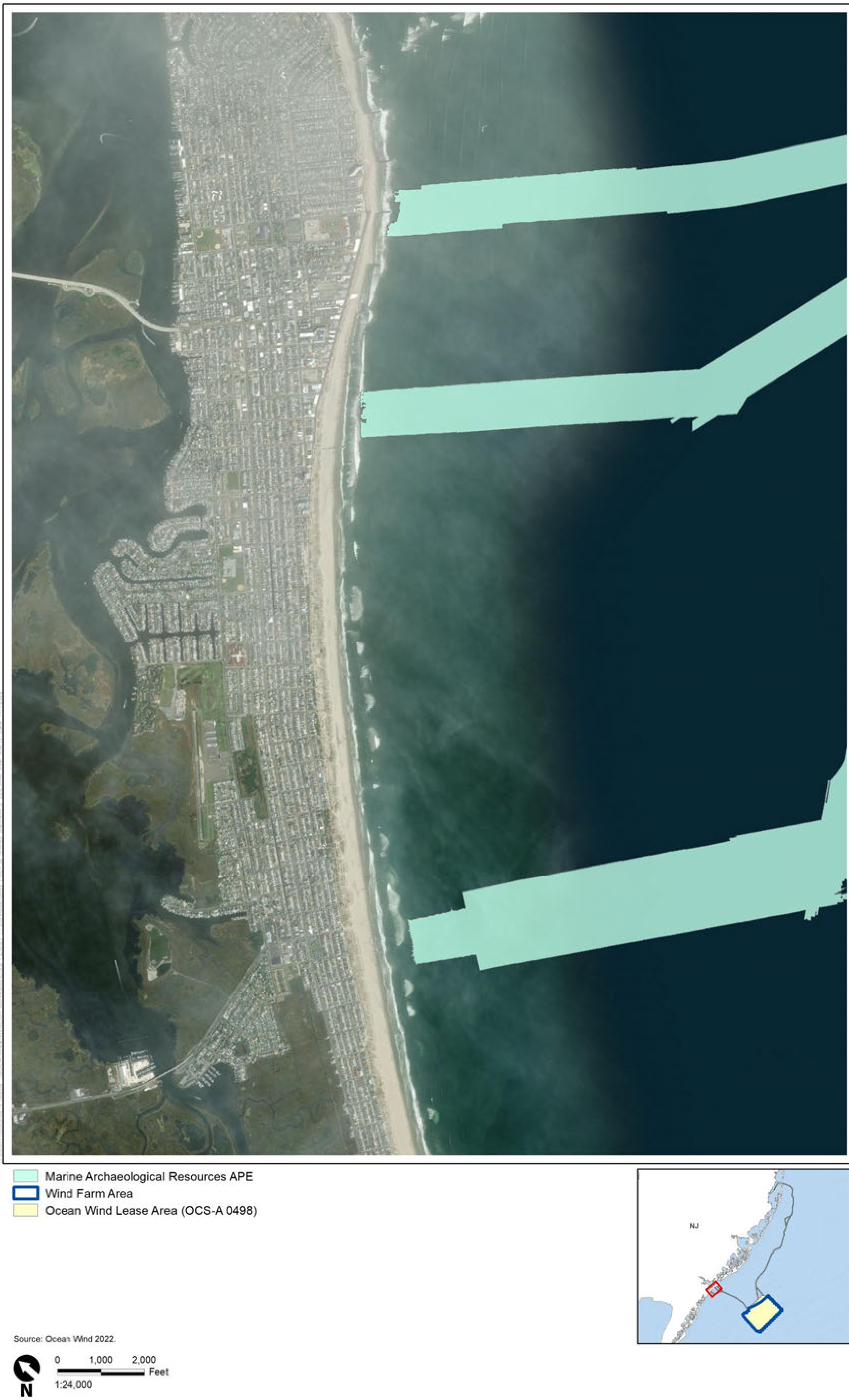

Figure 3 **Marine Archaeological Resources APE for Activities within the BL England Export Cable Route Corridor**

Figure 4 Terrestrial Archaeological Resources APE with Onshore Cable and Landfall Site Alternatives for BL England

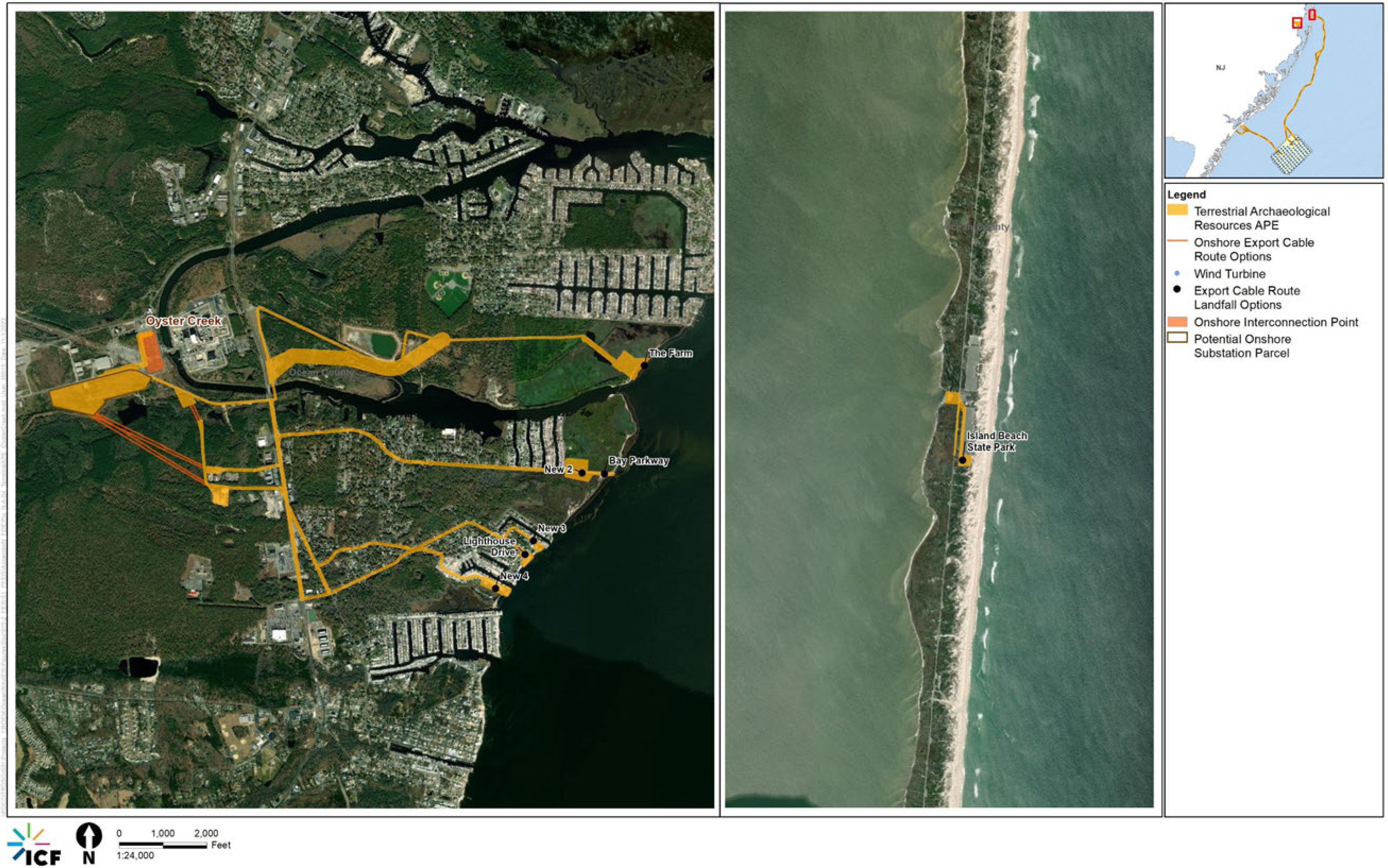

Figure 5 Terrestrial Archaeological Resources APE with Onshore Cable and Landfall Site Alternatives for Oyster Creek

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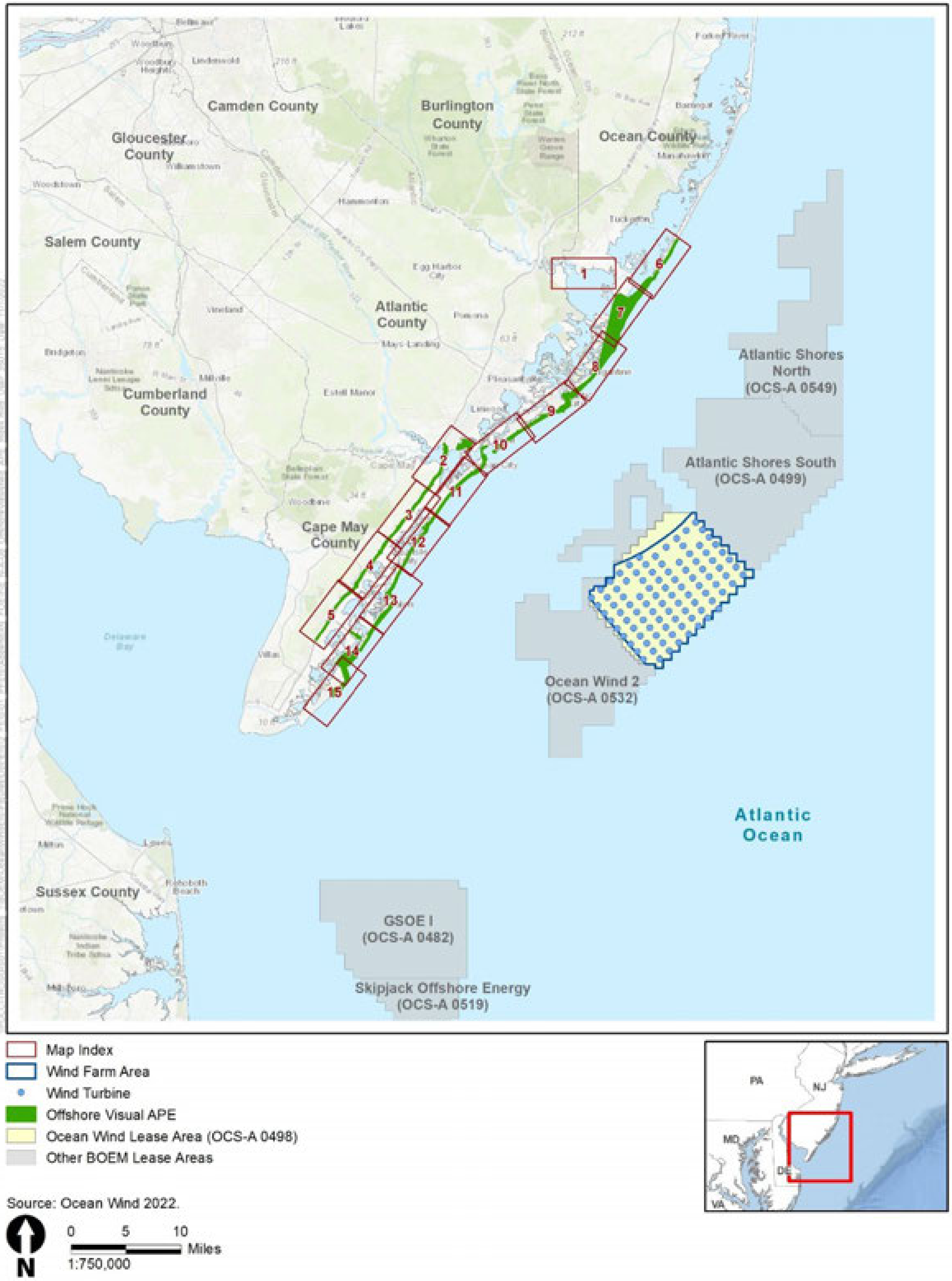

Figure 6 **Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Index**

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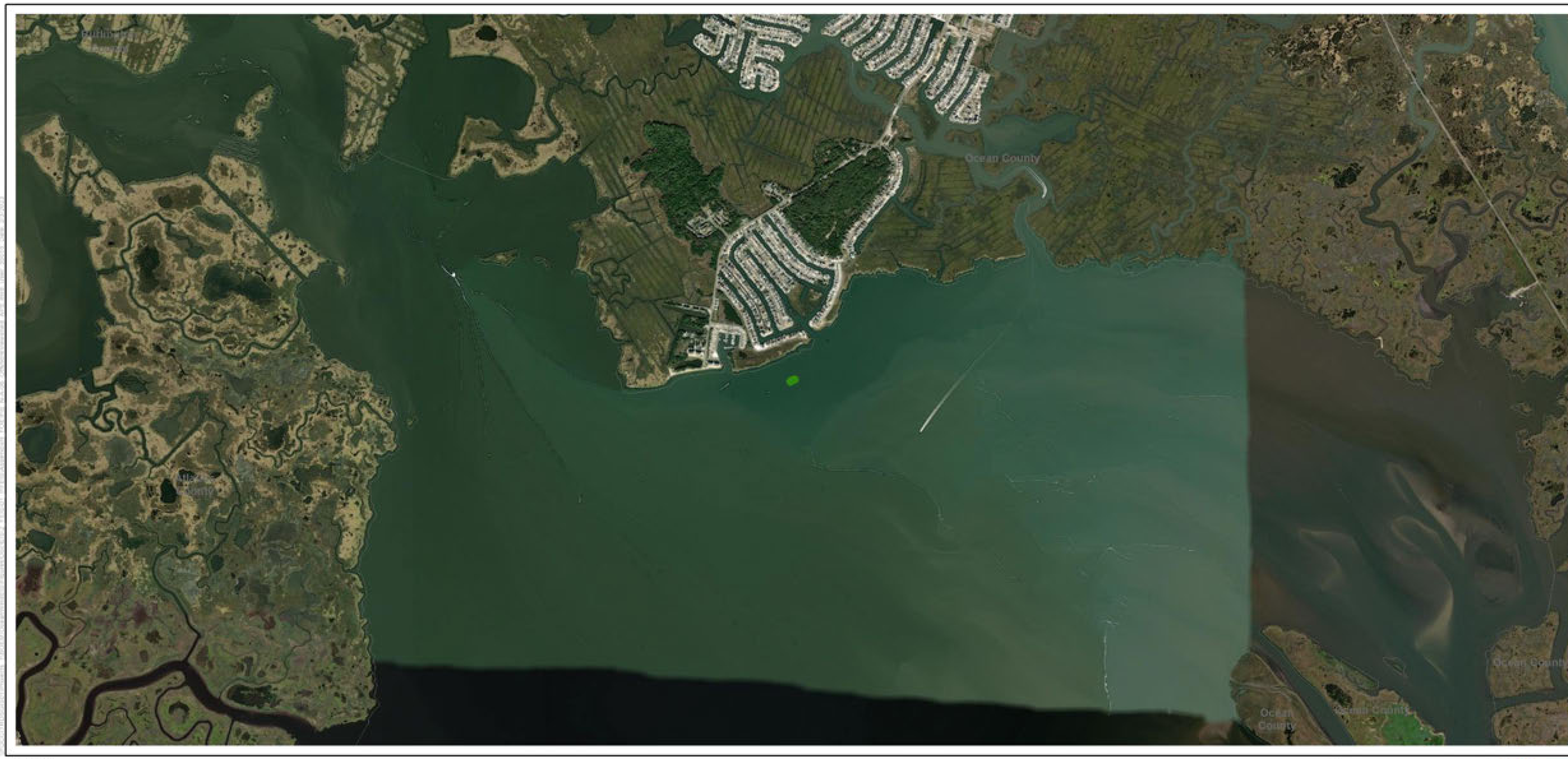

Legend

- Offshore Visual APE (Not to Scale)
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 1 of 15

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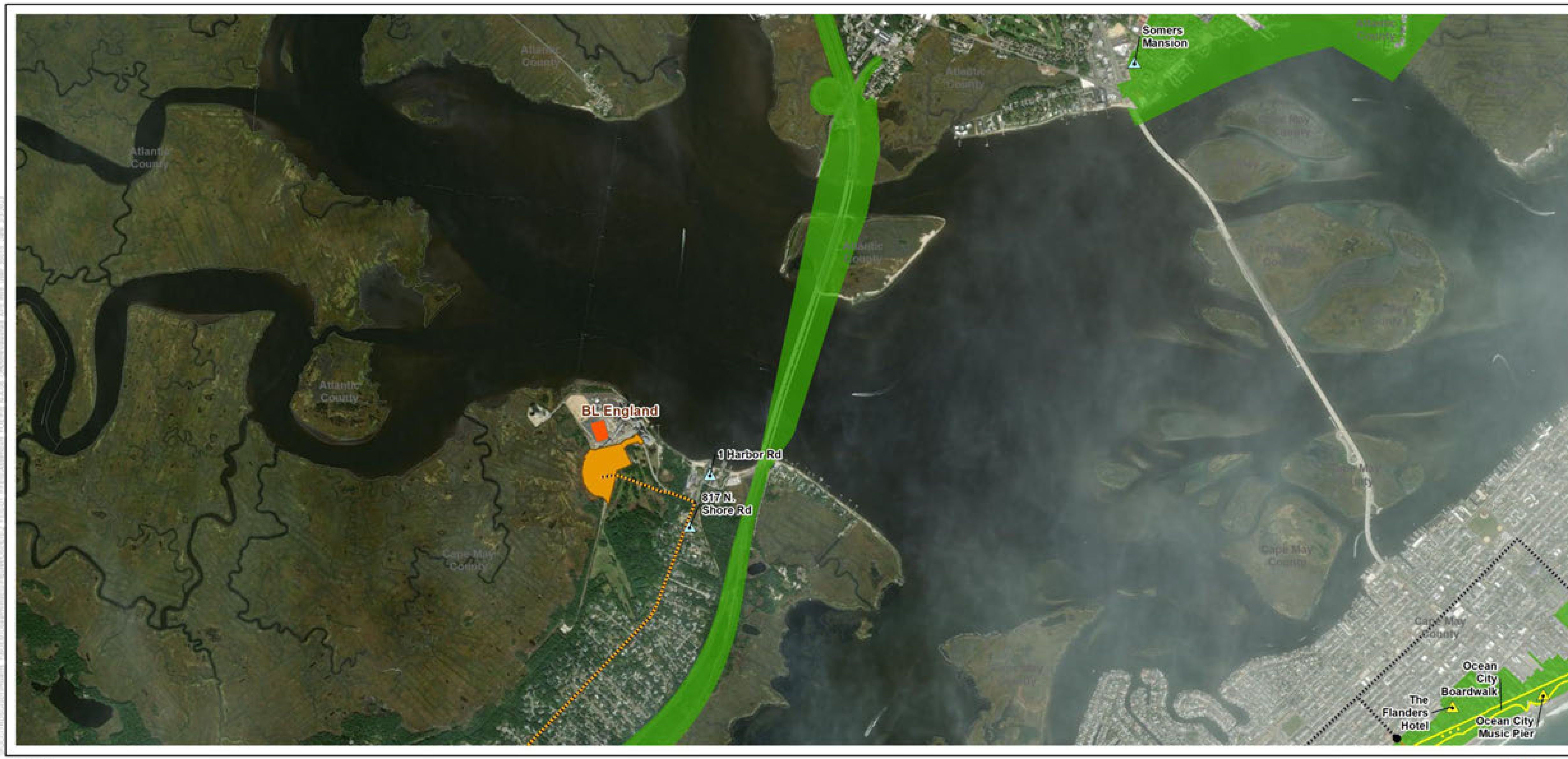
Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 1



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 2 of 15

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Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 2

Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

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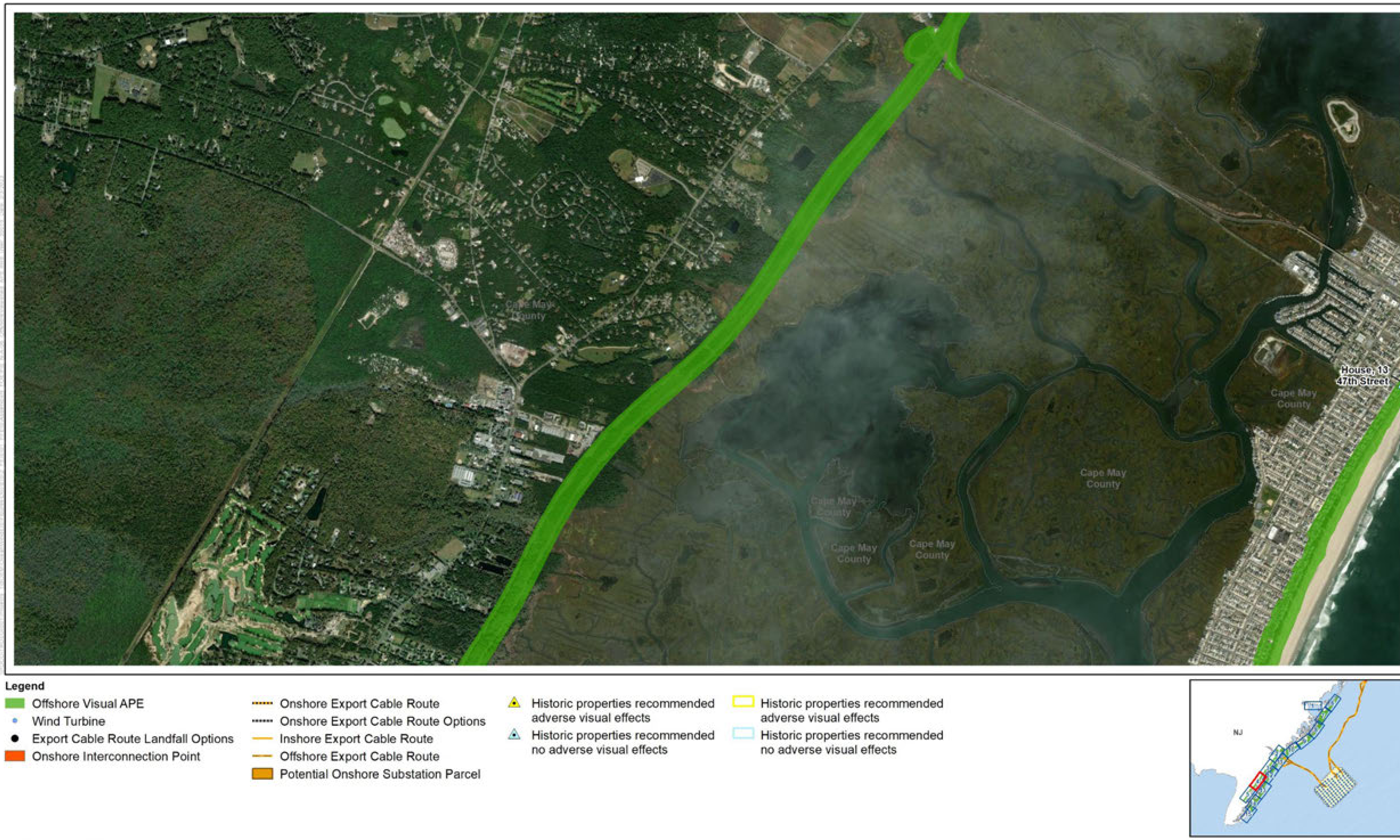
Sheet: 3 of 15

Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 3



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

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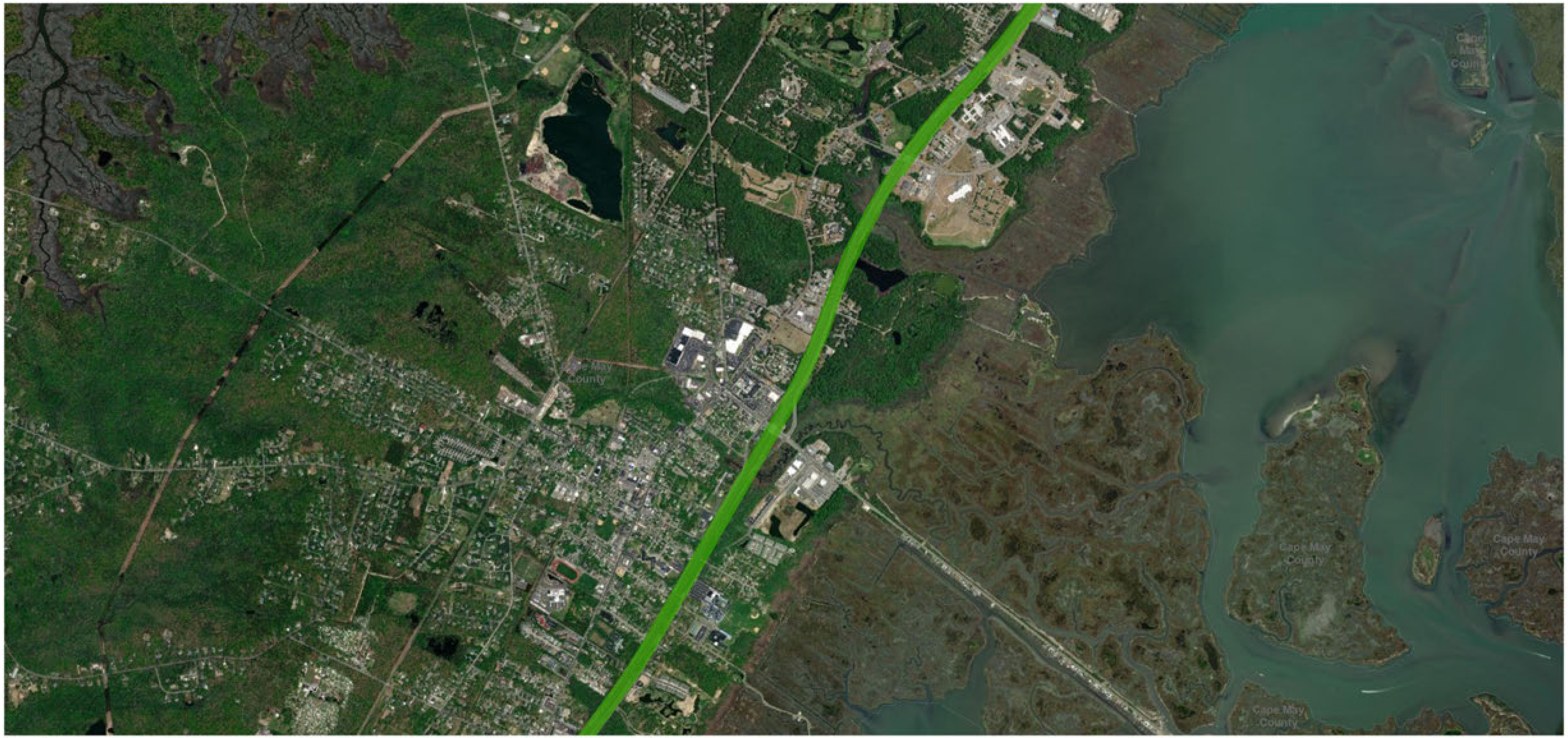
Sheet: 4 of 15

Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 4



Legend

Offshore Visual APE	Onshore Export Cable Route	Historic properties recommended adverse visual effects	Historic properties recommended adverse visual effects
Wind Turbine	Onshore Export Cable Route Options	Historic properties recommended no adverse visual effects	Historic properties recommended no adverse visual effects
Export Cable Route Landfall Options	Inshore Export Cable Route		
Onshore Interconnection Point	Offshore Export Cable Route		
	Potential Onshore Substation Parcel		

Sheet: 5 of 15

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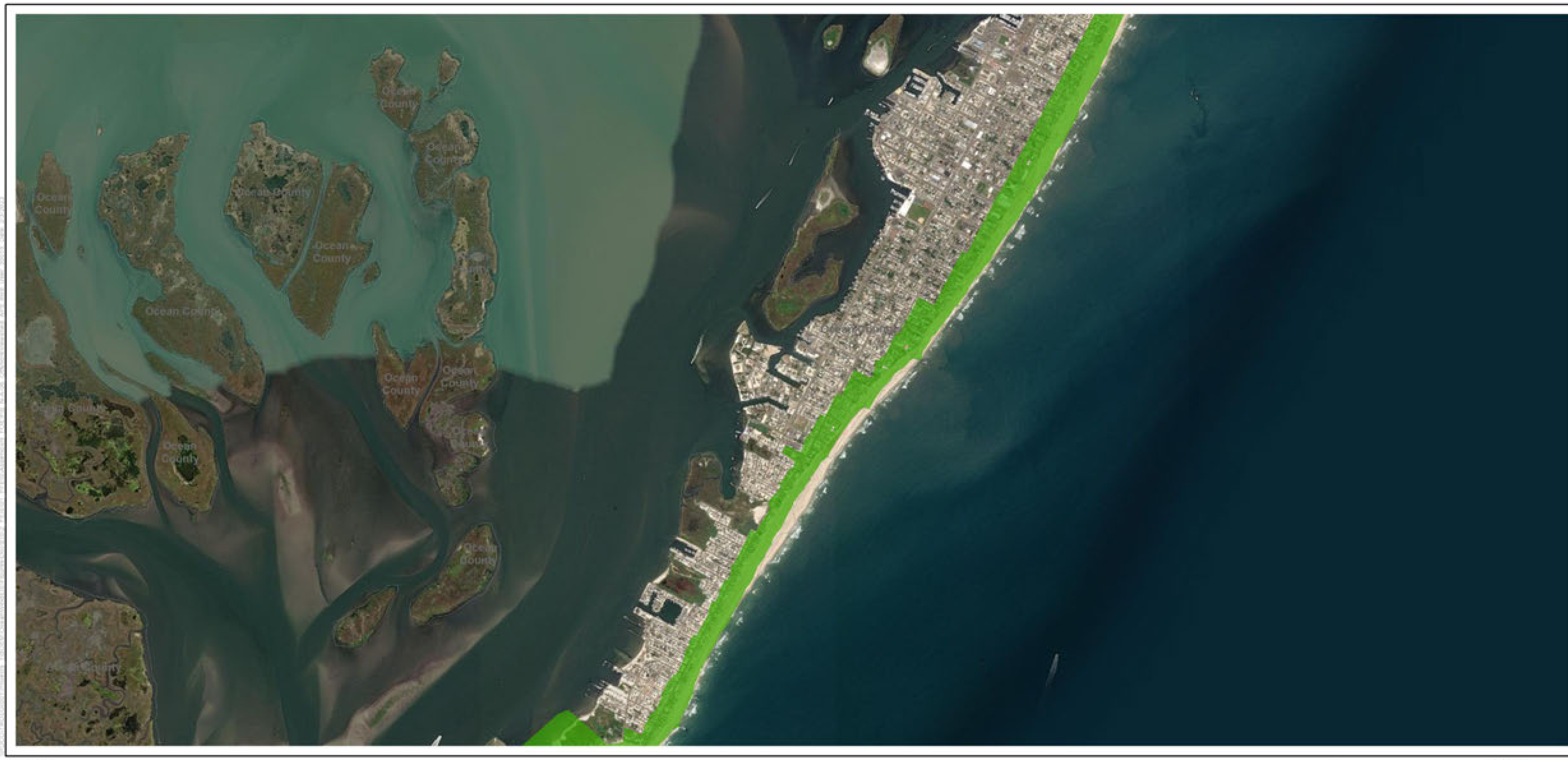
Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 5



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 6 of 15

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Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 6

Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 7 of 15

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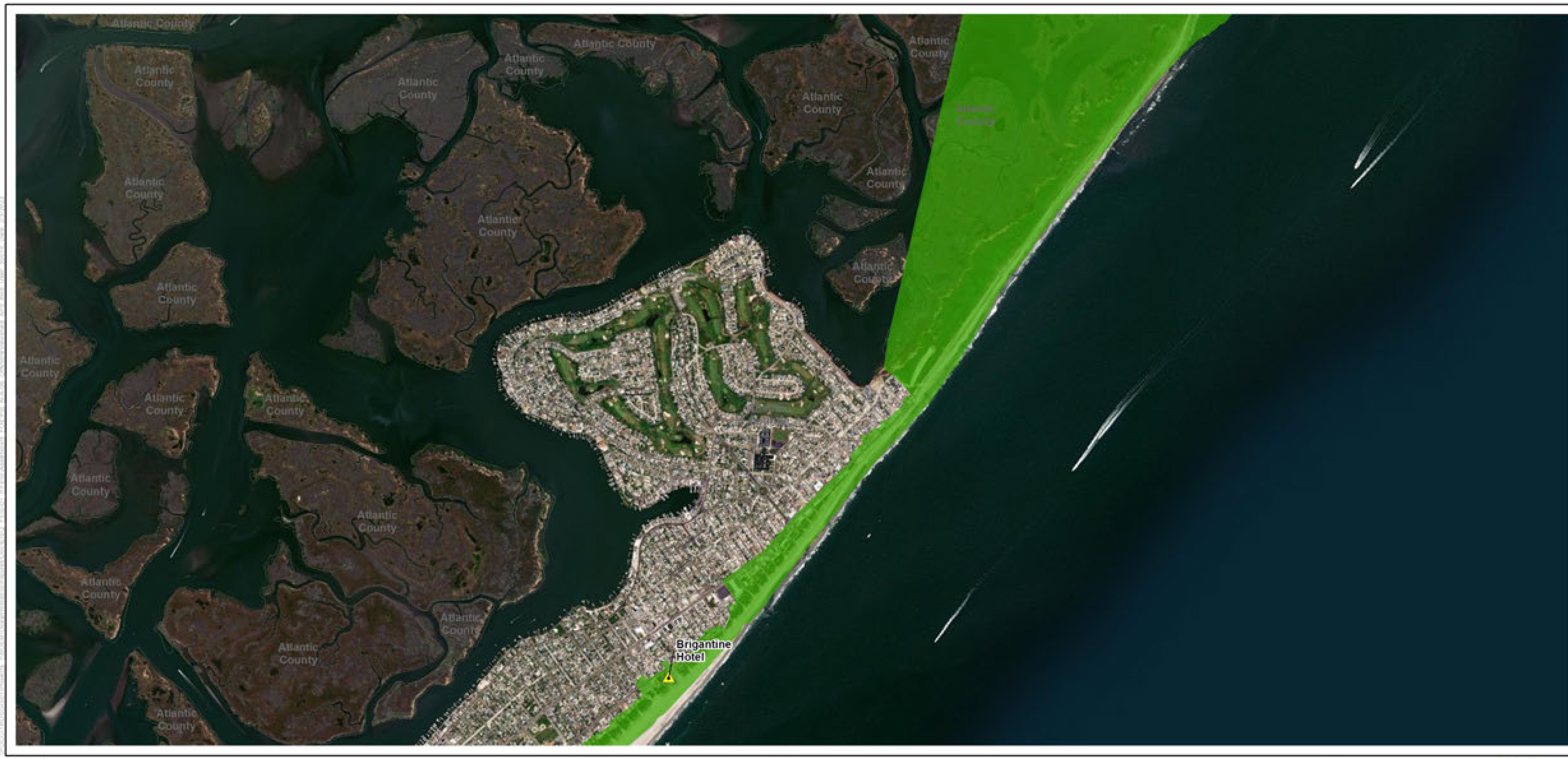
Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 7



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 8 of 15

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Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 8

Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

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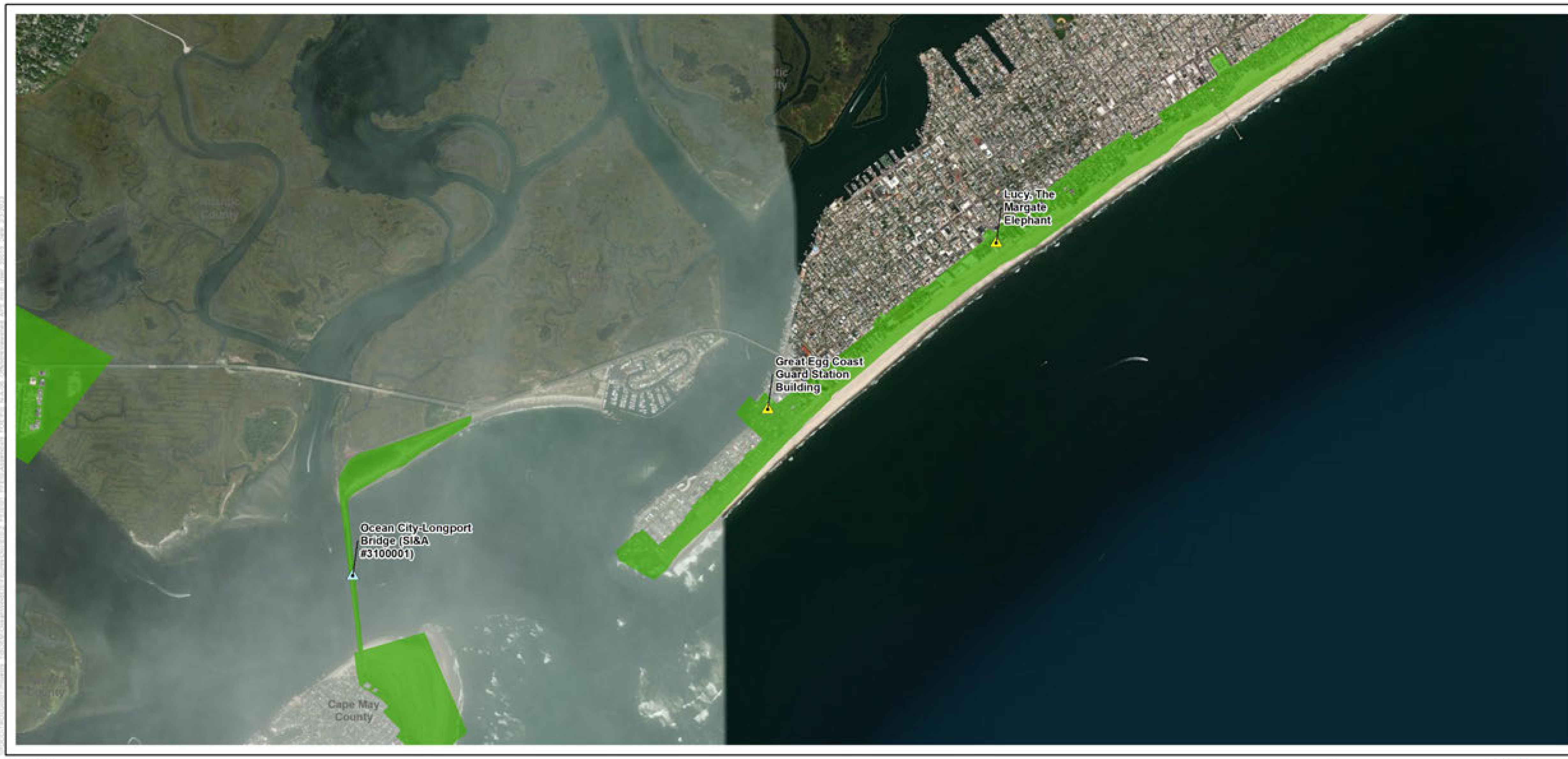
Sheet: 9 of 15

Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 9



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 10 of 15

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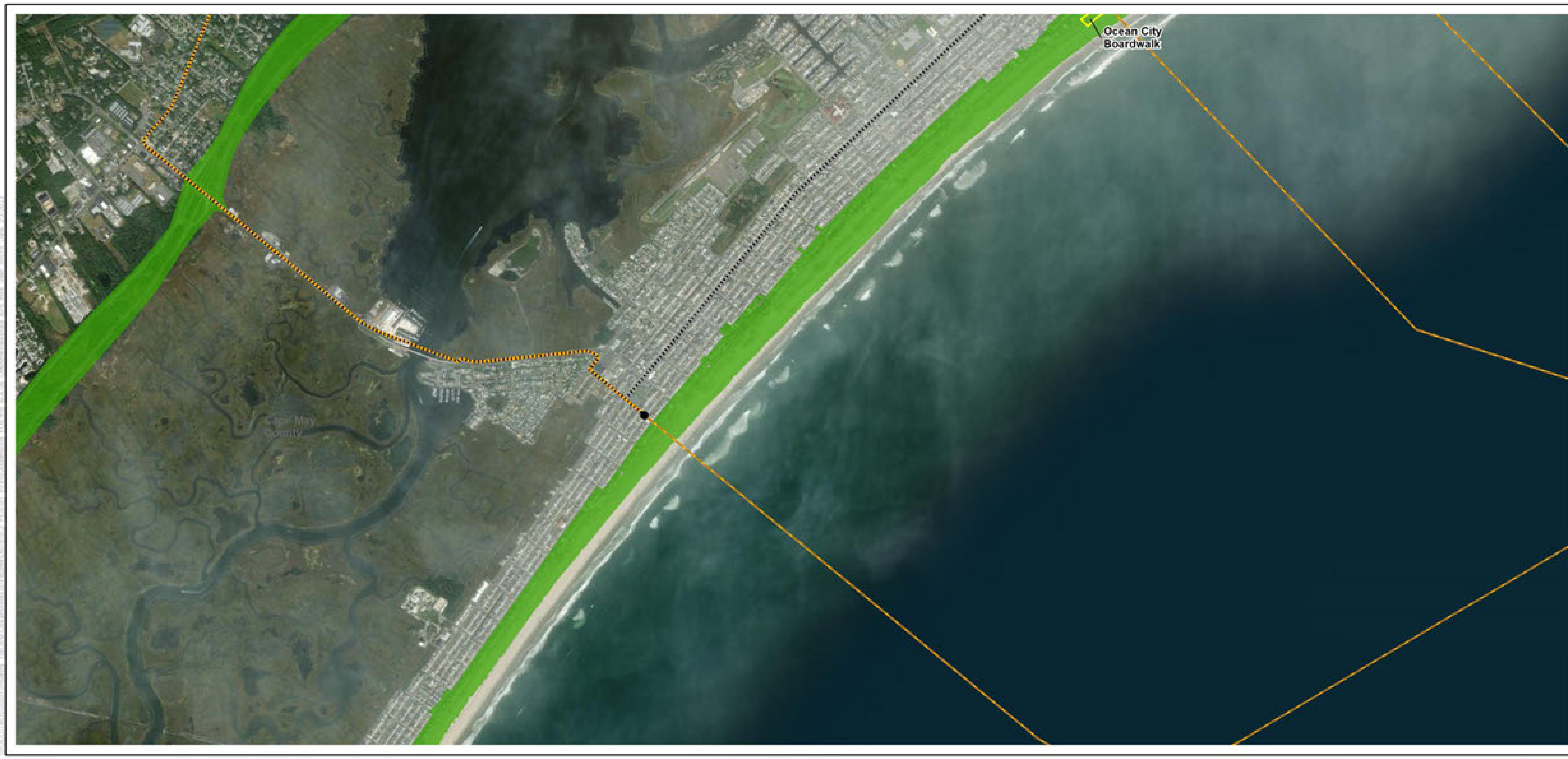
Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 10



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 11 of 15

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Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 11

Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 12 of 15

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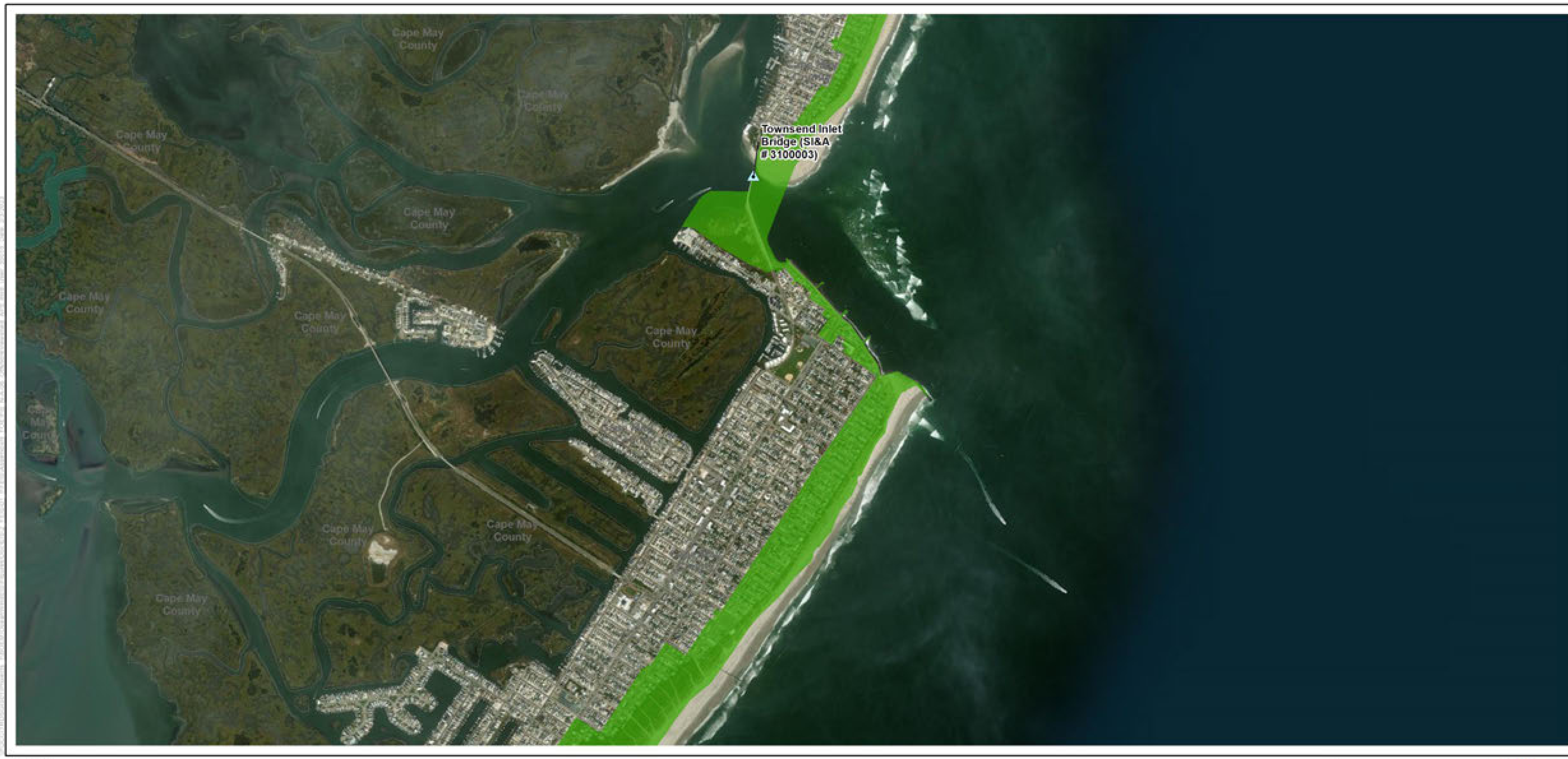
Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 12



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 13 of 15

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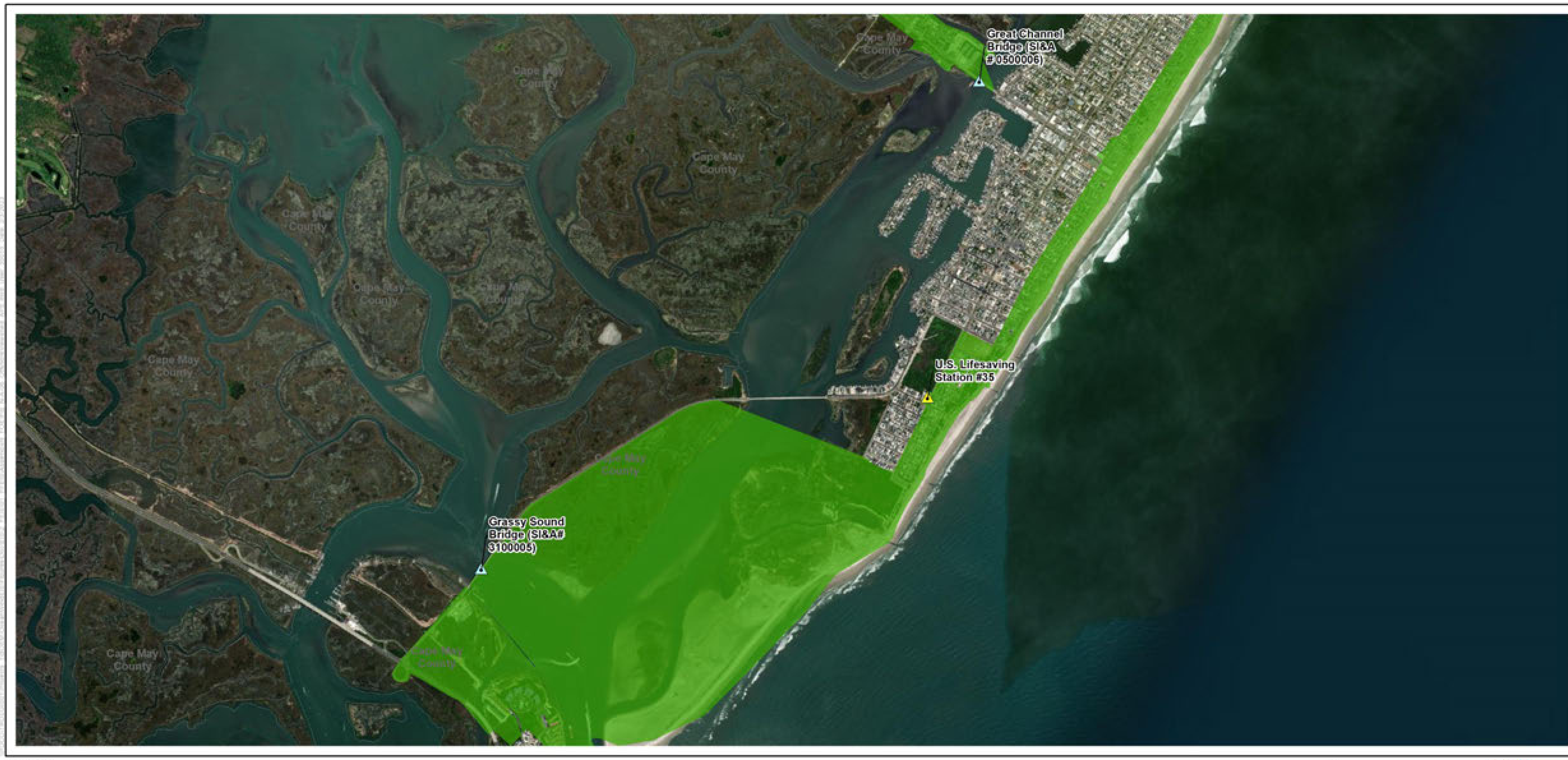
Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 13



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 14 of 15

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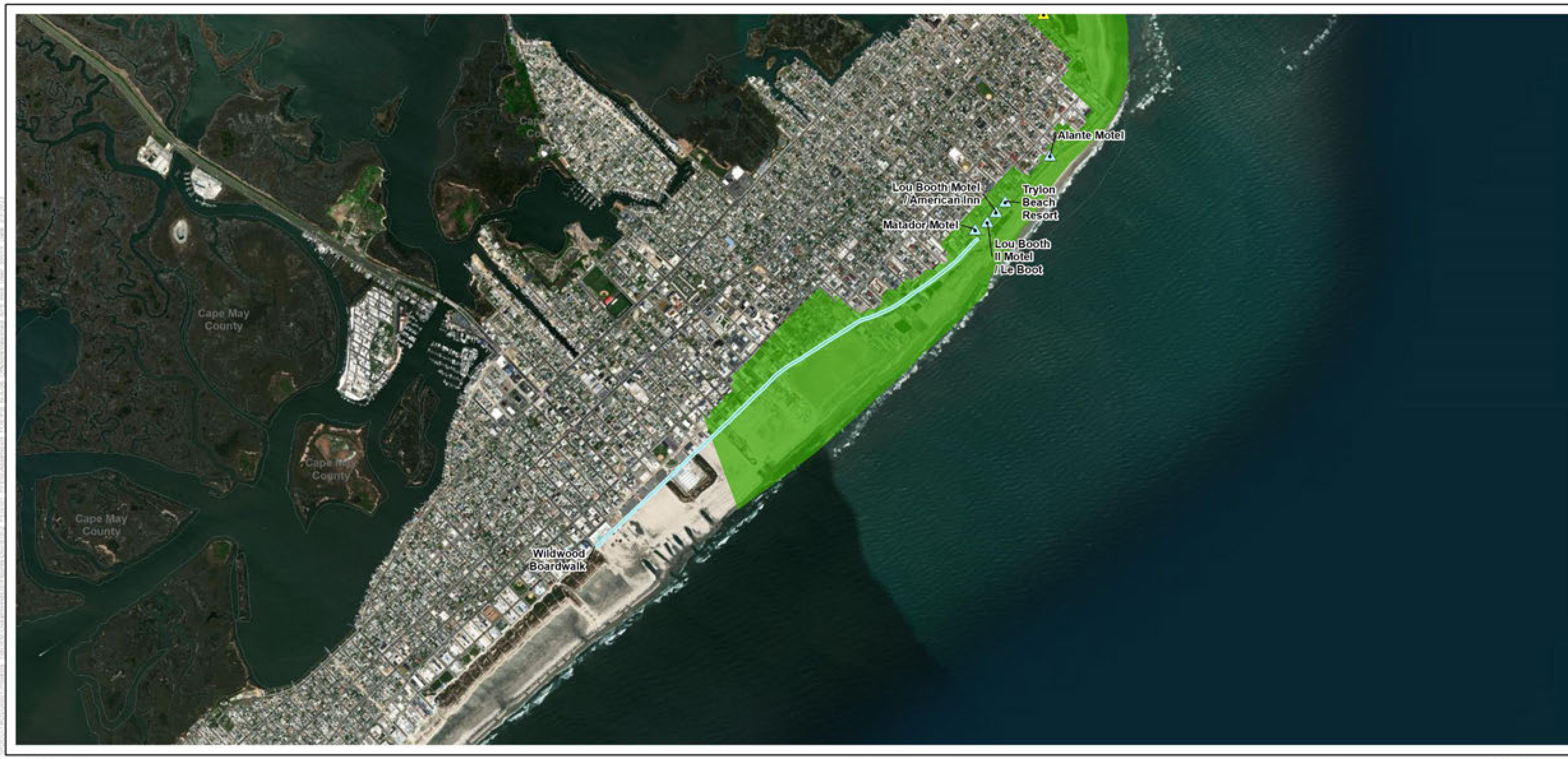
Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 14



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 15 of 15

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Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 15

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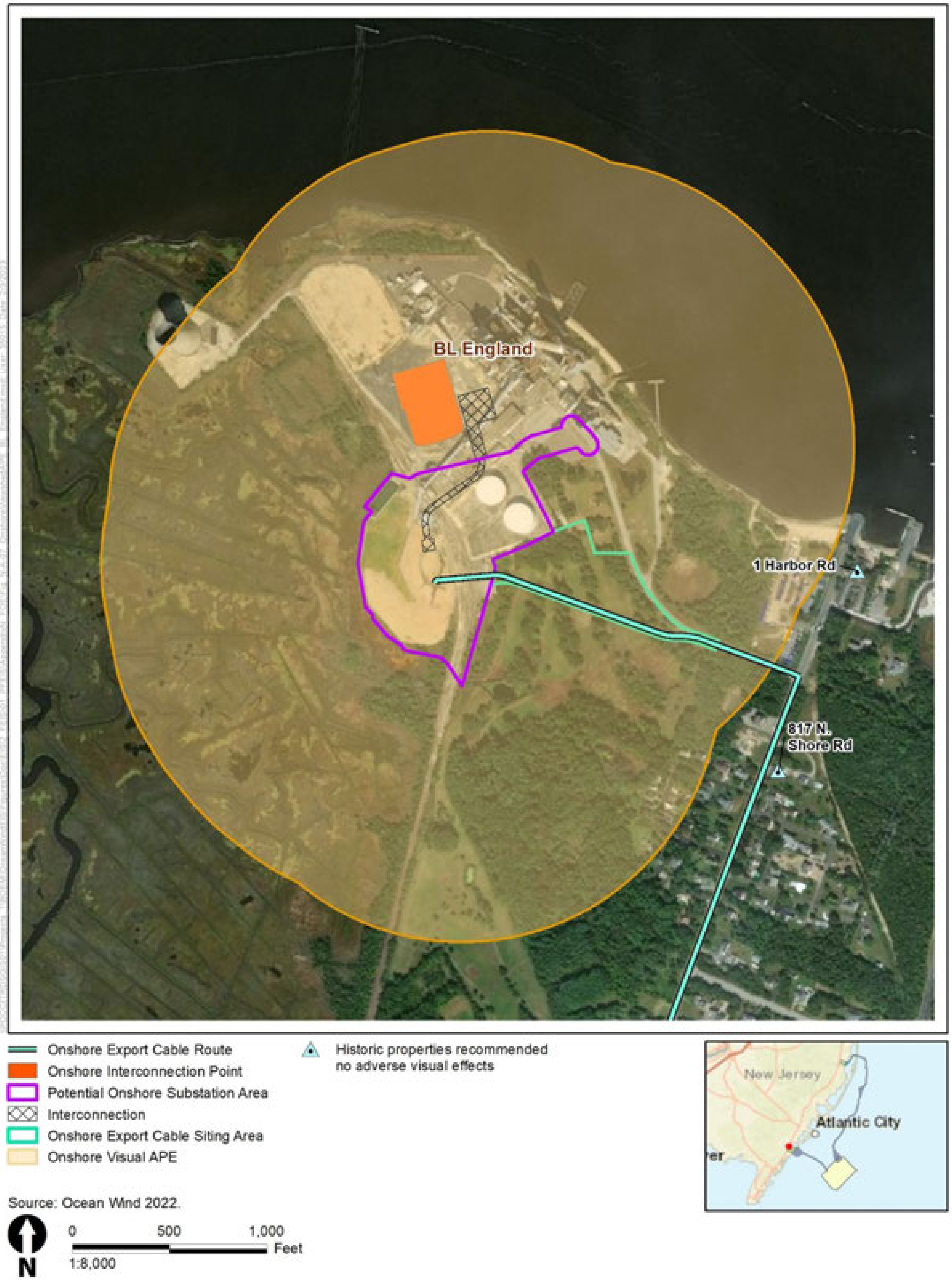

Figure 7 Onshore Visual APE for BL England Substation

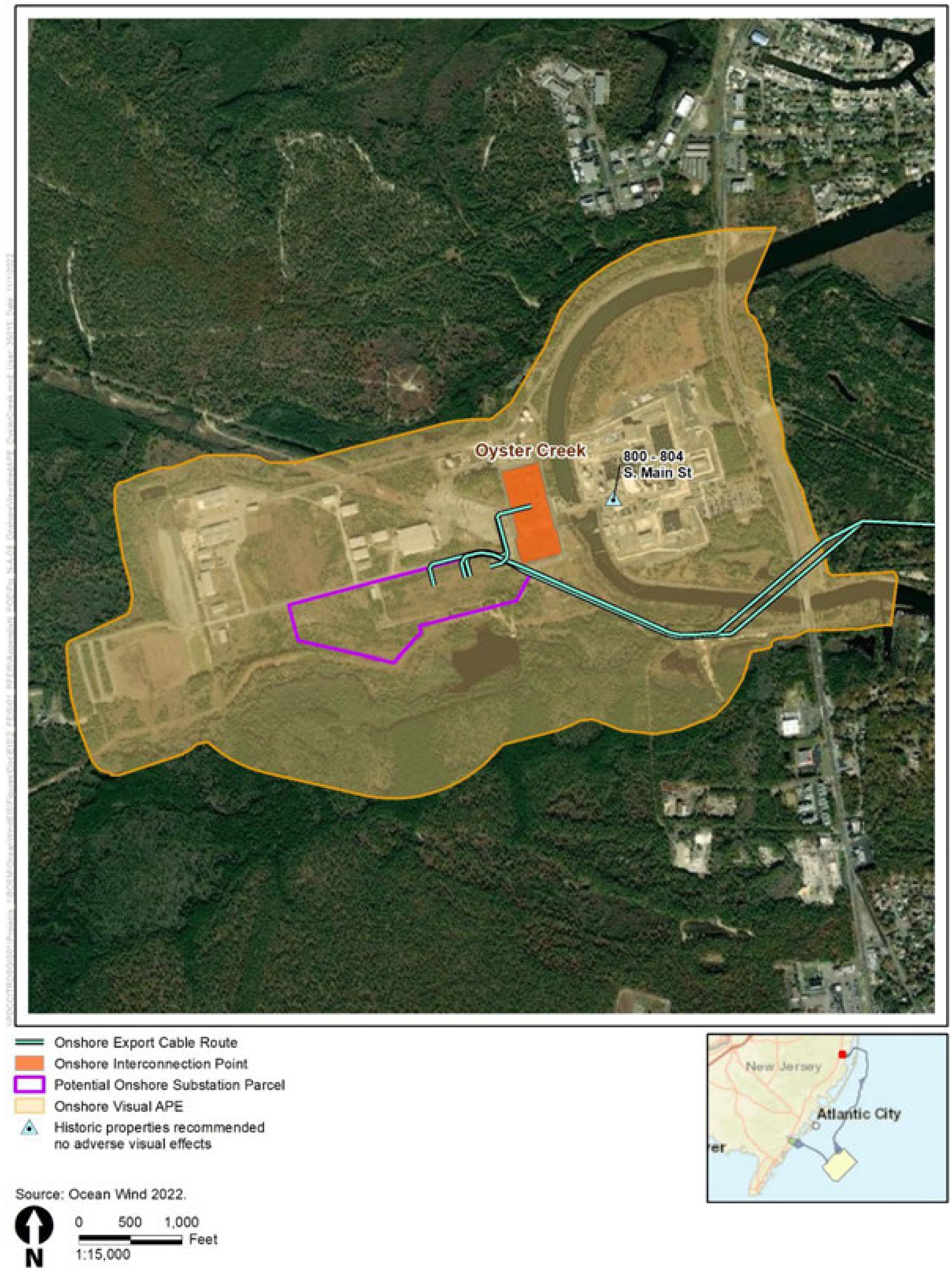

Figure 8 Onshore Visual APE for Oyster Creek Substation

ATTACHMENT 2 – LIST OF CONSULTING PARTIES

Table 1. Parties Invited to Participate in NHPA Section 106 Consultation

Participants in the Section 106 Process	Invited Parties
SHPOs and State Agencies	NJDEP, Historic Preservation Office
	NJDEP, Office of Historic Sites & Parks
	NJDLPS, Marine Service Bureau
	New Jersey Casino Reinvestment Development Authority
	New Jersey Historic Trust
Federal Agencies	ACHP
	NOAA
	USACE
	USCG
	USEPA
	USFWS
	National Park Service
	National Park Service, Region 1
Federally Recognized Tribes	Absentee-Shawnee Tribe of Indians of Oklahoma
	Delaware Tribe of Indians
	Eastern Shawnee Tribe of Oklahoma
	Shawnee Tribe
	The Delaware Nation
	Mashantucket Pequot Tribal Nation
	The Narragansett Indian Tribe
	The Rappahannock Tribe
	The Shinnecock Indian Nation
	Stockbridge-Munsee Community Band of Mohican Indians
Non-Federally Recognized Tribes	Lenape Indian Tribe of Delaware
	Nanticoke Indian Association, Inc.
	Nanticoke Lenni-Lenape Tribal Nation
	Nanticoke Lenni-Lenape Tribe
	Powhatan Renape Nation
	Ramapough Lenape Indian Nation
	Ramapough Mountain Indians
Local Governments	Absecon City
	Atlantic City
	Atlantic County
	Atlantic County, Department of Regional Planning and Development

Participants in the Section 106 Process	Invited Parties
	Avalon Borough
	Barnegat Light Borough
	Barnegat Township
	Beach Haven Borough
	Brigantine Beach City
	Cape May City
	Cape May County
	Cape May Point Borough
	Dennis Township
	Eagleswood Township
	Egg Harbor City
	Egg Harbor Township
	Galloway Township
	Hamilton Township
	Hammonton Town
	Harvey Cedars Borough
	Linwood City
	Little Egg Harbor Township
	Long Beach Township
	Longport Borough
	Lower Township
	Margate City
	Middle Township
	North Wildwood City
	Ocean City
	Ocean County
	Pleasantville City
	Sea Isle City
	Ship Bottom Borough
	Somers Point City
	Stafford Township
	Stone Harbor Borough
	Surf City Borough
	Tuckerton Borough
	Upper Township
	Ventnor City
	West Cape May Borough
	West Wildwood Borough

Participants in the Section 106 Process	Invited Parties
	Wildwood City
	Wildwood Crest Borough
	Woodbine Borough
Nongovernmental Organizations or Groups	Absecon Historical Society
	Absecon Lighthouse
	Atlantic City Convention Center
	Atlantic County
	Atlantic County Historical Society
	Avalon History Center
	Barnegat Light Museum
	Barnegat Lighthouse State Park
	Brigantine Beach Historical Museum
	Cape May Lighthouse
	Caribbean Motel
	Converse Cottage
	Donald & June Feith (114 South Harvard Avenue, Ventnor City, New Jersey)
	Dr. Edward H. Williams House
	Eagleswood Historical Society
	Emlen Physick Estate
	Flanders Condominium Association
	Friends of Barnegat Lighthouse
	Friends of the Cape May Lighthouse
	Friends of the World War II Tower
	Greater Cape May Historic Society
	Greater Egg Harbor Township Historical Society
	Hereford Inlet Lighthouse
	Historic Cold Spring Village
	Legacy Vacation Resorts
	Linwood Historical Society
	Long Beach Island Historical Association
	Long Beach Island Historical Association
	Longport Historical Society
	Madison Hotel
	Max Gurwicz Enterprises
	Museum of Cape May County
	New Jersey Lighthouse Society
	New Jersey Maritime Museum

Participants in the Section 106 Process	Invited Parties
	Ocean City Historical Museum
	Ocean City Music Pier
	Ocean County Historical Society
	Patriots for the Somers Mansion
	Preservation New Jersey
	Raphael-Gordon House
	Ritz Condominium Association
	Rutgers University, Department of Marine and Coastal Sciences, School of Environmental and Biological Sciences
	Save Lucy Committee, Inc.
	Stone Harbor Museum
	The Museum of Cape May County
	The Noyes Museum of Art
	Tuckerton Historical Society
	Vassar Square Condominium Association
	Wildwood Crest Historical Society
	Wildwood Historical Society

Table 2. Parties Participating in Section 106 Consultation

Participants in the Section 106 Process	Participating Parties
SHPOs and State Agencies	NJDEP, Historic Preservation Office
	NJDEP, Office of Historic Sites & Parks
	New Jersey Historic Trust
Federal Agencies	ACHP
	USACE
	USEPA
	USCG
	National Park Service
	U.S. Naval History and Heritage Command
Federally Recognized Tribes	Delaware Nation
	Delaware Tribe of Indians
	Stockbridge-Munsee Community Band of Mohican Indians
	The Shinnecock Indian Nation
	Wampanoag Tribe of Gay Head (Aquinnah)
Local Governments	Atlantic County
	Cape May City

Participants in the Section 106 Process	Participating Parties
	Cape May County
	Harvey Cedars Borough
	Linwood City
	Margate City
	North Wildwood City
	Ocean City
	Sea Isle City
	Somers Point City
	Stafford Township
Non-governmental Organizations or Groups	Absecon Lighthouse
	Donald & June Feith (114 South Harvard Avenue, Ventnor City, New Jersey)
	Flanders Condominium Association
	Garden State Seafood Association
	Long Beach Island Historical Association
	Save Lucy Committee, Inc.
	Ritz Condominium Association
	Rutgers University, School of Environmental and Biological Sciences
	The Noyes Museum of Art
	Vassar Square Condominiums

Table 3. Parties Invited to Consult under Section 106 and That Did Not Participate in Consultation

Participants in the Section 106 Process	Invited Consulting Parties
State Agencies	NJDEP, Office of Historic Sites & Parks
	NJDLPS, Marine Service Bureau
	New Jersey Casino Reinvestment Development Authority
Federal Agencies	NOAA
	USFWS
	National Park Service, Region 1
Federally Recognized Tribes	Absentee-Shawnee Tribe of Indians of Oklahoma
	Eastern Shawnee Tribe of Oklahoma
	Shawnee Tribe
	Mashantucket Pequot Tribal Nation
	The Narragansett Indian Tribe
	The Rappahannock Tribe
Non-Federally Recognized Tribe	Lenape Indian Tribe of Delaware
	Nanticoke Indian Association, Inc.
	Nanticoke Lenni-Lenape Tribal Nation
	Nanticoke Lenni-Lenape Tribe
	Powhatan Renape Nation
	Ramapough Lenape Indian Nation
	Ramapough Mountain Indians
Local Governments	Absecon City
	Atlantic City
	Atlantic County, Department of Regional Planning and Development
	Avalon Borough
	Barnegat Light Borough
	Barnegat Township
	Beach Haven Borough
	Brigantine Beach City
	Cape May Point Borough
	Dennis Township
	Eagleswood Township
	Egg Harbor City
	Egg Harbor Township
	Galloway Township
	Hamilton Township
	Hammonton Town
	Linwood City

Participants in the Section 106 Process	Invited Consulting Parties
	Little Egg Harbor Township
	Long Beach Township
	Longport Borough
	Lower Township
	Middle Township
	Ocean County
	Pleasantville City
	Ship Bottom Borough
	Stone Harbor Borough
	Surf City Borough
	Tuckerton Borough
	Upper Township
	Ventnor City
	West Cape May Borough
	West Wildwood Borough
	Wildwood City
	Wildwood Crest Borough
	Woodbine Borough
Nongovernmental Organizations or Groups	Absecon Historical Society
	Atlantic City Convention Center
	Atlantic County
	Atlantic County Historical Society
	Avalon History Center
	Barnegat Light Museum
	Barnegat Lighthouse State Park
	Brigantine Beach Historical Museum
	Cape May Lighthouse
	Caribbean Motel
	Converse Cottage
	Dr. Edward H. Williams House
	Eagleswood Historical Society
	Emlen Physick Estate
	Friends of Barnegat Lighthouse
	Friends of the Cape May Lighthouse
	Friends of the World War II Tower
	Greater Cape May Historic Society
	Greater Egg Harbor Township Historical Society
	Hereford Inlet Lighthouse

Participants in the Section 106 Process	Invited Consulting Parties
	Historic Cold Spring Village
	Legacy Vacation Resorts
	Linwood Historical Society
	Longport Historical Society
	Madison Hotel
	Max Gurwicz Enterprises
	Museum of Cape May County
	New Jersey Lighthouse Society
	New Jersey Maritime Museum
	Ocean City Historical Museum
	Ocean City Music Pier
	Ocean County Historical Society
	Patriots for the Somers Mansion
	Preservation New Jersey
	Raphael-Gordon House
	Stone Harbor Museum
	The Museum of Cape May County
	Tuckerton Historical Society
	Wildwood Crest Historical Society
	Wildwood Historical Society

ATTACHMENT 3 – HISTORIC PROPERTY TREATMENT PLAN FOR THE OCEAN WIND 1 FARM ANCIENT SUBMERGED LANDFORM FEATURES, FEDERAL WATERS ON THE OUTER CONTINENTAL SHELF

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Ocean Wind 1
An Ørsted & PSEG project

Applicant-Proposed Draft with BOEM Revisions – Subject to Review by BOEM and Consulting Parties

Draft Historic Property Treatment Plan

for the

Ocean Wind 1 Farm

Ancient Submerged Landform Features
Federal Waters on the Outer Continental Shelf

Submitted to:

BOEM
Bureau of Ocean Energy Management

Bureau of Ocean Energy Management
U.S. Department of the Interior

Prepared for:

Ocean Wind 1
An Ørsted & PSEG project

Ocean Wind 1,
https://oceanwind.com/

Prepared by:

SEARCH

www.searchinc.com

April 2023

Ocean Wind 1
An Ørsted & PSEG project

ABSTRACT

Federal Undertaking:	Ocean Wind 1 Offshore Wind Farm Project
Location:	Outer Continental Shelf, New Jersey
Federal and State Agencies:	Bureau of Ocean Energy Management U.S. Army Corps of Engineers New Jersey Department of Environmental Protections/State Historic Preservation Office Advisory Council on Historic Preservation
ACHP Project No.:	
Regulatory Process:	National Environmental Policy Act Section 106 of the National Historic Preservation Act
Regulatory Action:	Cultural Resources Mitigation pursuant to Bureau of Ocean Energy Management approval of the *Ocean Wind 1 Wind Farm Construction and Operations Plan*
Potential Adverse Effect Finding for:	13 Properties in Cape May, Ocean, and Atlantic Counties
Date:	April 2023

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LIST OF ACRONYMS

ACHP	Advisory Council on Historic Preservation
ADLS	Aircraft Detection Lighting System
APE	Area of Potential Effects
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
COP	Construction and Operations Plan
FEIS	Final Environmental Impact Statement
FR	Federal Regulation
HDR	HDR, Inc.
HPTP	Historic Properties Treatment Plan
MOA	Memorandum of Agreement
N/A	Not Applicable
NHL	National Historic Landmark
NHPA	National Historic Preservation Act of 1966
NJ DEP	New Jersey Department of Environmental Protection
NJHPO	New Jersey State Historic Preservation Office(r)
NPS	National Park Service
NRHP	National Register of Historic Places
OCS	Outer Continental Shelf
OCW1	Ocean Wind1 Offshore Wind Farm Project
QMA	Qualified Marine Archaeologist
PRDP	Post-Review Discoveries Plan
RFP	Request for Proposals
ROD	Record of Decision
SOI	Secretary of the Interior
TCP	Traditional Cultural Property
USCG	United States Coast Guard
WTG	Wind Turbine Generator

1.0 INTRODUCTION

Executive Summary

This Historic Properties Treatment Plan (HPTP) provides background data, historic property information, and detailed steps that will be implemented to carry out the potential cultural resources mitigation actions identified by the Bureau of Ocean Energy Management (BOEM) for the OCW1 Offshore Wind Farm (OCW1). The mitigation actions, if required, will be developed in consultation with the New Jersey State Historic Preservation Officer (NJHPO) and other National Historic Preservation Act (NHPA) Section 106 review consulting parties as elements of the Final Environmental Impact Statement (FEIS) and issued in accordance with 40 CFR parts 1500-1508, 36 CFR §§ 800.8, 800.10. This HPTP outlines the mitigation measures, implementation steps, and timeline for actions.

Section 1.0 Introduction: Outlines the content of this HPTP.

Section 2.0 Cultural Resources Regulatory Context: Briefly summarizes the OCW1 (the Undertaking) while focusing on cultural resources regulatory contexts (federal, tribal, state, and local, including preservation restrictions), identifies the 13 historic properties discussed in this HPTP that will be adversely affected by the Undertaking, and summarizes the pertinent conditions that guided the development of this document.

Section 3.0 Existing Conditions and Historic Significance: Provides a physical description of each historic property included in this HPTP. Set within their historic context, the applicable National Register of Historic Places (NRHP) criteria for each resource is discussed with a focus on the contribution of an ocean setting to its significance and integrity.

Section 4.0 Mitigation Measures: Presents specific steps to carry out the mitigation actions identified proposed by OCW1 in the COP. Each mitigation action includes a detailed description, intended outcome, and specifications that include maximum cost, methods, standards, requirements for documentation, and reporting instructions. Property-specific challenges, if any have been identified, are outlined as well.

Section 5.0 Implementation: Establishes the process for executing mitigation actions at the Historic Properties, as identified in Section 4.0 of this HPTP. For each action, organizational responsibilities are outlined, a timeline is provided, and regulatory reviews are listed.

Section 6.0 References: A list of works cited in this HPTP.

2.0 CULTURAL RESOURCES REGULATORY CONTEXT

Project Overview: Ocean Wind1 Offshore Wind Farm (OCW1)

BOEM has determined that approval, approval with modification, or disapproval of the OCW1 COP constitutes an undertaking subject to Section 106 of the National Historic Preservation Act (NHPA; 54 U.S.C. § 306108) and its implementing regulations (36 CFR 800), and that the activities proposed under the COP have the potential to affect historic properties. The OCW1 undertaking is defined as a wind-powered electric generating facility composed of up to 98 wind turbine generators (WTGs) and associated foundations, up to three offshore substations, and inter-array cables connecting the WTGs and the offshore substations (**Figure 2-1**). The WTGs, foundations, offshore substations, and inter-array cables will all be in federal waters on the Outer Continental Shelf (OCS), approximately 15 statute miles (mi) (13 nautical miles [nm]) southeast of Atlantic City, New Jersey. Cables will be buried below the seabed.

Export cables from the offshore substations will extend along the seabed and connect to buried onshore export cables, which will connect to two interconnection points, at Oyster Creek and BL England. Onshore cables will be buried within and up to a 15-meters (m)-wide (50-feet[ft]-wide) construction corridor with a permanent easement up to 9.8-m-wide (30-ft-wide) for BL England. Two new onshore substations are proposed at Oyster Creek and BL England along with grid connections to the existing grid for each substation. Onshore substation locations would be sited on existing parcels containing decommissioned power facilities at BL England and Oyster Creek. The Oyster Creek and BL England onshore substation locations would require a permanent site up to 31.5 acres (ac) (12.7 hectares [ha]) and 13 ac (5.3 ha) respectively, for the substation equipment and buildings, energy storage, and stormwater management and associated landscaping. Underground or overhead transmission lines would connect the substations to the planned interconnection point (grid connections).

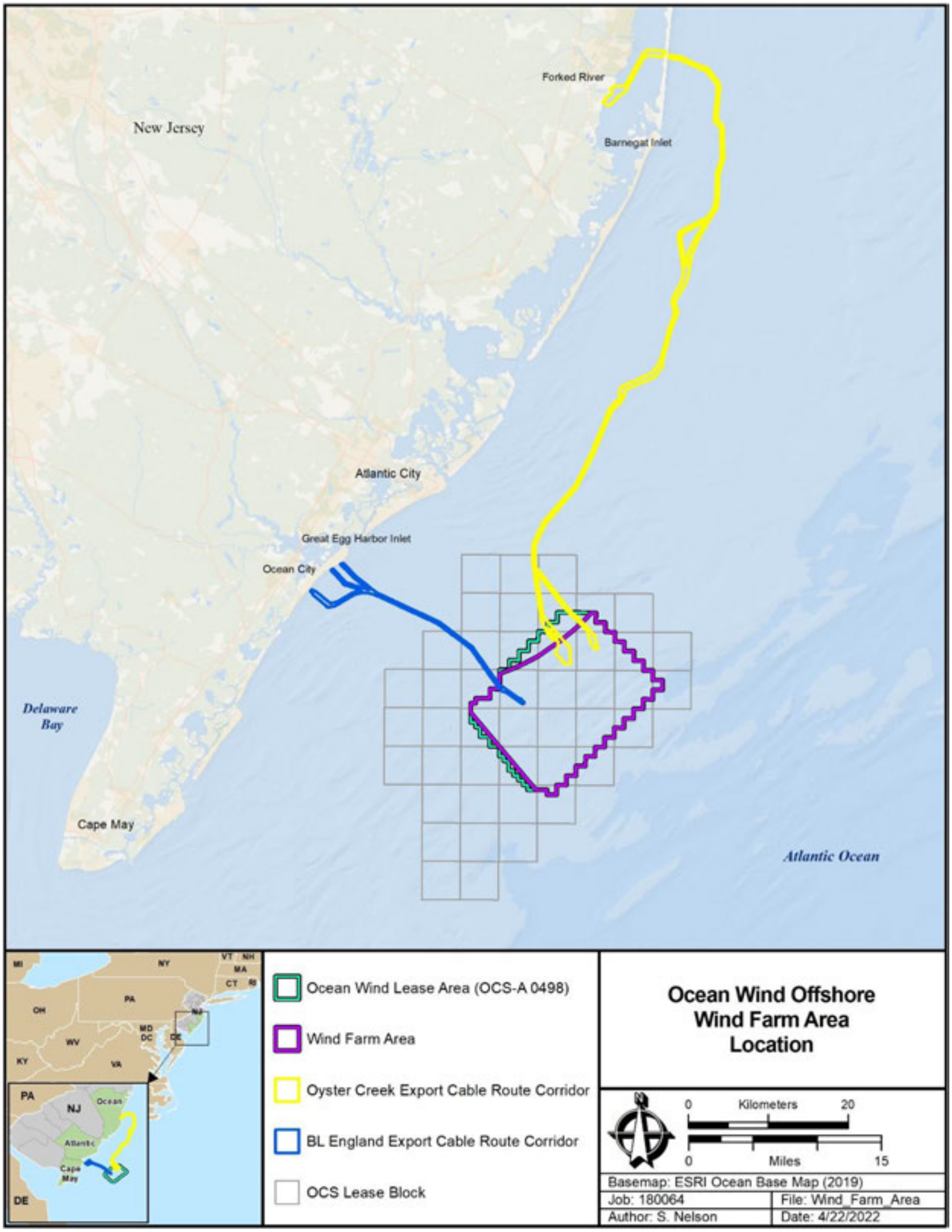

Figure 2-1. Project Location

Section 106 of the National Historic Preservation Act (NHPA)

This HPTP was developed based on coordination with BOEM and reflects consultations conducted by BOEM with multiple consulting parties, including the NJHPO and Tribes for whom the historic properties have traditional cultural and/or religious significance. The regulations at 36 CFR § 800.8 provide for use of the National Environmental Policy Act (NEPA) process to fulfill a federal agency's National Historic Preservation Act (NHPA) Section 106 review obligations in lieu of the procedures set forth in 36 CFR § 800.3 through 800.6. Under these provisions, issuance of a Record of Decision (ROD) and implementation of relevant conditions will resolve adverse effects to historic properties caused by the Undertaking. BOEM may also choose to develop an NHPA Section 106 Memorandum of Agreement (MOA) to resolve adverse effects to historic properties. As defined in 36 CFR § 800.6 (c), a project specific MOA will record the terms and conditions agreed upon to resolve adverse effects of the undertaking (i.e., the approval, approval with modification, or disapproval of the OCW1 COP). If BOEM chooses to approve the OCW1 COP or approve the COP with modifications, implementation of the NHPA Section 106 MOA will be included in the ROD).

OCW1 will implement the following applicant-proposed environmental protection measures to avoid and minimize potential impacts to marine archaeological resources:

- Tribal representatives were involved, and will continue to be involved, in marine survey protocol design, execution of the surveys, and review of the results;
- An anchoring plan for vessels will be developed prior to construction to identify avoidance/no-anchorage areas around historic properties to avoid anchoring impacts to these resources; and
- A Post-Review Discoveries Plan (PRDP) will be implemented that will include stop-work and notification procedures to be followed if a potentially significant archaeological resource is encountered during construction (refer to the Project's Marine Archaeological Resource Assessment Report [COP Appendix F-1]).

This HPTP describes the applicant-proposed treatment plans to resolve the remaining adverse effects after application of the above-listed measures. The mitigation measures reflect refinement of the conceptual mitigation framework proposed by Ocean Wind1 (see COP Appendix F-4).

All activities implemented under this HPTP will be conducted in accordance with any conditions imposed by BOEM in its ROD and with applicable local, state, and federal regulations and permitting requirements. Responsibilities for specific compliance actions are described in further detail in Section 5.0, Organizational Responsibilities.

Participating NHPA Section 106 Consulting Parties

BOEM initiated consultation under Section 106 with invitations to potential consulting parties in March 2021, including the NJHPO and ACHP. BOEM invited the following federally and state recognized Tribes with historic and cultural ties to the OCW1 project areas to participate in the Section 106 review as consulting parties:

- Absentee-Shawnee Tribe of Indians of Oklahoma
- Delaware Tribe of Indians
- Eastern Shawnee Tribe of Oklahoma
- Shawnee Tribe
- Stockbridge-Munsee Community Band of Mohican Indians
- The Delaware Nation
- The Narragansett Indian Tribe
- The Shinnecock Indian Nation

In addition to the federally and state recognized Tribes, BOEM invited the following state recognized Tribes to participate as Section 106 consulting parties.

- Nanticoke Indian Association, Inc.
- Nanticoke Lenni-Lenape Tribal Nation
- Nanticoke Lenni-Lenape Tribe
- Powhatan Renape Nation
- Ramapough Lenape Indian Nation
- Ramapough Mountain Indians
- Lenape Indian Tribe of Delaware

OCW1 anticipates the above-listed parties and any subsequently identified parties will participate in the finalization of this HPTP through BOEM's Section 106 consultation process.

After its initial invitation, BOEM hosted the following Section 106 consultation meetings with consulting parties on the following dates:

- April 13, 15, and 20, 2021: NEPA Public Scoping Meeting
- March 8, 2022: Section 106 Consulting Party Meeting 1
- May 4, 2022: Section 106 Consulting Party Meeting 2

Ocean Wind1 anticipates that BOEM will hold additional meetings pursuant to Sections 106 and 110(f) of the NHPA and in accordance with 36 CFR 800.8.

Consulting Parties referred to in this HPTP include the consulting parties, federally and state recognized Tribes, and state recognized Tribes detailed above. No additional Consulting Parties are expected to be involved in the implementation of this HPTP, not all parties identified may choose to provide input or participate in the HPTP mitigation process.

3.0 EXISTING CONDITIONS AND HISTORIC SIGNIFICANCE

Affected Ancient Submerged Landforms

This HPTP involves thirteen (13) historic properties, as identified below in **Table 3-1**. All 13 historic properties are ancient, submerged landform features (ASLFs) identified during geophysical and geotechnical investigations within the OCW1 Wind Farm Area (WFA) and within the BL England and Oyster Creek Export Cable Routes (ECRs) Corridors.

Table 3-1. Historic Properties included in the HPTP.

Name	Project Component Area
Target 21	Wind Farm Area
Target 22	Wind Farm Area
Target 23	Wind Farm Area
Target 24	Wind Farm Area
Target 25	Wind Farm Area
Target 26	Wind Farm Area
Target 28	Wind Farm Area
Target 29	Wind Farm Area
Target 30	Wind Farm Area
Target 31	Wind Farm Area
Target 33	BL England Export Cable Route Corridor
Target 34	Oyster Creek Export Cable Route Corridor
Target 35	Oyster Creek Export Cable Route Corridor

Adversely Affected Historic Properties

Physical Description and Existing Conditions

Target 21: Target 21 represents the northern portion of an interfluve of U30/H30 flanked on the west by a meandering channel and a possible sinuous channel on the east. This topographical high between two channels was most likely a vegetative-rich area. Covering approximately 29.4 ha (146.2 ac), the acoustic imagery of Target 21 indicates a well-preserved margin between two divergent river channels. The reflector is buried 7.5 m (24.7 ft) below seabed (bsb) and is 874.3 m (2,868.4 ft) at its widest. Approximately 40% (23.6 ha [58.2 ac]) of Target 21 is present within the APE around a proposed turbine location and the inter-array cable corridor.

Target 22: Target 22 represents two possible landscapes based on the ground model and the seismic data. Seismic data appears to represent a preserved interfluve associated with U30/H30, while the ground model depicts a margin adjacent to a deeply incised channel. Marine transgression removed a large portion of the possible eastern tributary, resulting in two possible interpretations. Either environment would have been a vegetative rich landscape; archaeological core AC-15 recovered an intact paleosol from this area, aiding in the interpretation of Target 22. Covering approximately 181.9 ha (449.6 ac), the acoustic imagery of Target 22 suggests a well-preserved margin between a major paleochannel and a tributary. The reflector is buried 7.8 m (25.6 ft) bsb and is 1,478.9 m (4,852.0 ft) at its widest. Approximately 70% (127.8 ha [315.7 ac]) of Target 22 is present within the APE around a proposed turbine location and the inter-array cable corridor.

Target 23: Target 23 represents the western flank of a meandering paleochannel associated with U30/H30. Marine transgression removed portions of this margin, downcutting into the potential former subaerial landscape. Nearby archaeological core AC-03_rev did not yield any evidence of a paleosol as it penetrated through the channel. Covering approximately 202.0 ha (499.2 ac), the acoustic imagery of Target 23 evidences a slightly eroded, yet preserved paleochannel flank. The reflector is buried 6.2 m (20.3 ft) bsb and is 2,468.7 m (8,099.4 ft) at its widest. Approximately 76% (154.5 ha [381.7 ac]) of Target 23 is present within the APE around a proposed turbine location and the inter-array cable corridor.

Target 24: Target 24 represents the eastern flank of a meandering paleochannel associated with U30/H30. Marine transgression removed portions of this margin, downcutting into the former subaerial landscape. Archaeological core AC-16 recovered an intact paleosol from this area, aiding in the interpretation of Target 24. Covering approximately 126.5 ha (312.5 ac), the acoustic imagery of Target 24 indicates a slightly eroded, yet preserved paleochannel flank. The reflector, , is buried 3.2 m (10.5 ft) bsb and is 1,178.7 m (3867.1 ft) at its widest. Approximately 60% (75.6 ha [186.9 ac]) of Target 24 is present within the APE around a proposed turbine location and the inter-array cable corridor.

Target 25: Target 25 represents the eastern flank and floodplain of a major paleochannel associated with U30/H30. This geomorphic feature of archaeological interest is an extensive, well-preserved surface represented by a dark reflector in seismic imagery covering approximately 650.6 ha (1,607.6 ac). Archaeological cores AC-13_rev and AC-14_rev recovered similar intact paleosols from within Target 25, aiding in the interpretation of Target 25. The reflector is buried 5.8 m (19.0 ft) bsb and is 2,364.3 m (7,756.9 ft) at its widest. Approximately 41% (268.1 ha [662.5 ac]) of Target 25 is present within the APE intersecting four turbine locations and inter-array cable corridors.

Target 26: Target 26 represents a discrete portion of the western flank and floodplain of a meandering paleochannel associated with U30/H30, similar to Target 23. Covering approximately 33.9 ha (83.7 ac), the acoustic imagery of Target 26 suggests a well-preserved paleochannel flank and floodplain. The reflector is buried 1.8 m (5.9 ft) bsb and is 763.1 m (2,503.6 ft) at its widest. Nearby archaeological core AC-01 did not yield any evidence of a paleosol as it penetrated through the channel (see 2020 Marine Archaeological Geotechnical Campaign). Approximately 99% (33.4 ha [82.5 ac]) of Target 26 is present within the APE around a proposed turbine location and the inter-array cable corridor.

Target 28: Target 28 represents an interfluve between a bifurcation or convergence of a major paleochannel and a tributary associated with U30/H30. A significant portion of this geomorphic feature of archaeological interest remains intact, although marine transgression removed portions of this feature in the northeast, downcutting into the potential former subaerial landscape. Nearby archaeological cores AC-09a and AC-10 did not yield any evidence of a paleosol, as both penetrated the paleochannel. Covering approximately 210.8 ha (520.9 ac), the acoustic imagery of Target 28 indicates a well-preserved surface between two paleochannels. The reflector is buried 2.5 m (8.2 ft) bsb and is 1,7551.1 m (5,758.2 ft) at its widest. Approximately 24% (50.6 ha [125.1 ac]) of Target 28 is present within the APE around a proposed turbine location and the inter-array cable corridor.

Target 29: Target 29 represents an interfluve between a meandering paleochannel and a straight paleochannel associated with U30/H30. Marine transgression removed portions of this margin, truncating the floodplains. Additionally, portions of the meandering paleochannel cut through Target 29 for a period. Nearby archaeological core AC-05a did not yield evidence of a paleosol as it penetrated through a thin portion of U30/H30 to capture lower stratigraphic units. Covering approximately 203.4 ha (502.7 ac), the acoustic imagery of Target 29 suggests a slightly eroded, yet preserved paleochannel flank. The reflector is buried 1.1 m (3.6 ft) bsb and is 1,907.7 m (6,258.8 ft) at its widest. Approximately 41% (83.0 ha [205.2 ac]) of Target 29 is present within the APE around four proposed turbine locations and inter-array cable corridors.

Target 30: Target 30 represents a discrete portion of the eastern flank of a major paleochannel associated with U30/H30. Nearby archaeological core AC-04 captured evidence of a paleosol; however, the spatial extent of this surface is highly truncated ephemeral due to marine transgression. Covering approximately 23.7 ha (58.5 ac), the acoustic imagery of Target 30 indicates a slightly eroded, yet preserved paleochannel flank. The reflector is buried 2.5 m (8.2 ft) bsb and is 417.3 m (1,369.1 ft) at its widest. Approximately 69% (16.3 ha [40.4 ac]) of Target 30 is present within the APE around a proposed turbine location and the inter-array cable corridor.

Target 31: Target 31 represents an extensive portion of the western flank of a major paleochannel associated with U30/H30. Marine transgression removed portions of this margin, downcutting into the potential former subaerial landscape. Nearby archaeological core AC-08 did not yield any evidence of a paleosol as it penetrated through the channel. Radiocarbon dating from Target 31 suggests the former subaerial landscape is older than the archaeological framework for human settlement in North America; however, overlying stratigraphic units dated within the accepted timeframe. Covering approximately 59.6 ha (147.6 ac), the acoustic imagery of Target 31 indicates a slightly eroded, yet preserved paleochannel flank. The reflector is buried 1.8 m (5.9 ft) bsb and is 1,828.9 m (6,000.3 ft) at its widest. Approximately 79% (47.3 ha [116.9 ac]) of Target 31 is present within the APE around two proposed turbine locations and array cable corridors.

Target 33: Target 33 is located along the BL England ECR Corridor and represents the flank and floodplain of a paleochannel associated with U30/H30. Marine transgression removed portions of this paleolandform, downcutting into the potential former subaerial landscape. Acoustic imagery of Target 33 is similar to other targets within the WFA (i.e., Target 29). Covering approximately 55.9 ha (138.2 ac), the acoustic imagery of Target 33 indicates a slightly eroded, yet preserved paleochannel flank. The reflector is buried 2.3 m (7.5 ft) bsb and is 1,198.8 m (3,933.1 ft) at its widest. Approximately 69% (38.4 ha [94.8 ac]) of Target 33 is present within the APE.

Target 34: Target 34 is within the Oyster Creek ECR Corridor and represents the preserved channel margins of a minor tributary associated with U30/H30. Marine transgression removed portions of this paleolandform, downcutting into the potential former subaerial landscape. Acoustic imagery of Target 34 is similar to other targets within the WFA (i.e., Target 29). Covering approximately 13.1 ha (32.3 ac), the acoustic imagery of

Target 34 is indicative of a slightly eroded, yet preserved paleochannel flank. The reflector is buried 4.0 m (13.1 ft) bsb and is 743.2 m (2,438.3 ft) at its widest. Approximately 80% (10.5 ha [25.8 ac]) of Target 34 is present within the APE.

Target 35: Target 35 is in the Oyster Creek ECR Corridor and a small portion of the WFA and represents the eastern flank of a major paleochannel associated with U30/H30. Marine transgression removed portions of this margin, downcutting into the potential former subaerial landscape. Acoustic imagery of Target 35 is similar to other targets within the WFA (i.e., Target 29). Covering approximately 20.4 ha (50.5 ac), the acoustic imagery of Target 35 suggests a slightly eroded, yet preserved paleochannel flank. The reflector is buried 4.3 m (14.1 ft) bsb and is 1,110.8 m (3,644.3 ft) at its widest. Target 35 exists entirely within the APE.

Historic Context

The paleolandscape reconstruction for the APE based on the geophysical and geotechnical data indicated that unit 30 and its corresponding basal horizon (U30/H30) represented the last subaerial surface available for human occupation prior to the terminal Pleistocene sea level transgression. Radiocarbon data collected during the geoarchaeological campaign confirmed that U30/H30 dated to 9,351 cal BP to 13,646 cal BP. This timeframe correlates to the archaeologically defined Paleoindian Period (Lothrop et al. 2016) and Early Archaic Period (Kraft and Mournier 1982). Targets 21-26, 28-31, and 33-35 represent discontinuous portions of this surface and are the preserved margins adjacent to the paleo-fluvial network that once dominated this landscape. The interpretation of these ASLFs suggests that stable, former subaerial surfaces, such as these, are the most likely locations where evidence of human occupation could be preserved.

Although direct evidence of the former inhabitants does not exist within the current dataset, the paleoenvironmental reconstruction and correlation to similar, known terrestrial archaeological sites suggest the ASLFs are types of locations frequented by indigenous peoples in the region. Paleoindian and early Archaic peoples were highly mobile populations that relied on resource rich areas for survival, such as river valleys. Coastal adaptation during this time is not well-understood due to the nature of marine transgression. It is highly likely that the former coastline now drowned and buried on the OCS also was a locale frequented and utilized by the same indigenous populations.

The ASLFs discussed above represent preserved elements of a former subaerial surface, one that was likely home to the indigenous peoples. These types of features are recognized as having traditional cultural significance to the consulting Tribes, many of whom are ancestors of the people that once traversed this landscape. Several of the Tribes maintain within their traditions that their people have always been present here. Their Tribal histories possess accounts of their ancestors existing and interacting with these former subaerial surfaces, a place that holds value and importance to their heritage and identity.

NRHP Criteria

Based on prior BOEM consultations for the South Fork Wind Farm and Vineyard Wind 1 Wind Farm undertakings and the lessee’s assessments, the identified ASLFs are potentially eligible for listing in the

National Register of Historic Places, per 36 CFR 60.4, under Criterion D for their potential to yield important information about the indigenous settlement of the northeastern United States and development of coastal subsistence adaptations. Each ASLF may also be eligible for listing under Criterion A for their association with and importance in maintaining the cultural identities of multiple Tribes.

4.0 MITIGATION MEASURES

This section details the proposed mitigation measures to resolve adverse effects to historic properties. The conceptual mitigation measures were developed on behalf of OCW1 by individuals who meet Secretary of the Interior (SOI) Qualifications Standards for Archeology and/or History (62 FR 33708) and are appropriate to fully address the nature, scope, size, and magnitude of adverse effects including cumulative effects caused by the Project to the NRHP-qualifying characteristics of each historic property that would be affected. OCW1 has prepared this draft HPTP for inclusion in the DEIS and subsequent review by consulting parties.

BOEM, OCW1, and NHPA Section 106 consulting parties with demonstrated interest in the affected properties will identify steps to implement the following proposed measures. The final mitigation measures agreed upon at the conclusion of the NHPA Section 106 consultations will be led by a Qualified Marine Archaeologist (QMA) pursuant to 30 CFR 585 and who meets SOI Qualifications Standards for Archeology and Historic Preservation (48 FR 44738-44739).

Preconstruction Geoarchaeology

Purpose and Intended Outcome

This mitigation measure will consist of, prior to construction, the collection of vibracores within the affected portions of each ASLF that was not previously investigated during the 2020 Geotechnical Survey campaign. Target 22, 24, 25, and 30 have already been sampled during the 2020 geoarchaeological effort and will not be sampled during this effort. The focus will be on the effected landforms not previously investigated. The collected cores, the locations which will be selected in consultation with Tribes, BOEM, and the NJHPO, and will be analyzed in collaboration with the Tribes to provide a more detailed understanding of ancient, former terrestrial landscapes within the OCW1 WFA and ECR corridors and how such settings may have been used by Late Pleistocene-Early Holocene indigenous peoples. Data acquired from this effort is expected to refine the age estimates for each stable landform, the timing and character of ecological transitions evidenced in the MARA report and provide an additional opportunity to recover evidence of ancient indigenous use of each ASLF.

This measure will provide for a more detailed analysis of the stratigraphy, chronology, and evolving ecological conditions at each ancient landform. Two separate reports on the analyses and interpretations will be developed. The first will be focused on content of specific interest to the consulting tribes, including a broad approach to integrating available data collected from other recent archaeological research and surveys on the Atlantic OCS. The specific content and formatting of this report will be refined in consultation with the tribes to align the work product with intended intra- and inter-tribal audiences. The second report will be geared primarily toward technical, Tribal/State Historic Preservation Officer and agency audiences.

Research Agendas

Research surrounding localized regression models and the potential for landscape preservation is growing as development along the Atlantic OCS continues. Results from additional geotechnical sampling may inform a detailed paleoshoreline regression model for this area. Integration of this data with adjacent regression models would serve to increase the understanding of the Pleistocene/Holocene transition and inundation. Additionally, sampling will reveal extant sediment profiles indicative of preserved landforms and living surfaces. The results of this study could inform numerous research agendas including, but not limited to, the following:

1) Inform scientific community of larger inundation trends;
2) Shift shoreline modeling based on localized dates;
3) Provide robust paleoenvironmental reconstruction data;
4) Indicate time frames associated with preserved landforms and cultural complexes;
5) Inform localized preservation potential based on environmental contexts;
6) Determine possible evidence of human presence in the environment.

Additional research agendas and specific research questions will be determined through consultation. The OCS represents the last preserved portion of a former subaerial landscape originally home to the Tribes now scattered along the eastern seaboard and across the United States. This mitigation effort (**Table 4.1**)is designed to be a dynamic interaction between scientific research and tribal knowledge. Combining these two factors will serve to produce an understanding of not only the former physical landscape of the OCS, but also the potential interactions of humans with and on this landscape.

Table 4-1. Proposed ASLF Mitigation

ASLF ID	Paleolandform Type	Geotechnical Testing/Results	Proposed Mitigation	Research Agenda
Target 21	Interfluve w/possible meandering and sinuous channels	No testing	2-3 geoarchaeological cores	1-6
Target 22	Possible interfluve or margin adjacent to a large paleochannel	AC-15/preservation	No additional testing recommended	N/A
Target 23	Flank of meandering paleochannel	AC-03/No preservation	2-3 geoarchaeological cores	1-6

ASLF ID	Paleolandform Type	Geotechnical Testing/Results	Proposed Mitigation	Research Agenda
Target 24	Flank of meandering paleochannel	AC-16/preservation	No additional testing recommended	N/A
Target 25	Flank and floodplain of major paleochannel	AC-13, AC-14/preservation	No additional testing recommended	N/A
Target 26	Flank and floodplain of meandering paleochannel	AC-01/No preservation	2-3 geoarchaeological cores	1-6
Target 28	Interfluve between bifurcation/convergence of major paleochannel and tributary	AC-09a, AC-10/No preservation	2-3 geoarchaeological cores	1-6
Target 29	Interfluve between meandering paleochannel and straight paleochannel	AC-05a/No preservation	2-3 geoarchaeological cores	1-6
Target 30	Flank of major paleochannel	AC-04/preservation	No additional testing recommended	N/A
Target 31	Extensive flank of major paleochannel	AC-08/No preservation	2-3 geoarchaeological cores	1-6
Target 33	Flank and floodplain of paleochannel	No testing	2-3 geoarchaeological cores	1-6
Target 34	Channel margins of minor tributary	No testing	2-3 geoarchaeological cores	1-6
Target 35	Flank of major paleochannel	No testing	2-3 geoarchaeological cores	1-6

Scope of Work

The scope of work will consist of the following:

- Collaborative review of existing geophysical and geotechnical data with Tribes;

- Selection of coring locations in consultation with Tribes;
- Collection of two to three vibracores within each affected ASLF that has not been previously sampled, with a sampling focus on areas that will be disturbed by Project construction activities;
- Written verification to BOEM that the samples collected are sufficient for the planned analyses and consistent with the agreed scope of work;
- Collaborative laboratory analyses at a laboratory located in Rhode Island or New Jersey;
- Screening of recovered sediments for debitage or micro-debitage associated with indigenous land uses;
- Third-party laboratory analyses, including micro- and macro-faunal analyses, micro- and macro-botanical analyses, radiocarbon dating of organic subsamples, and chemical analyses for potential indirect evidence of indigenous occupations;
- Temporary curation of archival core sections;
- Draft reports for review by Consulting Parties;
- Final reporting;
- Public or professional presentations summarizing the results of the investigations, developed with the consent of the consulting Tribes.

Methodology

OCW1 will conduct the Preconstruction Geoarchaeology in consultation with the Tribes, BOEM, and the NJHPO. Although BOEM and the NJHPO will be consulted, the research, analyses, and interpretations are intended to be a collaborative effort between OCW1 and the consulting Tribes, who will be invited by OCW1 to a series of working sessions to:

- Review existing data;
- Develop specific research questions addressing the Tribes' interests in the ASLFs;
- Select candidate coring locations;
- Split, document, and sample recovered vibracores in the laboratory;
- Review analytic results and preliminary interpretations; and
- Review draft reporting.

Vibracores placed within the affected sections of each ASLF will extend a maximum depth of approximately 20 ft (6 m) below the seafloor. The cores will be cut on the survey vessel into approximately 1-meter-long sections and sealed to minimize the risk of environmental contamination. The core segments will be logged on the survey vessel and a chain of custody will be maintained to ensure all samples are accounted for and that all samples are transferred to the laboratory for geoarchaeological analyses. Once the core segments are transferred to the onshore laboratory, OCW1 will invite Tribal representatives to participate in the splitting, documentation, and subsampling of each core.

Each core segment will be split longitudinally into working and archival halves. Subsamples collected from working halves for specific third-party analyses will be packaged in a manner appropriate to the specific analysis for which they are intended. Archival halves will be sealed and stored horizontally on shelves or racks in a climate-controlled facility for at least one year following completion of laboratory analyses. OCW1 will prioritize reasonable access to archival core segments by consulting parties and researchers when selecting the storage facility. All samples collected from the working halves will be submitted to third party laboratories within approximately 6 months of core transfer to the Qualified Marine Archaeologist facilities.

OCW1 will prepare a presentation of the preliminary results and interpretations for discussion with the Tribes (see work session schedule above). OCW1 will consider the Tribes' comments and suggestions when preparing the draft reports and will seek to resolve any disagreements among the parties through supplemental consultations prior to preparing the draft reports. OCW1 will submit the draft reports to the Consulting Parties for review and comment. OCW1 will consider all comments received when developing the final reports. Final digital copies of the completed reports will be provided to all Consulting Parties. Hard copies of the final reports will be submitted to the State Historic Preservation Officers, Tribes governments or other parties upon request.

Following the one-year retention period, OCW1 will offer transfer of the archival core segments to the Consulting Tribes, SHPOs and related state agencies, and regional research institutions with an interest in and capacity to conduct further analyses. OCW1 currently anticipates research institutions with potential interests/capacities to include the Princeton University, Rutgers University, New Jersey Institute of Technology, and the University of Rhode Island. OCW1 will notify the Consulting Parties of its intent to transfer archival core segments to any party at least 45 days prior to initiating such transfer and will consider any comments provided by Consulting Parties before proceeding. If no external parties agree to accept the archival core segments, OCW1 will water-screen the retained segments to identify and collect potential physical evidence of ancient Native American activity at the ASLFs. In such circumstances, OCW1 will prepare a technical memorandum summarizing the results of the archival core segment processing and analyses and submit that memorandum to the Consulting Parties.

Standards

The Preconstruction Geoarchaeology effort will be conducted in accordance with BOEM's *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* (May 2020). The qualified professional archaeologists leading the research will meet the SOI professional qualification standards for archeology (62 FR 33708) and BOEM's standards for Qualified Marine Archaeologists.

Documentation

The following documentation is to be provided for review by Consulting Parties:

- Draft Tribe Audience Report;
- Draft Technical Report;
- Final Tribes Audience Report;
- Final Technical Report; and

- Draft Public or Professional Presentations.

Funds and Accounting

OCW1 will be responsible for funding and implementation of this mitigation measure.

Open-Source GIS and Story Maps

Purpose and Intended Outcome

This mitigation measure will consist of the compilation and transfer of relevant geophysical, geotechnical, and geoarchaeological datasets pertaining to the ASLFs to a non-proprietary GIS system for use by Tribes. The datasets will include sub-bottom (seismic) data used to characterize the seabed and ASLF features, the location of all geotechnical/geoarchaeological samples collected, and the vertical and horizontal extents of the affected features or sub-features within each ASLF. The GIS will be, to the extent feasible and practicable, compatible with GIS datasets compiled for other OCS projects to assist in the Tribes on-going research and stewardship efforts. Story Maps or equivalent digital media presentations will be prepared to integrate and present the complex technical data compiled during the MARA and mitigation investigations in a manner best suited for inter- and intra-tribal audiences. Story Map content would be developed in close consultation and collaboration with the consulting Tribes.

Incorporation of OCW1 datasets into a broader GIS framework will allow the Tribes to better understand and protect preserved elements of the ASLF of traditional cultural significance. The intent of this measure is to enhance the Tribes understanding of existing conditions for a range of ASLFs located in the northeastern Atlantic OCS. This knowledge would allow for more effective Government to Government consultations regarding similar features that may be affected by future federal undertakings. The value of the GIS will increase as additional datasets are acquired and incorporated. Access to the GIS will support each Tribes capacity to pursue their own research or intra-tribal educational programs related to the OCS and traditional cultural uses of the now-submerged landscapes of their ancestors.

The combined MARA and Preconstruction Geoarchaeology investigations will provide an important perspective on the preservation of submerged Traditional Cultural Properties within formerly glaciated sections of the OCS and within the footprint of former glacial lakes. Integrated GIS that can accommodate datasets collected from other OCS development projects and surveys would allow for comparisons to areas south of the maximum glacial limits on the OCS to provide a more comprehensive view of the ancient landscapes within the region. OCW1 will provide reasonable compensation to tribal representatives working with OCW1 on implementation of this measure. Story Maps created within the GIS will provide a flexible approach to incorporating media from a variety of sources, including geospatial data, interviews with traditional knowledge-holders, photographs, audio recordings, and archival cartography for a compelling interpretive experience. Story Maps can be tailored for specific tribal audiences and uses and would be developed in consultation with the consulting Tribes.

Scope of Work

The scope of work will consist of the following:

- Consultation with the Tribes to determine the appropriate open-source GIS platform;
- Review of candidate datasets and attributes for inclusion in the GIS;
- Data integration;
- Development of custom reports or queries to assist in future research or tribal maintenance of the GIS;
- Work Sessions with Tribes to develop Story Map content;
- Training session with Tribes to review GIS functionality;
- Review of Draft Story Maps with Tribes;
- Delivery of GIS to Tribes; and
- Delivery of Final Story Maps.

Methodology

OCW1 will develop the GIS in consultation with the Consulting Parties. At least one work session will be scheduled to refine specific functionality of interest to the Tribes. That session will be conducted after the preliminary data analyses for the Preconstruction Geoarchaeology effort has been completed. This will allow for a more focused walk-through of the data and options for organizing and integrating different datasets. OCW1 will request from the Tribes details on any existing open-source GIS systems currently in use by each Tribe/Tribal Nation to minimize any issues with data integration or interoperability.

Once the work session has been conducted OCW1 will proceed with development of the GIS, considering the Tribes' comments and suggestions. The draft GIS system will be shared with the Tribes in a training session that presents the functions of the GIS and familiarizes the Tribal representatives with the interfaces, data organization, and any custom features developed to enhance useability. OCW1 will consider any feedback from the Tribes on the draft GIS before proceeding with finalizing the system design and implementation. OCW1 will provide the GIS to the Tribes by physical storage media or as a secure digital file transfer, as appropriate to each Tribes IT infrastructure and preference. OCW1 does not intend to be responsible for the upkeep of the GIS database.

Story Map content will be developed with the consulting Tribes through one or more scheduled work sessions. Potential options for content intended for youth audiences, tribal governments, and/or general tribal membership will be discussed to refine the conceptual framework and develop draft Story Maps for review by the Tribes. OCW1 will consider all comments and feedback provided by the Tribes when preparing the final Story Maps. All comments and feedback will be collated and provided back to the Consulting Parties as part of the process.

Standards

The GIS developed under this measure will be free to use and free to modify by the Tribes. To the extent feasible, all data will be provided in formats that allow for interoperability with other GIS platforms that the Tribes may use. All datasets incorporated in the GIS will comply with Federal Geographic Data Committee data and metadata standards.

Documentation

OCW1 will provide draft descriptions and documentation of the GIS for review by the Consulting Parties and will provide a description of the draft Story Maps to the consulting Tribes following the initial working sessions.

The following documentation is to be provided for review by Consulting Parties:

- Draft Description of the GIS with appropriate schema, data organization, and custom reports/queries;
- Draft Story Map descriptions with details on content, formatting, and intended audiences; and
- Final Technical Description of the GIS with schema, data organization, and custom reports/queries.

Funds and Accounting

OCW1 will be responsible for funding and implementation of this mitigation measure.

Post-Construction Seafloor Impact Inspection

Purpose and Intended Outcome

OCW1 proposes a mitigation measure to assess impacts to ASLFs via seafloor inspection due to construction activities. This effort will focus on areas of cable installation as this activity is more likely to disturb and redistribute shallow portions of a previously identified ASLF. OCW1 will construct a 3D model defining the spatial relationship of project components and installation methodology (e.g., cable installation via trenching or jetting) relative to the ASLFs. The 3D model will identify portions of the ASLFs within the vertical APE that will be impacted and possess a high preservation potential for evidence of human occupation. OCW1 will coordinate with BOEM and consulting parties on the results of this effort to select locations for post-construction visual inspection.

OCW1's QMA will design and direct the visual inspection of the seafloor at the selected locations identified through the above process to assess for the presence/absence of displaced cultural materials from the ASLF. BOEM and OCW1 will work together to determine the ROV inspection methodology. Post-construction inspection will focus on the areas of disturbance within the ASLFs. Various factors, including but not limited to environmental conditions, health and safety risks, the spatial extent of impacts, and the unique characteristics of each selected ASLFs will be considered before mobilization to conduct the visual inspection.

Scope of Work

The scope of work will consist of the following:

- Development of 3D model throughout ASLFs designated for review.
- Development of the ROV investigation methodology
- Review of candidate datasets and attributes for inclusion in the GIS;
- Data Interpretative technical report draft; and
- Final technical report.

Methodology

Inspection of the impacted portions of the ASLFs will consist of the following:

- Development of 3D model throughout ASLFs designated for review.
- Consultation with BOEM to discuss the ROV investigation methodology.
- QMA directed remotely operated vehicle (ROV) inspection of the seafloor along impacted portions of the selected ASLFs:
    - Multibeam Echosounder (MBES)
    - Scanning Sonar
    - Ultra-short baseline (USBL) positioning
    - HD photo & video camera with laser scale
    - Lowlight camera
    - ROV lighting
    - Forward-looking sonar (FLS) multibeam
- Data interpretative technical draft and final reports with accompanying investigation data.

SEARCH will define the spatial relationship of project components and installation methodology relative to the ASLFs. The upper and lower ranges of each ASLF are not static and undulate unpredictably. Detailed review of the 2D seismic data will allow for selection of the best suited ASLFs for post-construction inspection. Based on the preliminary 2D seismic assessment, SEARCH will develop a 3D model of the affected ASLFs to finalize the areas for review. The 3D model will identify portions of the ASLFs within the vertical APE that will be impacted and possess a high preservation potential for evidence of human occupation. SEARCH will coordinate with BOEM and consulting parties on the results of this effort to select locations for post-construction visual inspection.

This effort will focus on areas of cable installation as this activity is more likely to disturb and redistribute shallow portions of a previously identified ASLF. Therefore, the inspection process is designed to focus on the ASLFs with the shallowest subsurface expression and highest likelihood of containing intact deposits. The final number of ASLFs will be selected for this post-construction inspection based on a detailed review of the proposed cable route and the aforementioned factors. Review will focus on the disturbed sediments around the as-laid cable route and attempt to delineate any materials indicative of human presence (i.e., lithics, pottery sherds, etc.). It is important to note that it will not be possible to scientifically correlate any archaeological material to a particular ASLF. Any material identified during this inspection will be located on the seafloor and outside of its original archaeological context after being disturbed/removed by construction activities. There is no demonstrable way to determine if those materials were removed from an ASLF during construction activities, were removed from seafloor deposits overlaying the ASLF, or washed in by erosional and/or environmental factors. The goal of the investigation, therefore, is to determine the presence or absence of archaeological material on the OCS, as well as determine the preservation potential of material located on the OCS away from a coastal environment.

SEARCH will design and direct the visual and multibeam echosounder inspection of the seafloor at the selected locations identified through the above process to assess for the presence/absence of displaced cultural materials from the ASLF. ROV investigation will occur over three separate mobilizations and be conducted in 12-hour/day operations. The investigation will utilize a vessel based USBL for subsea positioning of the ROV. The site investigation would include conducting numerous passes at different approaches and orientations to capture video and still imagery of the selected ASLFs, which may be built into composite images and models. The QMA will direct the ROV to other points of interest and data acquisition points for further inspection/investigations and viewing. SEARCH will maintain detailed logs of ROV diving missions and archaeological information, as well as record video with voice-over narration and positioning overlay. Video will be recorded continuously recorded throughout the duration of all divers for later analysis and archiving. Detailed photographs, including the use of a laser scale, will be captured at the discretion of the QMA and ROV operator.

Reporting will include processing of bathymetry and imagery. MBES data will be processed in QPS Qimera to produce final sounding grids and bathymetric results on the project datum. Positional and attitude data will be refined using Applanix POSPac and post-processed vertical positions to reference the project's vertical datum. Spurious data points will be removed from gridding subsets, and sound velocity corrections will be applied before final points, grids and images are produced. Multibeam backscatter processing will be completed in QPS FMGT for each sonar. Photo and camera imagery will be utilized to provide information on potential further understanding of the selected ASLFs. Additionally, the imagery data may be merged in post-processing to develop composite images and extract point clouds to develop models of the sites in combination with the bathymetry. The goal of data acquisition and processing is to determine presence or absence of potential cultural material on the seafloor, but no cultural material will be collected.

Standards

To be determined in consultation with BOEM.

Documentation

OCW1 will provide appropriate Consulting Parties draft and final technical reports including the development of the 3D models and any resulting seafloor impact assessments.

Funds and Accounting

OCW1 will be responsible for funding and implementation of this mitigation measure.

Ethnographic Study

Purpose and Intended Outcome

OCW1 proposes a mitigation measure to fund an ethnographic study focusing on one New Jersey coastal watershed, the Great Egg Harbor River, and its potential submerged extension onto the Outer Continental Shelf (OCS) to be coordinated by the Delaware Tribe of Indians (DTI) with collaboration by The Delaware Nation (DN) and the Stockbridge-Munsee Community Band of Mohican Indians (SM).

The study will focus on Native American resources, sites, places, and knowledge of the established Great Egg Harbor River Watershed and OCS. This study constitutes baseline research to compile and assess multiple levels of documentary evidence about the ancestral and contemporary connections to the landscape (both onshore and offshore) and will utilize new data on the offshore paleolandscape, including identified ancient, submerged landform features. The study will result in a written report that may follow the general format of an Ethnographic Overview and Assessment document utilized by the National Park Service. The scope of the study may include, but is not limited to, an overview of documentary evidence including historic maps, photographs, oral histories, research reports, archival data, and interviews. Relevant GIS data layers from sources available to the public and from the recent Ocean Wind high resolution geophysical surveys could also be used for predictive modeling purposes to help identify areas of potential archaeological or other resource sensitivity of importance to the Tribes.

This study could complement additional similar studies funded by other offshore wind projects along the New Jersey shore. Although not included in this scope, the goal is for the results of this study to be integrated into a potential larger report focusing on the New Jersey coast and offshore landscapes with the intent of increasing community knowledge of the landscape and for potential use in guiding consultations for future federal undertakings.

Scope of Work

The scope of work will consist of the following:

- Funding ethnographic researcher selected by DTI for 2-year period;
- Funding for researcher travel to New Jersey for research and site visits;
- Funding for DTI, DN, and SM technology upgrades associated with analysis of GIS data;
- Funding for DTI Historic Preservation office oversight and indirect costs;
- Funding for DTI, DN, and SM THPO Collaboration;
- OCW1 will provide relevant ASLF GIS data layers to DTI for use in this study as well as provide a tutorial on the data (see previous Open-Source GIS and Story Maps mitigation measure);

- OCW1 will hold quarterly progress update calls lasting approximately one-half hour with DTI until the final technical reports are issued.
- Final deliverables will consist of one confidential report that may contain sensitive resource information and one report that could be made available to the public. Both reports will be distributed by the Tribes, at their discretion.
- Funding for a presentation to highlight the results of the study to be coordinated and executed by DTI.

Methodology

In addition to consulting the Tribal Nation's archives, documents, and oral history interviews with DTI elders, this study will also require archival research at applicable repositories in New Jersey by the ethnographic researcher with the intent of acquiring available land transfer documents, historic maps, and other historic documents. Site visits and additional research at the NJHPO facilities may also be completed by the ethnographic researcher as part of the study. Relevant GIS data layers will also be analyzed for insight into the location of potential archaeological or other resource sensitivity of importance to the Tribe. No archaeological fieldwork or landowner permissions will be required as part of this study. No sensitive or other confidential information including archaeological site locations will be made available in the public document.

Standards

The ethnographic researcher and key team members shall be fully qualified personnel as experts in their areas of traditional knowledge and research as determined by the DTI.

Documentation

To be determined in consultation with BOEM and DTI.

Funds and Accounting

OCW1 will be responsible for funding and implementation of this mitigation measure. Funding levels will follow dollar amounts previously agreed to by OCW1 and DTI.

5.0 IMPLEMENTATION

Timeline

The timeline for implementation of the mitigation measures will be determined in consultation with consulting parties based on the agreed upon mitigation measures described in the final version of this HPTP. This HPTP will be reviewed by and further developed in consultation with consulting parties as part of BOEM's NHPA Section 106 consultation and NEPA review schedule for OCW1 Wind Farm.

It is anticipated that the mitigation measure identified in Section 4.0 will commence within 2 years of ROD issuance or execution of a project specific MOA unless otherwise agreed by the consulting parties and accepted by BOEM. OCW1 assumes that the proposed scope of work will be completed within 5 years of ROD issuance or execution of the MOA, unless a different timeline is agreed upon by consulting parties and accepted by BOEM.

Organizational Responsibilities

Bureau of Ocean Energy Management (BOEM)

BOEM remains responsible for making all federal decisions and determining compliance with Section 106. BOEM has reviewed this HPTP to ensure, at minimum, it includes the content required.

- BOEM remains responsible for making all federal decisions and determining compliance with Section 106 of the NHPA;
- BOEM, in consultation with the Consulting Parties, will ensure that mitigation measures adequately resolve adverse effects, consistent with the NHPA;
- Work with OCW1, the NJHPO, Consulting Parties including federally and state recognized Tribes with cultural and/or historic ties to the Project development area, and the ACHP using the previously agreed upon HPTP framework;
- Review and provide feedback on draft HPTP;
- BOEM must accept the final HPTP before OCW1 may commence any of the actions included in the HPTP;
- BOEM will be responsible for sharing the annual summary report with consulting parties;
- BOEM is responsible for consultation related to dispute resolution; and
- If parties cannot reach concurrence, consult with ACHP and non-concurring party(s) to make final decision.

Ocean Wind LLC

Ocean Wind LLC will be responsible for:

- Funding the mitigation measures as required in the ROD and/or MOA and the final HPTP;
- Working with BOEM, the SHPO, federally and state recognized Tribes with cultural and/or historic ties to the Project development area, and the ACHP using the previously agreed upon HPTP framework;
- Considering the comments provided by the Consulting Parties in the development of this HPTP;
- Funding the mitigation measures specified in Section 4.0;
- Completion of the scope/s of work in Section 4.0;
- Ensuring all Standards in Section 4.0 are met;
- Providing the Documentation in Section 4.0 to the Consulting Parties for review and comment;
- Annual Reporting to BOEM; and

- OCW1 will be responsible for ensuring that all work that requires consultation with Tribes is performed by professionals who have demonstrated professional experience consulting with federally and state recognized Tribes.

New Jersey SHPO

The New Jersey SHPO will:

- Work with BOEM, Ocean Wind LLC, federally and state recognized Tribes with cultural and/or historic ties to the Project development area, and the ACHP using the previously agreed upon HPTP framework; and
- Review and provide feedback on draft HPTPs.

Federally and State recognized Tribes with cultural and/or historic ties to the Project development area

Federally recognized Tribes with cultural and/or historic ties to the Project development area will:

- Work with BOEM, Ocean Wind LLC, the SHPO, and the ACHP using the previously agreed upon HPTP framework;
- Review and provide feedback on draft HPTPs;
- Participate in all activities outlined in Section 4.0 and complete all associated reviews, comments, requests for feedback/input in agreed upon timeframes.

Advisory Council on Historic Preservation

The Advisory Council on Historic Preservation will:

- Work with BOEM, Ocean Wind, the SHPO, and federally and state recognized Tribes with cultural and/or historic ties to the Project development area using the previously agreed upon HPTP framework; and
- If parties cannot reach concurrence, consult with BOEM and non-concurring parties to make final decision.

Other Parties as Appropriate

OCW1 does not anticipate participation by any other NHPA Section 106 consulting parties. If BOEM determines additional consulting parties will participate in this plan, the plan will be updated to include those parties.

Participating Party Consultation

Consulting Parties will be provided opportunity for review and comment on the HPTP concurrent with BOEM's anticipated NHPA Section 106 review schedule for OCW1. OCW1 will provide this draft HPTP to BOEM for inclusion in the DEIS for review by consulting parties as part of BOEM's NHPA Section 106 review to provide meaningful input on the proposed mitigation measures to resolve adverse effects to historic properties. OCW1 anticipates that further coordination to refine the HPTP may include meetings, conference calls, HPTP draft reviews and document exchanges, or similar means of communication of information.

6.0 REFERENCES

Federal Regulations

Code of Federal Regulations (CFR). 2022. 40 CFR 1500 – National Environmental Policy Act Implementing Regulations. Available at https://www.ecfr.gov/current/title-40/chapter-V/subchapter-A.

CFR. 2021a. 36 CFR 800 – Protection of Historic Properties [incorporating amendments effective December 15, 2021]. Available at https://www.ecfr.gov/current/title-36/chapter-VIII/part-800.

CFR. 2021b. 36 CFR 61.4(e)(1) – Procedures for State, Tribal, and Local Government Historic Preservation Programs [incorporating amendments effective December 15, 2021]. Available at https://www.ecfr.gov/current/title-36/chapter-I/part-61#p-61.4(e)(1).

CFR. 2021c. 36 CFR 65.2(c)(2) – National Historic Landmarks Program – Effects of Designation [incorporating amendments effective December 15, 2021]. Available at https://www.ecfr.gov/current/title-36/chapter-I/part-65#p-65.2(c)(2). Accessed December 21, 2021.

Federal Register. 1997. 62 FR 33708 – The Secretary of the Interior's Historic Preservation Professional Qualifications Standards. Office of the Federal Register, National Archives and Records Administration. Washington, D.C. Available at https://www.govinfo.gov/app/details/FR-1997-06-20/97-16168.

United States Code. 2016. Title 54 - National Historic Preservation Act [as amended through December 16, 2016]. Available at https://www.achp.gov/sites/default/files/2018-06/nhpa.pdf.

State Regulations

New Jersey Register of Historic Places Act of 1970 (N.J.S.A. 13:1B-15.128 et seq.): https://www.state.nj.us/dep/hpo/2protection/njsa13.htm

Public documents related to Ocean Wind1

https://www.boem.gov/ocean-wind

Ocean Wind1 COP: https://www.boem.gov/ocean-wind-construction-and-operations-plan

Ocean Wind 1 DEIS: TBD

Ocean Wind 1 FEIS: TBD

Ocean Wind 1 ROD: TBD

General Information on Section 106

https://www.achp.gov/protecting-historic-properties/section-106-process/introduction-section-106 https://www.achp.gov/digital-library-section-106-landing/section-106-consultation-involving-national-historic-landmarks

Kraft, Herbert, C. and Alan R. Mournier. 1982 The Archaic Period in New Jersey (ca. 8000 BC–1000 BC). In New Jersey's Archaeological Resources, A Review of Research Problems and Survey Priorities: The Paleo-Indian Period to Present. Electronic resource, http://www.nj.gov/dep/hpo, accessed December 2018.

Lothrop Jonathan, Darrin Lowery, Arthur Spiess, and Christopher Ellis 2016. Early Human settlement of Northeastern North America. PaleoAmerica 2: 192-251

National Park Service (NPS). 1997. How to Apply the National Register Criteria for Evaluation. Rev. ed. National Register Bulletin 15. Available at: https://www.nps.gov/subjects/nationalregister/upload/NRB-15_web508.pdf. Accessed April 21, 2022.

ATTACHMENT 4 – HISTORIC PROPERTIES TREATMENT PLAN FOR THE OCEAN WIND 1 OFFSHORE WIND FARM PROJECT, HISTORIC PROPERTIES SUBJECT TO ADVERSE VISUAL EFFECT, CAPE MAY AND ATLANTIC COUNTIES, NEW JERSEY

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Draft
Historic Properties Treatment Plan
for the
Ocean Wind 1 Offshore Wind Farm Project

Historic Properties Subject to Adverse Visual Effect
Cape May, Atlantic, and Ocean Counties, New Jersey

Submitted to:

Bureau of Ocean Energy Management
U.S. Department of the Interior

Prepared for:

Ocean Wind 1
https://oceanwind.com/
Prepared by:

HDR Engineering, Inc.
www.hdrinc.com

April 2023

ABSTRACT

Federal Undertaking:	Ocean Wind 1 Offshore Wind Farm Project, OCS-A 0498
Location:	Outer Continental Shelf, New Jersey
Federal and State Agencies:	Bureau of Ocean Energy Management Bureau of Safety and Environmental Enforcement Environmental Protection Agency National Marine Fisheries Service U.S. Army Corps of Engineers New Jersey Department of Environmental Protection/State Historic Preservation Office Advisory Council on Historic Preservation
ACHP Project No.:	016649
HPO Project No.:	18-1184-30
Potential Adverse Visual Effect Finding for:	Properties in Cape May, Atlantic, and Ocean Counties
Date:	April 2023

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LIST OF ACRONYMS

ACHP	Advisory Council on Historic Preservation
ADLS	Aircraft Detection Lighting System
APE	Area of Potential Effects
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
COP	Construction and Operations Plan
EPA	Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FR	Federal Regulation
HDR	HDR, Inc.
HPTP	Historic Preservation Treatment Plan
HRVEA	Historic Resources Visual Effects Analysis
N/A	Not Applicable
NHL	National Historic Landmark
NHPA	National Historic Preservation Act of 1966
NJ DEP	New Jersey Department of Environmental Protection
NJHPO	New Jersey State Historic Preservation Office(r)
NMFS	National Marine Fisheries Service
NPS	National Park Service
NRHP	National Register of Historic Places
OCS	Outer Continental Shelf
OW1	Ocean Wind 1 Offshore Wind Farm Project
RFP	Request for Proposal
ROD	Record of Decision
SOI	Secretary of the Interior
TCP	Traditional Cultural Property
USCG	United States Coast Guard
WFA	Wind Farm Area
WTG	Wind Turbine Generator

INTRODUCTION

This Historic Properties Treatment Plan (HPTP) was prepared to support fulfillment of Stipulation III.B of the *Memorandum of Agreement (MOA) Among the Bureau of Ocean and Energy Management, The New Jersey State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Ocean Wind 1 Offshore Wind Farm Project*. This HPTP provides background data, historic property information, and detailed steps that will be implemented to carry out the mitigation actions to resolve adverse visual effects to 10 historic properties identified by the Bureau of Ocean Energy Management (BOEM) through Section 106 consultation for the Ocean Wind 1 Offshore Wind Farm (OW1), as identified in the *Ocean Wind Visual Effects on Historic Properties* (VEHP), also commonly referred to as the HRVEA (Historic Resources Visual Effects Analysis), dated October 2022 (HDR and SEARCH 2022), as well as seven additional historic properties BOEM has determined will be visually adversely affected as a result of consultation. The mitigation measures and the process for implementation described herein were developed in consultation with the federally recognized Tribes, New Jersey Historic Preservation Officer (NJHPO), the Advisory Council on Historic Preservation (ACHP), and other consulting parties. This HPTP outlines mitigation measures, implementation steps, and timeline for actions.

Introduction: Outlines the content of this HPTP.

Background Information: Briefly summarizes the OW1 (the Undertaking) while focusing on cultural resources regulatory contexts (federal, tribal, state, and local, including preservation restrictions), identifies the seventeen historic properties discussed in this HPTP that will be visually adversely affected by the Undertaking, and summarizes the pertinent conditions that guided the development of this document.

Existing Conditions and Historic Significance: Provides a physical description of each historic property included in this HPTP. Set within its historic context, each resource is discussed in terms of the applicable National Register of Historic Places (NRHP) criteria, with a focus on the contribution of a seaside setting to its significance and integrity.

Mitigation Measures: Presents specific steps to carry out the mitigation measures proposed by OW1 in the Construction and Operations Plan (COP). Each mitigation measure includes a detailed description, intended outcome, and specifications that include maximum cost, methods, standards, requirements for documentation, and reporting instructions. Property-specific challenges, if any have been identified, are outlined as well.

Implementation: Establishes the process for executing mitigation measures at the historic properties, as identified in Section 4.0 of this HPTP. For each action, organizational responsibilities are outlined, a timeline is provided, and regulatory reviews are listed.

References: A list of works cited in this HPTP.

BACKGROUND INFORMATION

BOEM has determined that the construction, operation, maintenance, and decommissioning of the Ocean Wind 1 Offshore Wind Farm constitutes an undertaking subject to Section 106 of the National Historic Preservation Act (NHPA; 54 U.S.C. § 306108) and its implementing regulations (36 CFR § 800), and that the activities proposed under the COP have the potential to affect historic properties. The Ocean Wind 1 Offshore Wind Farm undertaking (the Undertaking) includes a wind-powered electric generating facility composed of up to 98 wind turbine generators (WTGs) and associated foundations, up to three offshore substations, and inter-array cables connecting the WTGs and the offshore substations (Figure 1).

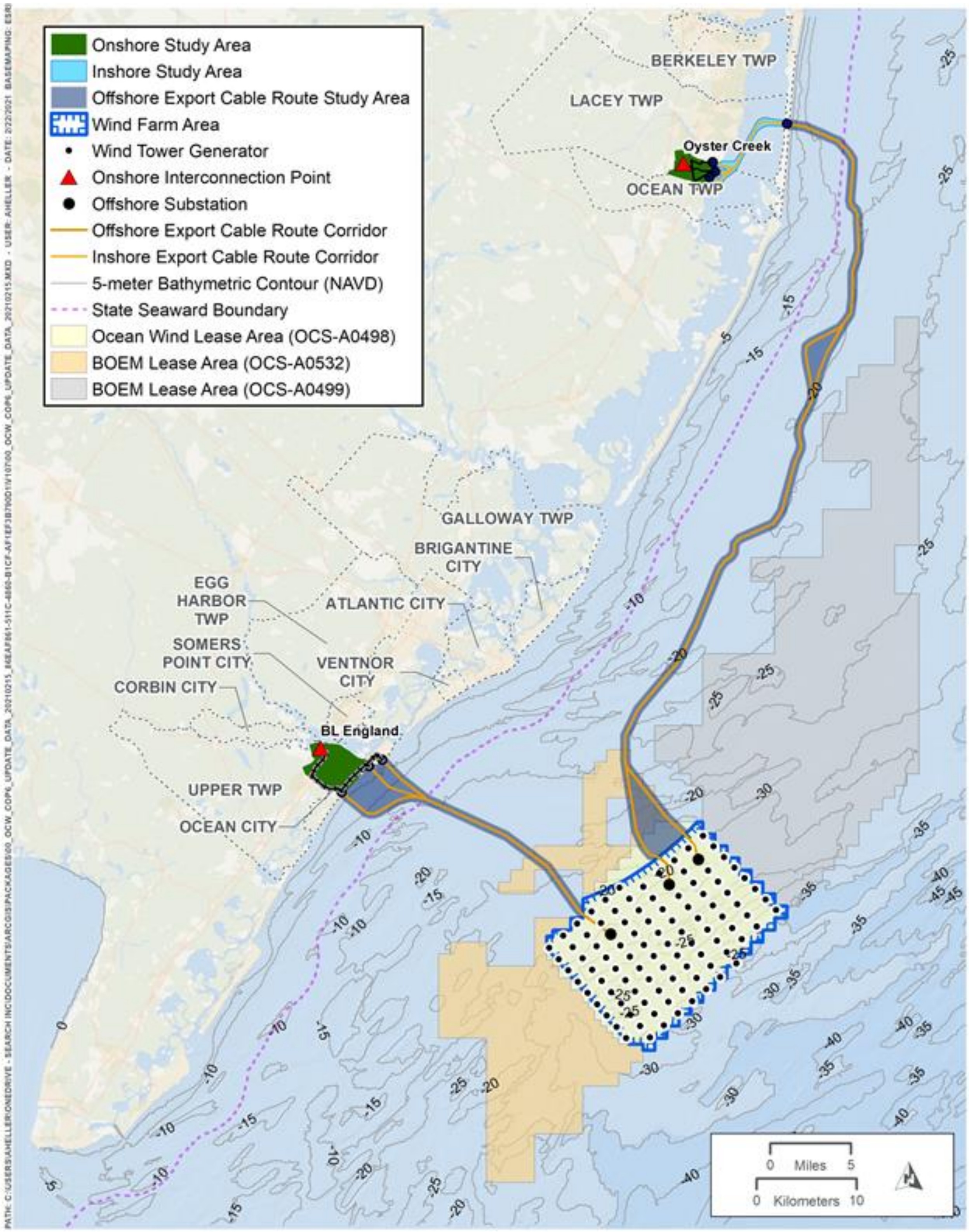
The WTGs, foundations, offshore substations, and inter-array cables will all be in federal waters on the Outer Continental Shelf (OCS), approximately 15 statute miles (mi) (13 nautical miles [nm]) southeast of Atlantic City, New Jersey. Cables will be buried below the seabed. Export cables from the offshore substations will extend along the seabed and connect to buried onshore export cables, which will connect to two interconnection points, at Oyster Creek and Bl England. Onshore cables will be buried within up to a 15-m-wide (50-ft-wide) construction corridor with a permanent easement up to 9.8-m-wide (30-ft-wide) for BL England. Two new onshore substations are proposed at Oyster Creek and BL England along with grid connections to the existing grid for each substation. Onshore substation locations would be sited on existing parcels containing decommissioned power facilities at BL England and Oyster Creek. The Oyster Creek and BL England onshore substation locations would require a permanent site up to 31.5 acres (ac) (12.7 hectares [ha]) and 13 ac (5.3 ha) respectively, for the substation equipment and buildings, energy storage, and stormwater management and associated landscaping. Underground or overhead transmission lines would connect the substations to the planned interconnection point (grid connections).

The maximum height of the offshore substations is 296 feet (ft) above mean lower low water (mllw) with a maximum length and width of 295 ft. The visible offshore components of the operational Undertaking will be located in Lease Area OCS-A 0532 (OCS-A 0498 prior to March 26, 2021) in water depths ranging from approximately 49 to 118 ft below mllw. See Figure 1, Project Location.

BOEM, as the lead federal agency for the NHPA Section 106 review, has defined the APE for the Undertaking as follows:

- The depth and breadth of the seabed potentially impacted by any bottom-disturbing activities;
- The depth and breadth of terrestrial areas potentially impacted by any ground disturbing activities;
- The viewshed from which renewable energy structures, whether located offshore or onshore, would be visible; and
- Any temporary or permanent construction or staging areas, both onshore and offshore.

Figure 1: Project Location



To support BOEM's efforts to identify historic properties within the APEs, OW1 conducted a terrestrial archaeological resource assessment (TARA), marine archaeological resource assessment (MARA), and historic resources visual effects assessment (HRVEA) within the APEs. The results of these investigations can be found in Volume II, Section 2.4 of the Ocean Wind 1 COP. Based on a review of these documents and consultations with federally recognized Tribes and NHPA Section 106 consulting parties, BOEM has determined that the undertaking will result in adverse effects to historic properties. Information about BOEM's assessment of adverse effects can be found in BOEM's Finding of Adverse Effect (FoAE) for the Undertaking.

In the FoAE, BOEM determined that the OW1 undertaking will have an adverse visual effect on 17 historic properties. BOEM has consulted with the Advisory Council on Historic Preservation (ACHP), New Jersey Historic Preservation Office (NJHPO), federally recognized Native American Tribes, and other NHPA Section 106 consulting parties to seek ways to avoid, minimize, or mitigate adverse effects to historic properties. BOEM has decided to codify the resolution of adverse effects through an NHPA Section 106 MOA pursuant to 36 CFR § 800.8(c)(4)(i)(B). As defined in 36 CFR § 800.6 (c), a project-specific MOA records the terms and conditions agreed upon to resolve adverse effects of the undertaking. This HPTP provides background data, historic property information, and detailed steps that will be implemented to carry out the mitigation measures. The resolution measures to resolve adverse effects to historic properties are recorded in the *Memorandum of Agreement Among the Bureau of Ocean and Energy Management, The New Jersey State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding the Ocean Wind 1 Offshore Wind Farm Project.*

Pursuant to the terms and conditions of the MOA, OW1 will implement applicant-proposed environmental protection measures to avoid potential visual impacts to historic properties (see MOA Stipulations I.B and II.A). This HPTP was developed by the applicant to fulfill Stipulation III.B of the MOA to resolve adverse visual effects to 17 historic properties. Mitigation measures implemented under this HPTP will be conducted in accordance with all agreed upon terms and conditions in the MOA and with applicable local, state, and federal regulations and permitting requirements. Responsibilities for specific compliance actions are described in further detail in Section 5.2, Organizational Responsibilities.

Municipal Regulations

Before implementation, any on-site mitigation measures will be coordinated with local cities, towns, and commissions to obtain approvals, as appropriate. These may include, but are not limited to building permits, zoning, land use, planning, historic commissions, and design review boards. See Table 1 for local government administrative departments that will be contacted as part of the mitigation measures for the adversely affected historic properties. Additional information regarding compliance with local requirements appears below in Section 5.0, Implementation.

Table 1. Municipal Departments Requiring On-Site Mitigation Coordination

Historic Property	Municipality	Departments
Ocean City Boardwalk	Ocean City	Construction Code Division, Planning Board, Historic Preservation Commission
Ocean City Music Pier	Ocean City	Construction Code Division, Planning Board, Historic Preservation Commission
Flanders Hotel	Ocean City	Construction Code Division, Planning Board, Historic Preservation Commission
U.S. Lifesaving Station #35	Stone Harbor	Planning Board, Zoning Board
North Wildwood Lifesaving Station	North Wildwood	Construction Office, Planning Board, Historic Preservation Commission
Hereford Inlet Lighthouse	North Wildwood	Construction Office, Planning Board, Historic Preservation Commission
Brigantine Hotel	Brigantine	Planning Board
Absecon Lighthouse	Atlantic City	Construction Division, Planning and Development, Historic Preservation Commission
Atlantic City Boardwalk	Atlantic City	Construction Division, Planning and Development, Historic Preservation Commission
Atlantic City Convention Hall	Atlantic City	Construction Division, Planning and Development, Historic Preservation Commission
Ritz-Carlton Hotel	Atlantic City	Construction Division, Planning and Development, Historic Preservation Commission
Riviera Apartments	Atlantic City	Construction Division, Planning and Development, Historic Preservation Commission
Vassar Square Condominiums	Ventnor City	Division of Construction Code Enforcement, Planning Board
114 S Harvard Avenue	Ventnor City	Division of Construction Code Enforcement, Planning Board
Lucy the Margate Elephant	Margate City	Planning Board and Zoning, Historical Society
Great Egg Coast Guard Station	Longport	Zoning/Planning Board
Little Egg Harbor U.S. Lifesaving Station #23 (U.S. Coast Guard Station #119)	Little Egg Harbor	Construction Department, Zoning and Code Enforcement

Preservation Easements and Restrictions

Preservation easements and restrictions protect significant historic, archaeological, or cultural resources. Any mitigation work associated with a historic property will comply with the conditions of all extant historic preservation legislation (see Table 2. Additional information regarding compliance with extant preservation legislation appears below in Section 5.0, Implementation.

Table 2. Applicable State/Local Legislation for Historic Properties

Legislation	Legislation	Agency
New Jersey Register of Historic Places Act	Chapter 268, Laws of 1970	Department of Environmental Protection
New Jersey Conservation Restriction and Historic Preservation Restriction Act	Chapter 378, Laws of 1979	Department of Environmental Protection
New Jersey Economic Recovery Act of 2020, Historic Property Reinvestment Program	Chapter 156, Laws of 2020, amended 2021	New Jersey Economic Development Authority
Municipal Land Use Law	Chapter 291, Laws of 1975	Municipal Historic Preservation Commissions/Planning Boards

Participating NHPA Section 106 Participating Parties

For the purposes of this HPTP, Participating Parties are defined as a subset of the NHPA Section 106 consulting parties that have a functional role in the process of fulfilling Stipulation III.B of the MOA and the mitigation measure implementation processes described herein. The roles of Participating Parties are identified for each mitigation measure in Section 4.0 of this document, including meeting participation and document reviews. Participating Parties with a demonstrated interested in the adversely affected historic properties are summarized in Table 3.

No other NHPA Section 106 consulting parties are anticipated to be Participating Parties for this Visual Effect HPTP. If BOEM determines additional consulting parties will participate in this plan, the plan will be updated to include those parties. The list of invited and participating of consulting parties is available as Attachment 3 of the MOA.

Table 3. Participating Parties involved with the Historic Property/s[1]

Name	Relationship to Historic Property	Address
Absecon Lighthouse	Interested Party	31 S Rhode Island Ave, Atlantic City, New Jersey 08401
Advisory Council on Historic Preservation	Federal Agency	Federal Property Management Section, 401 F St NW, Suite 308, Washington DC 20001
Atlantic City	Local Govt/Property Owner	1301 Bacharach Boulevard, Atlantic City, New Jersey 08401
Cape May County (Cultural Heritage Partners)	Interested Party	2101 L Street NW, Suite 800, Washington DC 20037
Delaware Nation	Tribal Govt	PO Box 825, Anadarko OK 73005
Delaware Tribe of Indians	Tribal Govt	5100 Tuxedo Blvd, Bartlesville OK 74006
Donald and June Feith	Property Owner	204 Marvin Road, Elkins Park, Pennsylvania 19027

Name	Relationship to Historic Property	Address
Environmental Protection Agency	Federal Agency	Region 2, 290 Broadway, 25th Fl, New York NY 10007
Flanders Condominium Association	Property Owner	Flanders Condominium Association, 719 East 11th Street, Ocean City, New Jersey 08226
Legacy Vacation Resorts	Property Owner	PO Box 690999, Orlando, Florida 32869
Margate City	Local Govt/Property Owner	Rutala Associates, LLC, 717 River Drive, Linwood, New Jersey, 08221-1226
Max Gurwicz Enterprises	Property Owner	331 Tilton Road, Northfield, New Jersey, 08225
Stockbridge-Munsee Community Band of Mohican Indians	Tribal Govt	N8705 MohHeConNuck Rd, Bowler WI 54416
MThirtySix PLLC	Tribal Advocacy	700 Pennsylvania Ave SE, 2nd Fl – The Yard, Washington DC 20003
National Park Service	Federal Agency	Region 1, 1234 Market Street, 20th Fl, Philadelphia PA 19107
New Jersey Casino Redevelopment Authority	State Agency/Property Owner	15 S. Pennsylvania Avenue, Atlantic City, New Jersey 08401
New Jersey Department of Environmental Protection – Historic Preservation Office	State Agency	Mail Code 501-048, NJDEP Historic Preservation Office, PO Box 420, Trenton, New Jersey 08625-0420
New Jersey Department of Environmental Protection – Office of Historic Sites & Parks	State Agency/Property Owner	NJDEP Office of Historic Sites & Parks, PO Box 420, Trenton, New Jersey 08625-0420
New Jersey Department of Law & Public Safety, Marine Service Bureau	State Agency/Property Owner	New Jersey Marine Service Bureau, 25 Market Street, Trenton, New Jersey, 08611
North Wildwood City	Interested Party	Blaney Donohue & Weinberg, P.C., 2123 Dune Drive, Suite 11, Avalon, New Jersey 08202
Ocean City	Local Govt/Property Owner	861 Asbury Ave, Ocean City, New Jersey 08226
Ritz Condominium Association	Property Owner	Ritz Condominium Association, 2715 Boardwalk, Atlantic City, New Jersey 08401
Rutgers University, Department of Marine and Coastal Sciences, School of Environmental and Biological Sciences	Property Owner	88 Lipman Drive, New Brunswick, New Jersey 08901
Save Lucy Committee, Inc.	Interested Party	Rutala Associates, LLC, 717 River Drive, Linwood, New Jersey, 08221-1226
Stone Harbor Museum	Property Owner	9410 2nd Avenue, Stone Harbor, New Jersey, 08247
US Coast Guard	Federal Agency/Property Owner	Sector Delaware Bay, 1 Washington Ave, Philadelphia PA 19147
US Coast Guard	Federal Agency/Property Owner	National Offshore Safety Advisory Committee, 2703 Martin Luther King Jr. Ave SE, Stop 7509, Washington DC 20593-7509
Vassar Square Condominiums	Property Owner	Vassar Square Condominiums, 4800 Boardwalk, Ventnor City, New Jersey 08406
Wampanoag Tribe of Gay Head (Aquinnah)	Tribal Govt	20 Black Brook Rd, Aquinnah MA 02535

[1] Ongoing consultation may result in refinement of this list of Participating Parties.

EXISTING CONDITIONS AND HISTORIC SIGNIFICANCE

Historic Properties

This HPTP involves 17 resources, as identified below in Table 4. All 17 historic properties are located along the New Jersey shoreline within 15–24 miles of the Wind Farm Area (WFA), and ocean views are a character-defining feature of each property's significance.

Table 4. Historic Properties included in the Visual Effect HPTP

Name	Property Address	BOEM Effect Finding
Cape May County		
Ocean City Boardwalk	East 6th Street to East 14th Street, Ocean City	Adverse effect
Ocean City Music Pier	811 Boardwalk, Ocean City	Adverse effect
Flanders Hotel	719 East 11th Street, Ocean City	Adverse effect
U.S. Lifesaving Station #35	11617 2nd Avenue, Stone Harbor	Adverse effect
North Wildwood Lifesaving Station	113 North Central Avenue, North Wildwood	Adverse effect
Hereford Inlet Lighthouse	111 North Central Avenue, North Wildwood	Adverse effect
Atlantic County		
Brigantine Hotel	1400 Ocean Avenue, Brigantine City	Adverse effect
Absecon Lighthouse	Pacific and Rhode Island Avenues, Atlantic City	Adverse effect
Atlantic City Boardwalk	South New Jersey Avenue to South Georgia Avenue	Adverse effect
Atlantic City Convention Hall	Boardwalk at Pacific Avenue	Adverse effect
Ritz-Carlton Hotel	2715 Boardwalk, Atlantic City	Adverse effect
Riviera Apartments	116 South Raleigh Avenue, Atlantic City	Adverse effect
Vassar Square Condominiums	4800 Boardwalk, Ventnor City	Adverse effect
114 South Harvard Avenue	114 South Harvard Avenue, Ventnor City	Adverse effect
Lucy the Margate Elephant	Decatur and Margate Avenues, Margate City	Adverse effect
Great Egg Coast Guard Station	2301 Atlantic Avenue, Longport	Adverse effect
Ocean County		
Little Egg Harbor U.S. Lifesaving Station #23 (U.S. Coast Guard Station #119)	800 Great Bay Boulevard, Little Egg Harbor	Adverse effect

Adversely Affected Historic Properties

In Section 3.2, the resources are described generally both physically and historically, with a focus on the contribution of an ocean view to the properties' significance and integrity.

Physical Description and Existing Conditions

Ocean City Boardwalk

Origins of the Ocean City Boardwalk date to 1880, when the first seasonal structure was constructed from 2nd Street to 4th Street and West Avenue. The Boardwalk was expanded in 1885 to extend the length of the beach, accommodating a new amusement pavilion at 11th Street (The Shore Blog 2021). In keeping with Ocean City's history as a Methodist camp, the Boardwalk offered not only live music, restaurants, and shopping, but free educational seminars and church services (*Daily Intelligencer Journal* 1950:10). The Boardwalk burned in 1927 and was reconstructed the following year. The 1928 Boardwalk was built on a concrete foundation in response to the fire, but portions reconstructed in the 2000s removed the concrete and replaced it with more cost-effective wood (*The Morning Call* 2017). Two important outcomes of the Boardwalk fire were the relocation of a large section of the Boardwalk one block closer to the beachfront and the establishment of a city ordinance that banned building on the ocean side of the Boardwalk (Kelly 2018). The Boardwalk was again reconstructed after the Ash Wednesday Storm of 1962. The Ocean City Boardwalk currently extends approximately 2.5 mi. Like the boardwalks in neighboring Atlantic City and Wildwood, the Ocean City Boardwalk is home to hotels, motels, amusement parks and other entertainments, restaurants, and shopping, housed in buildings constructed throughout the twentieth century. The local ordinance prohibiting construction on the east side of the Ocean City Boardwalk has preserved open and unobstructed views of the ocean along its length. Only the Ocean City Music Pier stands on the ocean side of the Boardwalk, as it was built in 1928, immediately after the fire. The Ocean City Boardwalk was treated as eligible for the NRHP as a result of the survey undertaken for OW1, with a boundary extending from East 6th Street to East 14th Street, reflecting the concentration of commercial development along its length. The property's significance is associated with the commercial and recreation-related growth of Ocean City (Criterion A). The WFA is approximately 15 mi southeast of this historic property.

The Ocean City Boardwalk is integral to the history of commercial development and recreation on the Jersey Shore. While the physical infrastructure of the Boardwalk has changed through the years, due to expansion, general improvements, and storm-related replacement and repairs, its role as a conduit along the shoreline has remained constant. The Ocean City Boardwalk is home to resources from the early twentieth century through the twenty-first century, offering visitors accommodations, entertainment, and food. Upgrades and improvements made to the buildings that line the Boardwalk have impacted the overall setting and feeling of the Boardwalk, as have modern infill buildings and structures. The Boardwalk has offered commercial and recreational opportunities along the seashore since its inception, and it has been subject to ongoing investment and economic development along its route, which in fact attests to its ongoing vitality and viability. However, visitors walking along the Boardwalk in 2022 are offered similar unobstructed sea views as those who walked the Boardwalk 50 years ago and 100 years ago, due the ordinance restricting development on the ocean side of the Boardwalk. The WFA would be visible along the horizon approximately 15 mi from the Boardwalk. Views of the WFA from the entire length of Boardwalk will alter its setting, which has been preserved through the local ordinance passed in the 1920s. As a result, the project will have an adverse effect on the Ocean City Boardwalk.

Ocean City Music Pier

The Ocean City Music Pier was constructed as a concert hall in 1928, after a fire destroyed much of the Ocean City boardwalk. The Ocean City Music Pier was determined eligible for the NRHP in 1990. NJHPO online records do not include information on the building's NRHP significance; however, it appears to be significant under Criterion A for Entertainment and Recreation due to its long history as an entertainment venue on the Ocean City Boardwalk, and under Criterion C for Architecture. The Ocean City Music Pier continues to function as a music venue. The building includes an enclosed concert hall and attached open-air loggia. The enclosed portion of the building features large arched windows, while the loggia has open arches. There are sea views from both inside the concert hall and inside the loggia, although the views have changed somewhat over the years. Originally, the pier was built over the water and views were exclusively of the ocean. In 1993, a major beach restoration project imported 6.4 million cubic ft of sand to widen Peck Beach in Ocean City (USACE 2011). Since 1993, the pier has been over sand rather than water and the views to the north and south primarily include the beach, with water views visible at an angle. The building's primary entrance faces west and is accessed via the Ocean City Boardwalk, and the rear of the building sits on piers driven into the sand. The WFA is due east of the Ocean City Music Pier, approximately 15.2 mi away.

The Ocean City Music Pier is the only building in Ocean City located on the east side of the Boardwalk. The building has a direct relationship with the ocean due to its location. Location and setting are both character-defining features that are echoed in the building's design and construction, and directly relate to its significance under Criterion A for Entertainment and Recreation, and Criterion C for Architecture. As a result of its location and lack of development on its north, east and west sides, the views of the beach and ocean are unobstructed for people enjoying programs inside of the facility and people observing the building from the Boardwalk. The building's significance under Criterion A for Entertainment and Recreation is historically tied to its prominent location on the Boardwalk. The building is at the center of activity in Ocean City and although there are other entertainment venues in Ocean City, the music pier is arguably the most popular due to its location and setting (Pritchard 2012). The property's significance under Criterion C is for its Mediterranean Revival style. The open loggia and expansive arched windows with sea views are key features of that significance. Given the proximity of the WFA to this property and that open shoreline and sea views are character-defining features, the proposed project's introduction of a modern visual element to the music pier's setting may diminish its integrity of setting, feeling, and association as it relates to its significance. Therefore, the project will have an adverse effect on the Ocean City Music Pier.

Flanders Hotel, Ocean City

The Flanders Hotel is an NRHP-listed property located one-half block from the boardwalk in Ocean City. The building is listed under Criterion A for Entertainment and Recreation, and Community Planning and Development, and under Criterion C for Architecture. The property currently includes a 1923 nine-story U-Shaped Spanish-Colonial style hotel, a two-story commercial and solarium annex, a pool, and a parking lot (Bethke 2009). The hotel is the tallest building in the area. Its upper floors (approximately floors 5–9) have unobstructed views of the ocean, while its lower levels (approximately floors 1–4) have views blocked or obscured by Playland's Castaway Cove and other nearby development.

The two-story solarium annex is located on the building's east side, and from 1927 to 1978, the solarium overlooked three saltwater pools located between the hotel and the Ocean City Boardwalk. When it was built, the two-story solarium annex featured large windows and an open central section, all with direct views to the water. The pools were removed in 1978 and the land was later redeveloped (Bethke 2009). The building originally featured an 8th-story terrace overlooking the ocean. The terrace was a significant part of the original design meant to capture expansive sea views. According to the hotel's 2009 NRHP nomination, the terrace was enclosed in 1960. The building also originally featured a tower on the building's south wing with open sides that had unobstructed sea views. A 1990s remodeling project included the addition of two stories to the south wing. According to the NRHP nomination, much of the building's significance is associated with it being the first high-end hotel in Ocean City. The project is due east of the hotel, approximately 15.2 mi distant. BOEM has determined that the project will have an adverse effect on the Flanders Hotel.

U.S. Lifesaving Station #35, Stone Harbor

The U.S. Lifesaving Station #35 (now the Steven C. Ludlum American Legion Post 331) is a former US Life-Saving Service and US Coast Guard Station constructed in 1895. The building is located at 11617 2nd Avenue at the northwest corner of 2nd Avenue and 117th Street in Stone Harbor. The American Legion currently owns and operates the building after purchasing it in 1948 when its function as a lifesaving station became obsolete. The building is listed in the NRHP under Criterion A for Transportation and Maritime History and under Criterion C for Architecture. The station is a representative example of the 1893 Duluth Design by George R. Tolman (Koski-Karell et al. 2013). The main structure features three parts and includes the primary lifesaving station building along the south, a four-story tower in the center, and a boat room along the north façade. The NRHP nomination for U.S. Lifesaving Station #35 states that the structure was originally located on ocean front property but is now positioned two blocks to the west due to dense residential infill and sand deposits to the east along the shoreline. The building is approximately 21.9 mi from the project. BOEM has determined that the project will have an adverse effect on U.S. Lifesaving Station #35.

North Wildwood Lifesaving Station, North Wildwood

The North Wildwood Lifesaving Station is a former U.S. Coast Guard Station constructed in 1938. The building is located at 113 North Central Avenue and sits on the northeast corner of the intersection of North Central Avenue and East First Avenue, directly to the northeast of the Hereford Inlet Lighthouse. The building was determined eligible by the New Jersey HPO in 2001. It was constructed later than the Hereford Lighthouse, thus, the North Wildwood Lifesaving Station is not mentioned as a contributing resource to the Hereford Lighthouse in its the lighthouse's NRHP nomination. NJHPO's online records do not include information on the building's significance; however, it is likely significant under Criterion A for Maritime History and under Criterion C as an example of the 1934 Roosevelt Design for Coast Guard stations during that era (Koski-Karell et al. 2013). The station is positioned near the Hereford inlet between North Wildwood and Stone Harbor. The inlet was heavily trafficked by ships and an important entry location for the Intracoastal Waterway pivotal to local commerce. The building was constructed in 1938 as a U.S. Coast Guard station, then later converted to the NJ Marine Police Headquarters.

The station replaced an 1888 lifesaving station at this same site (Koski-Karell et al. 2013). The 1934 Roosevelt Design was transitional, incorporating design cues from previous lifesaving station designs with evolving missions and administrative duties after consolidation of predecessor services under the U.S. Coast Guard. Key to the station's significance is its intact representation of the 1934 standardized Roosevelt Design. The station is approximately 23.4 mi from the project. BOEM has determined that the project will have an adverse effect on the North Wildwood Lifesaving Station.

Hereford Inlet Lighthouse, North Wildwood

The Hereford Inlet Lighthouse, constructed in 1874 and listed in the NRHP in 1977, is located at 113 North Central Avenue on the north end of North Wildwood. The lighthouse sits on the northeast corner of the intersection of North Central Avenue and East First Avenue. The lighthouse originally marked the Hereford Inlet between North Wildwood and Stone Harbor, an important waterway for local commerce. The lighthouse consists of one- and two-story sections surrounding a central four-story tower. The lighthouse's original setting was approximately 150 ft west of its present-day location. It was relocated in the early twentieth century due to erosion, weathering, and damage to the foundation (Elias 2018). Its NRHP nomination indicates that the lighthouse is no longer adjacent to the shoreline due to infill, which includes the construction of a contemporary police station to its north. The U.S. Coast Guard automated the lighthouse in 1964 and eventually converted it into a museum. The lighthouse is significant under Criterion A for Commerce and Criterion C for Architecture. The project is approximately 23.4 mi from the Hereford Inlet Lighthouse. BOEM has determined that the project will have an adverse effect on the Hereford Inlet Lighthouse.

Brigantine Hotel, Brigantine City

The Brigantine Hotel, at 1400 Ocean Avenue, is an 11-story rectangular plan, Art Deco-inspired hotel built in 1926–1927. The Brigantine Hotel was surveyed for OW1 in January 2021 and was recommended eligible for NRHP listing under Criterion A for Ethnic Heritage: Black, due to its associations with prominent African American figures and its role in integrating the Jersey Shore. The hotel is on Brigantine Beach at a distance of approximately 16 mi from the project.

The Brigantine Hotel is sited directly on the beach and has unobstructed sea views from most of the building. The hotel is recommended significant under Criterion A for Ethnic Heritage due to its association with black history on the Jersey Shore. As a hotel, the building represents a recreational property type associated with tourist activity in New Jersey, which heightens the importance of its setting, in particular those of sea views within the setting. As possibly the first hotel to welcome black guests and integrate New Jersey's beaches, the Brigantine Hotel reflects the challenges black Americans faced to gain equal access to recreational opportunities. Because the focus of recreational activity in this location is the beach and access to the sea, this aspect of the setting supports the hotel's significance under Criterion A. Conspicuous views of the WFA from the both the beach and guest rooms in the hotel will alter the character-defining setting of the building. As a result, the project will have an adverse effect on the Brigantine Hotel.

Absecon Lighthouse, Atlantic City

The Absecon Lighthouse, constructed in 1856, is an NRHP-listed property on the north end of Atlantic City. The lighthouse originally marked the inlet between Absecon and Brigantine Islands, although that channel has shifted northward since the lighthouse's construction. The 171-ft-tall light tower is constructed of iron and brick, and has a diameter of 27 ft at its base and 13 ft-7.5 in at the lens chamber. Lightkeepers had a view of the Absecon Inlet from "A catwalk at a storage level just below the lens" (Wilson 1970). The Absecon Lighthouse was decommissioned in 1933. Its original setting was the undeveloped north end of Absecon Island, and the light station site included a keeper's house, assistant keeper's house, and oil house (all nonextant, although the keeper's house has been reconstructed). The 1970 NRHP nomination states the lighthouse is significant for navigational history (Criterion A) and architecture (Criterion C). The project is approximately 15.3 mi southeast of the Absecon Lighthouse. BOEM has determined that the project will have an adverse effect on the Absecon Lighthouse.

Atlantic City Boardwalk, Atlantic City

Origins of the Atlantic City Boardwalk date to 1870, when the first seasonal structure was constructed between South Massachusetts Avenue and what is now Columbia Place (between South Mississippi and Missouri Avenues). Four boardwalks soon followed in succession prior to 1900: widened for increased usage, but still seasonal (1880); permanent with electric lighting (1884); replacement due to hurricane (1890); and steel-braced (1898). Several piers were added in the 1890s, including Playground Pier, Central Pier, and Steel Pier. Large-scale hotels attracting tourists and businesspeople lined the west side of the Boardwalk beginning in the late 1890s and into the first decades of the twentieth century. Only a few of the hotels remain, largely due to the 1976 state legislation that required hotels to have at least 400 rooms, 325 square ft each, in order to operate a casino on the premises. This precluded many of the existing hotels from taking advantage of the new gambling legislation without extensive renovations. Many of the grand hotels on the Boardwalk were razed in the 1970s and 1980s to make room for new construction (*The Daily News* 1978:13). The Atlantic City Boardwalk was identified as a potential historic property in 1978, with NJHPO data indicating a boundary extending from the Atlantic City Convention Hall (South Georgia Avenue) to just northeast of South New Jersey Avenue. NJHPO data indicates the property's potential significance is associated with the commercial and recreation-related growth of Atlantic City (Criterion A). The WFA is approximately 15.3 mi southeast of Atlantic City Boardwalk. The Boardwalk is being treated as eligible for NRHP listing for the purposes of Section 106 compliance for the Project.

The Atlantic City Boardwalk is integral to the history of commercial development and recreation on the Jersey Shore. While the physical infrastructure of the Boardwalk has changed through the years, due to expansion, general improvements, and storm-related replacement and repairs, its role as a conduit along the shoreline has remained constant. The Atlantic City Boardwalk is home to resources from the early twentieth century through the twenty-first century, offering visitors accommodations, entertainment, and food, and, since the late 1970s, gambling opportunities. While large-scale towers built since the 1970s, including Caesar's Atlantic City (1979), Atlantic Palace (1986), Showboat Atlantic City (1987), Bally's Tower (1989), Hard Rock Hotel and Casino (1990), Ocean Casino (2012), have impacted the overall setting and feeling of the Boardwalk, as have the upgrades and improvements made to many of the one- and two-story buildings that line the Boardwalk, visitors walking along the Boardwalk in 2022 are still offered unobstructed sea views in some locations. Dunes and vegetation obstruct views of the horizon in other locations. Yet the Boardwalk has offered commercial and recreational opportunities along the seashore since its inception, and it has been subject to ongoing investment and economic development along its route, which in fact attests to its ongoing vitality and viability. To the extent that the WFA would be visible along the horizon approximately 15.3 mi from the Boardwalk, BOEM has determined that_the impact to setting rises to the level of adverse effect.

Atlantic City Convention Hall, Atlantic City

The Atlantic City Convention Hall, constructed 1929, is a National Historic Landmark-designated property on the Boardwalk in Atlantic City. The Convention Hall's 1985 NRHP nomination notes its eligibility under Criterion A for Recreation and Criterion C for Engineering. The Convention Hall's relationship to the Boardwalk, and by extension to the ocean, is defined by a curved limestone exedra (arcade) across the Boardwalk and in front of the hall's oceanside entrance. The exedra is "appropriately ocean-oriented, with decoration, like that of contemporary Atlantic City hotels, using forms of ocean flora and fauna" (Charleton 1985:2). The Convention Hall's views to the ocean from the building's interior are limited to ground floor entrances, where direct views of the ocean are screened partially by the exedra, and a ballroom on the second floor. The WFA is approximately 15.5 mi from the Atlantic City Convention Hall.

The Atlantic City Boardwalk was the center of social activity on the Jersey Shore in the early twentieth century, and the Convention Hall epitomized the Boardwalk's social and entertainment appeal. The Convention Hall's significance as a recreational venue (Criterion A) is tied to its large auditorium that hosted concerts, pageants, and sporting and political events. While the auditorium has no views to the exterior, an event space on the second story above the main Boardwalk entrance features a loggia of arched windows designed to provide sea views. This space was historically utilized as a ballroom but currently serves as a multi-function space for gatherings and smaller events (a reversible change).

The Project will have a visual effect on the Atlantic City Convention Hall, largely borne by the exedra walkway, a contributing structure of the site, located across the Boardwalk from the Convention Hall. While the Project would not alter any characteristics or physical features within the Convention Hall that contribute to its historic significance, BOEM determined that the Project would diminish its integrity of setting, an aspect of its historic integrity that relates to its significance. The Atlantic City Convention Hall is significant under Criterion A for Recreation and Criterion C for Engineering. The building's location on Atlantic City's Boardwalk is paramount to its history and associated significance. To the extent that the WFA would be visible along the horizon approximately 15.5 mi from the historic property, BOEM has determined that the impact to setting rises to the level of adverse effect.

Ritz-Carlton Hotel, Atlantic City

The Ritz-Carlton Hotel (constructed 1921, now The Ritz Condominiums) is an NRHP-eligible property at 2715 Boardwalk in Atlantic City. It was designed by Philadelphia's Horace Trumbauer in association with New York-based Warren and Wetmore. The hotel has a five-story block fronting the Atlantic City Boardwalk and a 15-story block that extends north creating an L footprint. The hotel was determined eligible for the NRHP in 2011. NJHPO data indicates the property's significance is associated with its construction at the height of Atlantic City's "urban hotel by the sea" period. The Boardwalk wing capitalizes on the Boardwalk's commercial activity while the orientation of the main block of hotel rooms maximized rooms with northeast and southwest sea views. It was determined to be significant under Criterion A for Commerce and Criterion C for Architecture. The WFA is approximately 15.3 mi southeast of this property.

The Ritz-Carlton Hotel is on the Atlantic City Boardwalk with the main hotel block extending north-northwest from the shoreline. The hotel block rising behind the commercial Boardwalk block is oriented to maximize the number of rooms on its narrow, deep lot. The ocean-facing elevation of this block is three bays wide, with a central-bay Juliet balcony on each floor. In addition to southeast elevation windows on both the main hotel block and the five-story Boardwalk block, most windows on the southwest elevation will have a view of the WFA. The building's siting and orientation are important to its Criterion A significance for Commerce. While architectural elements oriented toward the WFA have been subject to modification, most notably at the mezzanine level on the exterior, where a redesign with replacement materials creates a solid screen in front of double-height arched windows, conspicuous views of the WFA from guest rooms in the hotel will alter the character-defining setting of the building. As a result, the project will have an Adverse Effect to the Ritz-Carlton Hotel.

Riviera Apartments, Atlantic City

The Riviera Apartments at 116 South Raleigh Avenue in Atlantic City is a nine-story apartment building dating to 1930. It was surveyed for OW1 in January 2021 and was recommended eligible under Criterion C for its Spanish-influenced Art Deco style of architecture. NJHPO records attribute the design to Philadelphia architect Harry Sternfeld, and describe the building as "the queen of Atlantic City's larger apartment houses—its concrete and tile decoration are exuberant and original, rare outside of New York" (NJHPO 1980). The building appears to have undergone very few changes over the years, maintaining its original form, massing, and Art Deco design details. The building is adjacent to the Atlantic City Boardwalk. Its primary façade (northeast elevation) does not face the ocean. Both the northeast and southeast elevations include bands of windows, some of which are bay windows to optimize sea views. The building also includes rooftop balconies with sea views. It is approximately 15.6 mi from the WFA.

The Riviera Apartments building sits directly on the Atlantic City Boardwalk. This area was developed by the time the Riviera Apartments were constructed; however, aerial imagery shows that the surrounding buildings were primarily modest single-family detached homes in the 1930s, likely two to three stories tall. The apartment building was the tallest building in the area and would have had clear ocean views. The building's design focused on both the northeast and southeast elevations, with the southwest elevation having the appearance of a wall that would typically be found facing an alley. The two elevations with design emphasis have numerous windows, including bay windows, that maximize light and views in the apartments. Under the apartment building's significance for Criterion C, the property's historic integrity of location, design, materials and workmanship are critical, and those will not be altered by the proposed Project. Integrity of setting, feeling, and association have the potential to be affected by the project. Both ground-level views and views from inside the nine-story building may be affected by the introduction of the WFA on the horizon. The seascape was an important consideration in the selection of the location for this building, reflected in its design and siting. The project will be conspicuously visible in the viewshed, and it will affect views to the sea, a character-defining feature of the property. Therefore, the project will have an adverse effect on the Riviera Apartments.

Vassar Square Condominiums, Ventnor City

The Vassar Square Condominiums building at 4800 Boardwalk in Ventnor City is a high-rise building dating to 1969. The 21-story building is 218 ft (66.45 m) tall (CTUBH 2021) and was surveyed for OW1 in January 2021. The building was surveyed for OW1 in January 2021 and was recommended eligible for the NRHP under Criterion C for Architecture, as a good example of mid-century high-rise design with Formalist architectural details (reinterpretations of classical building components). The building's units each have a cantilevered balcony with glass railings. Corner balconies have views in multiple directions. This is especially important for units at the rear of the building (northwest), which, despite their location, have sea views due to the balcony design. Balconies on the northeast and southwest elevations angle outward to create an interesting dimensional effect across the wall plane. The angle also affords additional space on the balcony and increases the field of view from each unit. The building's upper levels are primarily glass and brick, while the ground level features stuccoed arches infilled with glass or metal grate. The building is approximately 16 mi from the WFA.

The Vassar Square Condominiums building sits directly on the Atlantic City Boardwalk. It sits on a deep lot with its longest elevations facing to the northeast and southwest. Although these elevations are perpendicular to the coastline, due to the building's height, extended balconies allow for sea views along these longer elevations. When the building was originally constructed, the Vassar Square area primarily included single-family detached houses two to three stories tall. However, multistory and multi-unit buildings were becoming more common south of the Atlantic City core. Although there are several similarly sized buildings in the vicinity as of 2021, Vassar Square Condominiums offer sea views from nearly all units. The building's design maximized sea views for its residents. Each unit has a glass-railed balcony, and even those that are farthest from the beachfront have corner balcony designs that allow for at least partial water views. Under the property's significance for Criterion C, its historic integrity of location, design, materials and workmanship are critical, and those will not be altered by the proposed project. Integrity of setting, feeling, and association have the potential to be affected by the project. Both ground-level views along the Boardwalk and views from inside the building may be affected by the introduction of the WFA on the horizon. Because the seascape was an important consideration in the selection of the location for this building and the building's design maximized expansive sea views, the project will impact a characteristic of the property that supports its eligibility for listing in the NRHP. Therefore, the project will have an adverse effect on the Vassar Square Condominiums building.

114 South Harvard Avenue, Ventnor City

The house at 114 South Harvard Avenue in Ventnor City is a two-and-a-half-story French Eclectic style building dating to 1925. The building was surveyed for OW1 in January 2021 and was recommended NRHP-eligible under Criterion C for Architecture as a good example of early twentieth-century beachfront housing in Ventnor City. The building appears to retain its original form and massing, and includes French Eclectic features such as textured stucco walls, a steeply pitched roof, flared eaves and multiple eave heights, and an asymmetrical plan with a tower. The house is immediately adjacent to the beach and Boardwalk, and has open views toward the Atlantic Ocean. The building faces northeast toward South Harvard Avenue, with its southeast elevation facing the Boardwalk. The southeast elevation includes an enclosed ground-level sun room with arched windows facing the ocean. Above the sun room is a second-story porch with unobstructed sea views. The WFA is approximately 15.7 miles southeast of the property.

With limited visual obstructions, the project is expected to be visible on the horizon from this location. The building does not directly face the water, but sea views appear to have been an important consideration in the building's design, as it includes a sea-facing sun room and a second-story deck on its southeast elevation. Under significance for Criterion C for Architecture, the property's historic integrity of location, design, materials and workmanship are critical, and those will not be altered by the proposed project. Integrity of setting, feeling, and association may be impacted by the project. Both ground-level views and views from inside the building may be affected by the introduction of the WFA on the horizon. The seascape was an important consideration in the building's design, and the proposed project will alter a characteristic of the property that qualifies it for NRHP eligibility. Therefore, the project will have an adverse effect on the house at 114 South Harvard Avenue in Ventnor City.

Lucy the Margate Elephant, Margate City

Lucy the Margate Elephant, originally known as Elephant Bazaar, was NRHP-listed in 1971 and designated as a National Historic Landmark in 1976. The building is listed under Criterion C for Invention, Sculpture, and Other: "architectural folly" (Pitts 1971). Lucy the Margate Elephant is a six-story, elephant-shaped architectural folly located in Margate City. Lucy was built in 1881 by inventor James V. Lafferty, who had received a U.S. patent with exclusive rights to construct buildings in the shape of animals beginning in 1881. Lafferty was a land speculator who owned undeveloped land in the area that is now Margate City. Lucy was originally constructed in this barren location by Lafferty as a means of attracting potential buyers and visitors to the area (Lucy the Elephant 2011a). Lafferty sold Lucy to Anton Gertzen in 1887, and members of the Gertzen family continued to own the building until 1970 (Lucy the Elephant 2011a, 2011d). During the Gertzen family ownership, the building was used temporarily as both a house and tavern, but primarily as a piece of novelty architecture. The family capitalized on it by offering tours for an admission fee (Lucy the Elephant 2011b, 2011c).

Modifications to Lucy include the partitioning of the domed interior space in 1902 and replacement of the original howdah (canopied seat) after it was destroyed in a storm in 1928. The building went without a howdah (or with a very deteriorated howdah) for several years. When the building was nominated as an NHL in 1976, the nomination stated, "she will have a new howdah when funds permit." The howdah was eventually replaced with a less ornate version with a different roof type (Pitts 1971). In 1968, the Gertzen family sold the parcel on which Lucy was located and donated the building to the City. It was moved to its current parcel in 1970. Lucy's original location was near the intersection of present-day Atlantic Avenue and South Cedar Grove Avenue, two blocks north-northeast of its present location (NETR 1963, 1970). The building is currently located approximately one half-block farther inland than its original location. It continues to operate as a tourist attraction, with guided tours offered for a fee. The immediate surroundings include a single-story beachfront grill, several two- and three-story condominium buildings, a restaurant, and a 19-story condominium building (located on Lucy's original site). The building is approximately 15.3 mi west-northwest of the WFA. From its upper levels, views to the Atlantic Ocean are unobstructed.

Lucy the Margate Elephant is integral to the history of commercial development and recreation on the Jersey Shore. Originating as an architectural folly, it stands as one of the most recognizable symbols of the Jersey Shore experience. Part commercial, part recreational, part functional, part folly, Lucy is a tourist attraction that represents the vision a late nineteenth-century entrepreneur had for seaside development that continued through the twentieth century, a vision reflected in Margate's growth all around the building. While some original materials have changed through the years, and its setting has been subject to infill, impacting ground-level views of the sea, Lucy provides similar unobstructed sea views from its upper level as it did when it was first built. The uniqueness of the resource and its property type merited additional consideration during effects assessment.

The building's seaside location, while not original, generally replicates the sea views and setting of its original location a few blocks away. The building has windows on all sides, albeit small. The 18-in windows facing the ocean are inserted as the elephant's porthole eyes. The howdah (canopied seat) at the top of the building also has unobstructed ocean sea views; it was reportedly used by Lafferty as a viewing platform for potential investors to see advantageous views of the surrounding real estate (NJ South 2019).

At a distance of 15.3 mi, characterized in the VIA as apparent, the WFA will be visible on the horizon, altering the property's setting and potentially, the experience of visitors to the site. Lucy's significance as an architectural folly and sculpture, while not specified in its NRHP nomination, likely falls under Criteria A and C. Sea views are a key component of the building's property type and contribute to its significance. Therefore, a finding of Adverse Effect is recommended for Lucy the Margate Elephant.

Great Egg Coast Guard Station, Longport

The Great Egg Coast Guard Station is located at 2301 Atlantic Avenue in Longport. It was listed in the NRHP in October 2005 under Criterion C for Architecture as an example of the 1934 Roosevelt Design for Coast Guard stations (Berkey 2005; Koski-Karell et al. 2013). The station is located in an area of Longport that is approximately two blocks deep between Great Egg Harbor and the Atlantic Ocean. The station was constructed in 1938 as a U.S. Coast Guard station, and was abandoned in 1947 by the U.S. Treasury Department, which oversaw the Coast Guard until 1967. The City of Longport purchased the building and used it as a municipal hall (Berkey 2005). In 1994, it was leased to the Longport Historical Society and Museum. The primary building is two-and-a-half stories with a central three-story tower set within the roof ridgeline. The station replaced an 1888 lifesaving station at this same site (Berkey 2005). The 1934 Roosevelt Design was transitional, incorporating design cues from previous lifesaving station designs with evolving missions and administrative duties after consolidation of predecessor services under the U.S. Coast Guard. Located approximately 0.14 mi (740 ft) from the shore, the building is one-and-a-half blocks removed from the ocean front. It is approximately 15.2 mi from the project. BOEM has determined that the project will have an adverse effect on the Great Egg Coast Guard Station.

Little Egg Harbor U.S. Lifesaving Station #23 (U.S. Coast Guard Station #119, Little Egg Harbor)

The original Little Egg Harbor U.S. Lifesaving Station #23 was built in 1869 on Tucker Island and moved several times due to beach erosion. It succumbed to the ocean in the early 1930s, while Tucker Island itself disappeared by the early 1950s. In 1937, the U.S. Coast Guard constructed the current station, a two-and-one-half-story building, just west of Tucker Island on the southern point of Little Egg Harbor's salt marsh peninsula on Great Bay. The station used the federal government's 1934 Roosevelt Design that incorporated Colonial Revival elements into a two-story, rectangular plan with a central cupola. The station and associated boathouses are on elevated piers to accommodate the tides (Koski-Karell et al. 2013). The station is accessed from Great Bay Road by a long pedestrian boardwalk. The Coast Guard operated the station into the 1960s. It was then left vacant until purchased in 1972 by Rutgers University for use as a marine field station, and it continues to operate as Rutgers Tuckerton Marine Field Station.

The station was determined individually eligible for NRHP listing by NJHPO in 2014. NJHPO's online records do not include information on the building's NRHP significance; however, it appears to be significant under Criterion A for Maritime History and under Criterion C for Architecture as an example of the 1934 Roosevelt Design, based on application of the eligibility requirements in the U.S. Government Lifesaving Stations, Houses of Refuge, and pre-1950 U.S. Coast Guard Lifeboat Stations Multiple Property Documentation Form (MPDF) (Koski-Karell et al. 2013). The 1934 Roosevelt Design was transitional, incorporating design cues from previous lifesaving station designs with evolving missions and administrative duties after consolidation of predecessor services under the U.S. Coast Guard. Key to the station's significance is its intact representation of the 1934 standardized Roosevelt Design. Its period of significance, 1937–1960s, reflects its use as a Coast Guard station. The project is approximately 21.25 mi south of the station. BOEM has determined that the project will have an adverse effect on U.S. Coast Guard Station #119.

Historic Context

North Wildwood, Cape May County

The city of North Wildwood is on Five Mile Island, where the Lenni-Lenape tribe often visited to fish and collect shells they used as currency. Farmers used the Wildwood area to graze their livestock, and fishermen and whalers established temporary camps on Five Mile Island between the early seventeenth and the mid-nineteenth centuries. Fishermen established the first settlement on Five Mile Beach—Anglesea—ca. 1859. Development increased following construction of a railroad and bridge in 1884. Anglesea incorporated as the North Wildwood Borough in 1885. The borough became the City of North Wildwood City in 1917. The city experienced a post-World War II boom following the growing popularity of personal automobiles and resultant tourism (VisitNJShore.com 2021a). New hotels featured futuristic forms and neon signage, a distinctive style later called Wildwood's "Doo Wop." North Wildwood was heavily damaged by the Ash Wednesday Storm of 1962, which flooded and destroyed beachfront properties and roads and caused major coastline loss (NPS 2019). Tourism declined in the 1970s and 1980s, but rebounded in the late 1990s with the establishment of the Doo Wop Preservation League, charged with restoring and promoting appreciation of the Wildwood area hotels and their history (VisitNJShore.com 2021a).

Ocean City, Cape May County

A barrier island, Ocean City (first known as Peck's Beach) was regularly used as a whaling camp by 1700. Later in the eighteenth century, John Townsend acquired much of the seven-mile-long island that featured several freshwater ponds, making it beneficial for grazing cattle (Miller 2003). It had its first permanent residence by 1850. In the post-Civil War period, Peck's Beach evolved into a tourist destination. Atlantic City, which featured a famous boardwalk and hotels in the 1870s, served as a model for Peck's Beach, albeit with exceptions. In 1879, a group of Methodists leaders—including Rev. Ezra B. Lake, Rev. James B. Lake, Rev. S. Wesley Lake, and Rev. William H. Burrell—founded Ocean City. The founders were intent of developing a Christian-influenced resort that, unlike Atlantic City, boasted no gambling or drinking (Esposito and Esposito 1996). One of the main attractions was a boardwalk completed in 1883. Development of transportation was key to the city's success as a tourist destination, as early twentieth-century options included a steamboat service, bridges, and a trolley (VisitNJShore.com 2021b). The national prosperity of the post-World War I period was reflected in the development of beachfront hotels. A fire destroyed much of Ocean City in 1927, including the city's beachside boardwalk (Ocean City, New Jersey 2021). The boardwalk was rebuilt in 1928–1929. The Great Depression severely impacted the local New Jersey Shore economy (Bzdak 2001), but bolstered by a post-World War II economic recovery, Ocean City was the largest town in Cape May County by 1960 (VisitNJShore.com 2021b).

Brigantine City, Atlantic County

The Lenni-Lenape tribe first traveled to Brigantine Island from the mainland to fish and collect shells they used as currency. Brigantine Improvement Company purchased the island by the late nineteenth century. Railroad and light rail transportation facilitated early development during the period, but growth was limited by bad weather and difficult financial times. Brigantine invested in infrastructure development in the 1920s, including the construction of roads and sewage lines, only to have its growth stymied again by numerous storms and the Great Depression (SouthJersey.com 2015). Development continued post-World War II. Brigantine was heavily damaged by the Ash Wednesday Storm of 1962, which flooded and destroyed beachfront properties and roads, causing major coastline loss (NPS 2019). Due to its proximity and access to Atlantic City, development was consistent in the second half of the twentieth century, with older neighborhoods and commercial development interspersed with newer single-family and multi-family housing (Gatza 1991).

Atlantic City, Atlantic County

Atlantic City is located on Absecon Island, where the Lenni-Lenape tribe often visited to fish and collect shells they used as currency. Jeremiah Leeds built the first structure on the island in 1785, and his descendant had built seven permanent dwellings by 1850 (Town Square Publications 2010). The city incorporated in 1854 and rail development soon followed. The city grew quickly in the late nineteenth century as a resort town located near New York and Philadelphia. Unlike primarily residential communities on the New Jersey Shore, Atlantic City development included businesses, recreational spaces, and tourist attractions like theaters and the Boardwalk. Half of the Boardwalk was destroyed in the Great Atlantic Hurricane of 1944. The city's popularity continued through the mid-twentieth century. but diminished in the 1950s when air travel allowed vacationers more options (ACFPL 2021). Atlantic City was heavily damaged by the Ash Wednesday Storm of 1962, which flooded and destroyed beachfront properties and roads and caused major coastline loss (NPS 2019). Another wave of large-scale development followed the city's gambling legalization in 1976 (ACFPL 2021).

Ventnor City, Atlantic County

Ventnor City is located immediately south of Atlantic City on Absecon Island. The name Ventnor City was chosen in 1889 in honor of Ventnor, England. The arrival of railroad service catalyzed development in the late nineteenth and early twentieth centuries. The city incorporated in 1903, and between 1910 and 1917, the number of buildings in Ventnor City increased from approximately 100 to nearly 1,300. New York-based architects John M. Carrère and Thomas Hastings created a downtown plan for Ventnor City ca. 1907–1908 using City Beautiful planning principles. Architect Frank Seeburger designed homes in what is now the John Stafford NRHP-listed historic district (Thomas 1986). The city's popularity continued through the first half of the twentieth century given its proximity to Atlantic City. Films advertising Ventnor City were shown in Reading Terminal in Philadelphia, highlighting the city's beaches, boardwalk, public buildings, and homes (Smith 1963). Ventnor City was heavily damaged by the Ash Wednesday Storm of 1962, which flooded and destroyed beachfront properties and roads and caused major coastline loss (NPS 2019). By the mid-1960s, Ventnor City was the second-largest municipality on Absecon Island, a primarily residential resort that catered to seasonal rentals (Smith 1963).

Margate City, Atlantic County

Margate City is located five miles south of Atlantic City on Absecon Island, where the Lenni-Lenape tribe often visited to fish and collect shells they used as currency. Early settlers moved to modern Margate City in the early nineteenth century, and by the mid-nineteenth century, fishing, trade, and salt industries attracted increasing numbers of workers (VisitNJShore.com 2021c). Completion of a rail line from Philadelphia also opened Margate to seasonal residents, and Margate City neighborhoods like Marven Gardens attracted affluent vacationers interested in buying second homes (Ralph 1989). In 1882, James V. Lafferty built Lucy the Elephant, an elephant-shaped hotel and restaurant, to attract land buyers and commercial development. The city incorporated as South Atlantic City in 1897, and changed its name to Margate City in 1909. Development continued in the late nineteenth and early twentieth centuries following the arrival of railroad service (VisitNJShore.com 2021c). The Ash Wednesday Storm of 1962 heavily damaged Margate City, including washing away what remained of the city's boardwalk that had initially been washed out in the Great Atlantic Hurricane of 1944 (Galloway 2019).

Longport, Atlantic County

Longport is located on Absecon Island, where the Lenni-Lenape tribe often visited to fish and collect shells they used as currency. The borough is named for James Long, who owned the area including modern Longport from 1857 to 1882. Long sold the parcel to M. Simpson McCollough, who planned to develop a resort community. Development in the late nineteenth and early twentieth centuries was largely commercial, while development in the mid-twentieth century was primarily residential. Longport was heavily damaged by the Ash Wednesday Storm of 1962 (NPS 2019). Two early twentieth-century buildings—the Longport Cabin Inn and the Gospel Hall Home for the Aged—were demolished in the early twenty-first century in favor of residential development. Several historic buildings have been remodeled and repurposed, however, including the Betty Bacharach Home for Afflicted Children, which has served as Borough Hall since 1987 (Borough of Longport 2021).

MITIGATION MEASURES

This section details the proposed mitigation measures to resolve adverse effects to historic properties stipulated in the MOA, and describes the purpose and intended outcome, scope of work, methodology, standards, deliverables and funds and accounting for each measure. The content of this section was developed on behalf of OW1 by individuals who meet Secretary of the Interior (SOI) Qualifications Standards for History, Architectural History and/or Architecture (62 FR 33708) and is consistent with fulfilling the mitigation measures such that they fully address the nature, scope, size, and magnitude of the visual adverse effect. Fulfillment of the mitigation measures will be led by individuals who meet SOI Qualifications Standards for History, Architectural History and/or Architecture. This document identifies which mitigation measures are likely to trigger need for compliance with the identified state/local level legislation.

Historic Context Mitigation Measures

Purpose and Intended Outcome

Based on input from Participating Parties during consultation, historic contexts consistent with agreed upon themes will be developed to disseminate significance of specific property types to Jersey Shore history. Consistent with MOA stipulations III.B.1.i.a-c, historic context themes will include:

- Historic Context addressing early 20th century New Jersey Shore Hotels
- Historic Context addressing Mid-century High-rise residential buildings at the New Jersey shore
- Historic Context addressing Boardwalks of the New Jersey Shore, and Survey and Evaluation of Atlantic City Boardwalk, Ocean City Boardwalk, and Wildwood Boardwalk.

Historic context content would draw largely on additional research to expand on existing documentation. Each context will also provide registration requirements to assist in future NRHP eligibility evaluations. Survey and evaluation will only be conducted for Atlantic City Boardwalk, Ocean City Boardwalk, and Wildwood Boardwalk.

Scope of Work

The scope of work for each historic context will consist of the following:

- Historic Context addressing New Jersey Shore early 20th century Hotels (MOA Stipulation III.B.1.i.a)
    - Compile research for historic context;
    - Deliver Draft historic context for review by OW1, BOEM, and Participating Parties; and
    - Deliver Final historic context NJHPO.
- Historic Context addressing Mid-century High-rise residential buildings at the New Jersey shore (MOA Stipulation III.B.1.i.b)
    - Compile research for historic context;
    - Deliver Draft historic context for review by OW1, BOEM, and Participating Parties; and
    - Deliver Final historic context NJHPO.
- Historic Context addressing Boardwalks of the New Jersey Shore, and Survey and Evaluation of Atlantic City Boardwalk, Ocean City Boardwalk, and Wildwood Boardwalk (MOA Stipulation III.B.1.i.c)
    - Compile research for historic context;

- Deliver Draft historic context for review by OW1, BOEM, and Participating Parties; and
    - Deliver Final historic context to NJHPO.
    - Conduct field survey of Atlantic City Boardwalk, Ocean City Boardwalk, and Wildwood Boardwalk.
    - Deliver draft Survey and Evaluation Report for review by OW1, BOEM, and Participating Parties, and
    - Deliver Final Survey and Evaluation Report to NJHPO.

Methodology

OW1 will release an RFP for consultant services and select a consultant to perform the Scope of Work listed for Historic Context Mitigation Measures, for each context, or as part of a larger consultancy RFP for additional or all mitigation measures listed herein. The chosen consultant should have staff that meet SOI Professional Qualifications for Architecture, Architectural History, or History. A draft of the documents will be provided to the Participating Parties for review and comment. The final documents will be developed incorporating comments from the Participating Parties and will be submitted to NJHPO by OW1 in an NJHPO-approved format.

Standards

The project will comply with following standards and guidelines:

- NPS White Paper: The Components of a Historic Context, Barbara Wyatt (2009);
- NPS Bulletin 15: How to Apply the National Register Criteria for Evaluation (revised 1995);
- New Jersey Historic Preservation Office Guidelines for Architectural Survey; and
- New Jersey Historic Comprehensive Statewide Historic Preservation Plan 2023–2028 (2022).

Deliverables

The following documentation is to be provided for review by the Participating Parties and ultimately, submitted to the NJHPO:

- Historic Context addressing New Jersey Shore Hotels
    - Draft Historic Context
    - Final Historic Context
- Historic Context addressing Mid-century High-rise residential buildings at the New Jersey shore
    - Draft Historic Context
    - Final Historic Context
- Historic Context addressing Boardwalks of the New Jersey Shore, and Survey and Evaluation of Atlantic City Boardwalk, Ocean City Boardwalk, and Wildwood Boardwalk.
    - Draft Historic Context
    - Final Historic Context
    - Draft Survey and Evaluation Report
    - Final Survey and Evaluation Report

Schedule

The following is a preliminary schedule for execution of historic contexts based on the current BOEM timeline for completing the OW1 NEPA and NHPA Section 106 reviews. A more detailed schedule will be requested in the solicitation/request for proposal used to identify and select a consultant to perform the scope of work described in the HPTP. Once the consultant is identified and under contract, the consultant, OW1, and the Participating Parties will develop and agree upon a final delivery schedule.

Fall 2023	Solicitation/Request for Proposal for consultant and contracting consultant to perform tasks.
Winter 2023-2024	Preliminary documentation submitted for 30-day review first by OW1 and then by BOEM. Consultant revisions completed.
Spring 2024	Draft deliverables for 30-day review by Participating Parties followed by submission of final deliverables.

Funds and Accounting

OW1 will be responsible for funding and implementation of this mitigation measure.

Funding for Visitor Experience and Public Access

Purpose and Intended Outcome

Based on input from Participating Parties during consultation, funding will be provided to facilitate access and support the visitor experience at historic properties with public visitation applicable to but not limited to Lucy the Margate Elephant, Absecon Lighthouse (Atlantic city), and the Atlantic City Boardwalk (Atlantic City). Examples for use of these funds may include: directional signage, parking, improvements to site circulation (including ADA accessibility), public access, safety and security, and funding for maintenance and improvement to areas heavily used or damaged due to public visitation. When applicable, physical improvements to the properties should adhere to applicable preservation standards, including but not limited to the Secretary of the Interior Standards for the Treatment of Historic Properties. The intent of this funding is to support and improve public access at these historic properties to foster an appreciation of the sites and their contribution to the historic character of the Jersey Shore. This funding should ensure that improvements are made with careful consideration of the historic character of the property and sympathetic to the existing physical structure.

Scope of Work

The scope of work for each historic property, as appropriate, will consist of the following:

- Determine priority projects in collaboration with Participating Parties and property owners.
- Develop plans appropriate to the identified project, and submit plans for review by OW1, BOEM, and Participating Parties.;
- Identify qualified contractors to execute plans.

- Complete planned work and acquire final approval from OW1, BOEM, and Participating Parties, or a designated representative for the three entities.

Methodology

OW1 will provide funds to the property owner for an approved Scope of Work. In consultation with OW1, the property owner will solicit bids for consultant services and select a consultant to perform the approved Scopes of Work. The chosen consultant should have staff that meet SOI Professional Qualifications for Architecture or Architectural History. Draft project plans developed by the consultant will be provided to OW1, the Participating Parties and the property owner, as appropriate, for review and comment. Work will be monitored as needed, and a final walkthrough and approval of work is required. Work must be approved by OW1, Participating Parties, and the property owner, or a designee of all three.

Standards

The project will comply with following standards:

- Local preservation standards as applicable.
- The Secretary of the Interior Standards for Rehabilitation (for applicable projects).

Deliverables

The following documentation is to be provided for review by the Participating Parties:

- Project plans.
- Photos of completed work.

Schedule

The following is a preliminary schedule for execution of visitor experience and public access improvements based on the current BOEM timeline for completing the OW1 NEPA and NHPA Section 106 reviews. A more detailed schedule will be requested in the solicitation/request for proposal used to identify and select a consultant to perform the scope of work described in the HPTP. Once the consultant is identified and under contract, the consultant, OW1, and the Participating Parties will develop and agree upon a final delivery schedule.

Fall 2023	Determination of priority projects at each historic property.
Winter 2023-2024	Solicitation/Request for Proposal for consultant and contracting to perform tasks.
Spring 2024	Execution of projects followed by submission of complete project photos and approval of work. .

Funds and Accounting

OW1 will be responsible for funding and implementation of this mitigation measure.

IMPLEMENTATION

Timeline

Within one year of the MOA being executed, these mitigation measures must be initiated. Tasks associated with the Historic Context Mitigation Measures can occur during and/or after construction. Mitigation measures within this HPTP are to be completed within four years of its initiation, unless a different timeline is agreed upon by Participating Parties and accepted by BOEM and may be completed simultaneously, as applicable.

Reporting

Following the execution of the MOA until it expires or is terminated, OW1 shall prepare and, following BOEM review and approval, provide all signatories, invited signatories, and consulting parties to the MOA a summary report detailing work undertaken pursuant to the MOA consistent with MOA Stipulation XV (Monitoring and Reporting), including the mitigation measures outlined in the final HPTP. This report will be prepared, reviewed, and distributed by January 31, and summarize the work undertaken during the previous year.

Organizational Responsibilities

BOEM

- Make all federal decisions and determine compliance with Section 106;
- Ensure that mitigation measures adequately resolve adverse effects, consistent with the NHPA, and in consultation with the Participating Parties;
- Consult with OW1, NJHPO, ACHP, and other consulting parties with demonstrated interest in the affected historic properties; and
- Review and approve the annual summary report prepared and distributed to the consulting parties by OW1.

Ocean Wind LLC

- Fund and implement the mitigation measures Stipulated in III.B of the MOA and described in the Mitigation Measures section of this HPTP;
- Prepare Annual Reporting, submit reporting to BOEM for review and approval, and distribute to Consulting Parties per the Mitigation Measures section of this HPTP;
- Submit information for Participating Party review per the Mitigation Measures section of this HPTP;
- Creation and distribution of RFPs to solicit consultant support for mitigation measure fulfillment;
- Proposal review and selection of a consultant who meets the qualifications specified in the SOI Qualifications Standards for History, Architectural History and/or Architecture (62 FR 33708);
- Initial review of Documentation for compliance with the Scope of Work, Methodology and Standards;

- Distribution of Documentation to Participating Parties for their review; and
- Review and comment on deliverables.

New Jersey SHPO

- Consult, when necessary, on implementation of this HPTP.

Advisory Council on Historic Preservation

- Consult, when necessary, on implementation of this HPTP.

REFERENCES

Works Cited

Atlantic City Free Public Library (ACFPL). 2021. "Atlantic City History." Electronic document, http://acfpl.org/ac-history-menu/atlantic-city-faq-s/15-heston-archives/147-atlantic-city-history-22.html. Accessed March 30, 2021.

Berkey, Joan E. 2017. *A Survey of 80 Historic Buildings and Sites in Upper Township Cape May County, New Jersey*. Historical Preservation Society of Upper Township. Report on file, New Jersey Department of Environmental Protection, Historic Preservation Office.

Bethke, Alex. 2009. *National Register of Historic Places Registration Form: Flanders Hotel*. On file New Jersey Historic Preservation Office, Trenton, New Jersey.

Borough of Longport. 2021 "History of Longport." Electronic document, https://longportnj.gov/history.html, accessed March 31, 2021.

Bzdak, Meredith. 2001. Ocean City Residential Historic District, National Register of Historic Places Registration Form. Produced by Ford, Farewell, Mills and Gatsch, Architects, Princeton, New Jersey, for the National Park Service, Department of the Interior, Washington, D.C. Available at https://npgallery.nps.gov/GetAsset/f74e7baa-c2a9-4042-acbb-455c663fdff7/.

Charleton, James H. 1985. *National Register of Historic Places Inventory – Nomination Form: Atlantic City Convention Hall*. On file New Jersey Historic Preservation Office. Trenton, New Jersey.

Council on Tall Buildings and Urban Habitat (CTUBH). 2021. Vassar Square Condominiums: Ventnor City, United States. Online [URL]: https://skyscraper-staging.ctbuh.org/building/vassar-square-condominiums/12723. Accessed February 25, 2021.

The Daily Intelligencer (Lancaster, Pennsylvania). 1950. Many Features at Ocean City, N.J. June 29, 1950:10.

The Daily News (Huntingdon, Pennsylvania). 1978. Atlantic City Demolition to Begin Soon. January 25, 1978:13.

Elias, Donna. 2018. *Hereford Inlet Lighthouse*. Online [URL]: http://www.herefordlighthouse.org/history.html. Accessed February 19, 2021.

Esposito, Frank J. and Robert J. Esposito. 1996. *Ocean City, New Jersey*. Volume 1. Arcadia Publishing, Charleston, S.C.

Kelly, Tim. 2018. "Great Boardwalk Fire" of 1927 Re-shaped Ocean City. Online [URL]: https://ocnjdaily.com/great-boardwalk-fire-of-1927-re-shaped-ocean-city/. Accessed September 2022.

Koski-Karell, Daniel and Melissa Wiedenfeld, Chad Blackwell, Marjorie Nowick, Kathryn Plimpton, and Lori Vermass (Koski-Karell et al.). 2013. *National Register of Historic Places Multiple Property Documentation Form: U.S. Government Lifesaving Stations, Houses of Refuge, and pre-1950 U.S. Coast Guard Lifeboat Stations*.

On file US Department of the Interior, National Park Service, Washington, DC. Online [URL]: https://www.nps.gov/nr/feature/places/pdfs/64501177.pdf. Accessed July 29, 2019.

Lucy the Elephant. 2011a. *Chapter 1 – Elephant to Starboard*. Online [URL]: https://www.lucytheelephant.org/history/chapter-1-elephant-to-starboard/. Accessed July 30, 2019.

Lucy the Elephant. 2011b. *Chapter 2 – The Gertzens*. Online [URL]: https://www.lucytheelephant.org/history/chapter-2-the-gertzens/. Accessed July 30, 2019.

Lucy the Elephant. 2011c. *Chapter 4 – The Turkish Pavilion*. Online [URL]: https://www.lucytheelephant.org/history/chapter-4-the-turkish-pavilion/. Accessed July 30, 2019.

Lucy the Elephant. 2011d. *Chapter 5 – Tourist Camp*. Online [URL]: https://www.lucytheelephant.org/history/chapter-5-tourist-camp/. Accessed July 30, 2019.

Miller, Fred. 2003. *Ocean City: America's Greatest Family Resort*. Arcadia Publishing, Charleston, S.C.

The Morning Call (Allentown, Pennsylvania). Historic Boardwalk Being Replaced in Ocean City, N.J. Online [URL]: https://www.mcall.com/news/local/mc-nws-ocean-city-boardwalk-20171211-story.html. Accessed July 30, 2019.

National Park Service (NPS). 2019. "Ash Wednesday Storm of 1962." Electronic document, https://www.nps.gov/articles/ash-wednesday-storm-of-1962.htm. Accessed March 29, 2021.

National Environmental Title Research (NETR). 1963. Historic Aerial Photograph. Online [URL]: https://www.historicaerials.com/viewer. Accessed August 2019.

National Environmental Title Research (NETR). 1970. Historic Aerial Photograph. Online [URL]: https://www.historicaerials.com/viewer. Accessed August 2019.

NJ South. 2019. *Lucy the Elephant*. Online [URL]: http://www.njsouth.com/index-lucy.htm. Accessed July 30, 2019.

Ocean City, New Jersey. 2021. "The History of Ocean City, New Jersey." Electronic document, https://oceancityvacation.com/history/history-of-ocean-city-nj.html. Accessed March 31, 2021.

Pitts, Carolyn. 1971. *National Register of Historic Places Registration Form: Lucy the Margate Elephant*. On file US Department of the Interior, National Park Service, Washington DC. Online [URL]: https://npgallery.nps.gov/GetAsset/1abd9673-d3a5-456b-a91d-cbf6a507488d. Accessed July 29, 2019.

Smith, Sarah T. 1963. *The History of Ventnor, New Jersey*. Self-published. Available at http://downbeachbuzz.com/wp-content/uploads/2015/11/History-Of-Ventnor.pdf. Accessed April 14, 2021.

TheShoreBlog.com. 2019. "History of Stone Harbor." Electronic document, https://theshoreblog.com/history-of-stone-harbor/. Accessed April 15, 2021.

The Shore Blog. 2021. History of Ocean City, New Jersey. Online [URL]: https://theshoreblog.com/history-of-ocean-city/. Accessed September 2022.

Thomas, George E. 1986. John Stafford Historic District, National Register of Historic Places Nomination Form. Produced by Clio Group, Inc., Philadelphia, for the National Park Service, Department of the Interior, Washington, D.C. Available at https://npgallery.nps.gov/GetAsset/addd3b51-8881-45bf-bb78-c00faa13a9d9.

Town Square Publications. 2010. "Atlantic City, New Jersey History." Electronic document, https://local.townsquarepublications.com/newjersey/atlantic-city/01/topic.html. Accessed April 15, 2021.

United States Army Corps of Engineers (USACE). 2012. *New Jersey Shore Protection: Great Egg Harbor Bay and Peck Beach, (Ocean City), NJ*. Online [URL]: https://www.nap.usace.army.mil/Missions/Factsheets/Fact-Sheet-Article-View/Article/490782/new-jersey-shore-protection-great-egg-harbor-and-peck-beach-ocean-city-nj/. Accessed July 18, 2019.

VisitNJShore.com. 2021a. "History of North Wildwood, NJ." Electronic document, https://www.visitnjshore.com/north-wildwood/history/. Accessed March 1, 2021.

VisitNJShore.com. 2021b. "History of Ocean City, NJ." Electronic document, https://www.visitnjshore.com/ocean-city/history/. Accessed March 1, 2021.

VisitNJShore.com. 2021c. "History of Margate City, NJ." Electronic document, https://www.visitnjshore.com/margate-city/history/. Accessed March 1, 2021.

Wilson, Charles, Jr. 1970. *National Register of Historic Places Registration Form: Absecon Lighthouse*. On file US National Archives, Washington DC. Online [URL]: https://catalog.archives.gov/id/135813729. Accessed February 17, 2021.

Federal Regulations

Code of Federal Regulations (CFR). 2022. 40 CFR 1500 – National Environmental Policy Act Implementing Regulations. Available at https://www.ecfr.gov/current/title-40/chapter-V/subchapter-A.

CFR. 2021a. 36 CFR 800 – Protection of Historic Properties [incorporating amendments effective December 15, 2021]. Available at https://www.ecfr.gov/current/title-36/chapter-VIII/part-800.

CFR. 2021b. 36 CFR 61.4(e)(1) – Procedures for State, Tribal, and Local Government Historic Preservation Programs [incorporating amendments effective December 15, 2021]. Available at https://www.ecfr.gov/current/title-36/chapter-I/part-61#p-61.4(e)(1).

CFR. 2021c. 36 CFR 65.2(c)(2) – National Historic Landmarks Program – Effects of Designation [incorporating amendments effective December 15, 2021]. Available at https://www.ecfr.gov/current/title-36/chapter-I/part-65#p-65.2(c)(2). Accessed December 21, 2021.

Federal Register. 1997. 62 FR 33708 – The Secretary of the Interior's Historic Preservation Professional Qualifications Standards. Office of the Federal Register, National Archives and Records Administration. Washington, D.C. Available at https://www.govinfo.gov/app/details/FR-1997-06-20/97-16168.

United States Code. 2016. Title 54 - National Historic Preservation Act [as amended through December 16, 2016]. Available at https://www.achp.gov/sites/default/files/2018-06/nhpa.pdf.

State Regulations

New Jersey Register of Historic Places Act of 1970 (N.J.S.A. 13:1B-15.128 et seq.):
https://www.state.nj.us/dep/hpo/2protection/njsa13.htm

Public documents related to Ocean Wind1

https://www.boem.gov/ocean-wind
https://www.boem.gov/ocean-wind-1-construction-and-operations-plan
[Ocean Wind1 FEIS]
[Ocean Wind1 ROD]

General Information on Section 106

https://www.achp.gov/protecting-historic-properties/section-106-process/introduction-section-106

https://www.achp.gov/digital-library-section-106-landing/section-106-consultation-involving-national-historic-landmarks

ATTACHMENT 5 – TERRESTRIAL ARCHAEOLOGICAL MONITORING PLAN

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Monitoring Plan

Monitoring Plan for the Treatment of Cultural Resources Encountered During Construction of Onshore Facilities associated with the Ocean Wind Offshore Wind Farm (Lease Area OCS-A 0498)

Cape May and Ocean Counties, New Jersey

1 Introduction

Ocean Wind LLC (Ocean Wind) has proposed construction of the Ocean Wind 1 Offshore Wind Project (Project), consisting of the Wind Farm located in federal water on the Atlantic Outer Continental Shelf (OCS) within the Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Area OCS-A 0498 (Lease Area) as well as the export cable routes from offshore to onshore, nearshore and onshore horizontal directional drilling (HDD) locations and open-trench cuts, and substation interconnections (Figure 1).

This plan describes the protocols to be followed in the event that cultural resources and/or human remains are inadvertently exposed during onshore construction activities performed in the Area of Potential Effects (APE) and as documented in the Terrestrial Archaeological Resources Assessment (TARA) and nearshore/onshore portions documented in the Marine Archaeological Resources Assessment (MARA).

1.1 Regulatory Framework

The Outer Continental Shelf Lands Act, 1953 (as amended) (43 U.S.C 1337), grants the lead enforcement of laws and regulations governing offshore leasing on Federal offshore lands to BOEM (CFR Title 30, Chapter V, Subpart B-Offshore). The issuance of Lease Area OCS-A 0498 to Ocean Wind under the “Commercial Lease of Submerged Lands for Renewable Energy Development of the Outer Continental Shelf, Number OCS-A 0498”) constitutes a federal undertaking subject to Section 106 of the National Historic Preservation Act (NHPA) (54 U.S.C. § 300101 et seq.). The Section 106 implementing regulations (36 CFR Part 800) define an undertaking as a:

> project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; and those requiring a federal permit, license or approval (36 CFR 800.16[y]).

The Section 106 process “requires Federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings” (36 CFR 800.1[a]). In December 2020, BOEM made the decision to substitute the National Environmental Policy Act (NEPA) review process to comply with Section 106 procedures, under 36 CFR 800.8(c). Procedures and documents required for the preparation of the Project’s environmental impact statement (EIS) and record of decision (ROD) replaced the standard Section 106 review process.

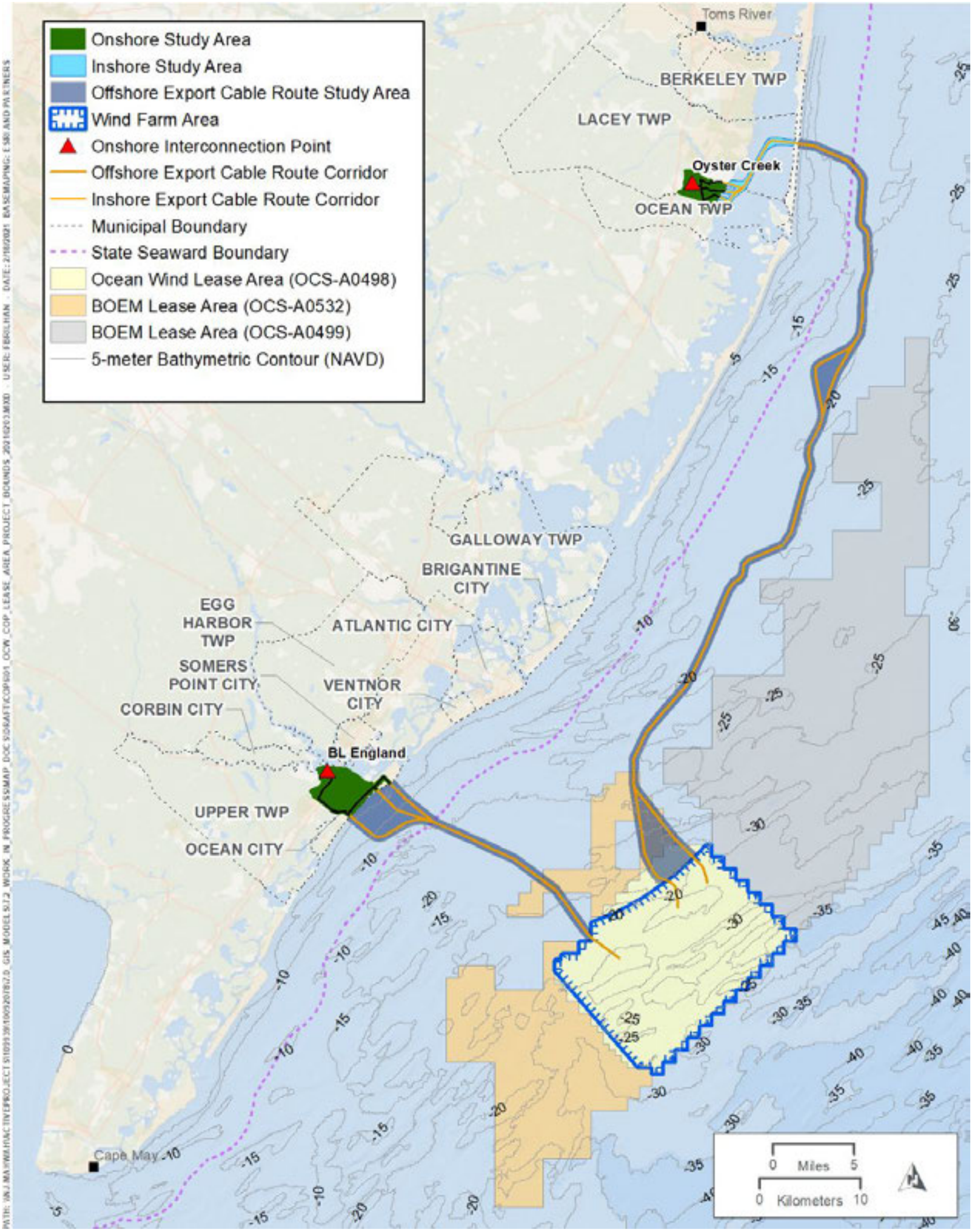

Figure 1. General Location of the Project.

1.2 Purpose

Between 2018 and 2022, Ocean Wind conducted Phase I archaeological investigations of the onshore portions of the Project, including the export cable routes from offshore to onshore, nearshore and onshore HDD locations and open-trench cuts, and substation interconnections. These surveys were completed in accordance with NJ HPO's *Guidelines for Phase I Archaeological Investigations: Identification of Archaeological Resources*, and its *Guidelines for Preparing Cultural Resources Management Archaeological Reports Submitted to the Historic Preservation Office*. The surveys identified six archaeological sites; two are expansions of previously reported sites, three are newly reported, and one is a previously reported site adjacent to the APE. Avoidance, protective measures, and monitoring were recommended during construction for this Project.

The purpose of this monitoring plan is to prevent or address unintended adverse effects to historic properties that may occur during the construction of the Project. This plan was prepared in accordance with the TARA recommendations found in Section 8.5.3 and conveyed within subsequent Section 106 consultation meetings.

Prior to beginning any construction activities related to the onshore cable routes at both Oyster Creek and BL England, Ocean Wind will share this construction monitoring plan that addresses the following:

- Training procedures to familiarize construction personnel with the identification and appropriate treatment of historic properties;
- Monitoring of construction activities by a qualified archaeologist meeting, at a minimum, the *Secretary of the Interior's (SOI) Professional Qualifications Standards for Archaeologists* (48 Federal Register 44738-44739);
- Provisions for monitoring and coordination with Tribal Monitors;
- Provisions for temporary avoidance measures;
- Process for determining the relevance of monitoring a construction activity;
- Reporting including regular updates to the Section 106 consulting parties (e.g. BOEM, New Jersey Historic Preservation Office [NJ HPO] serving as the State Historic Preservation Office [SHPO]), and Tribal representatives and/or Tribal Historic Preservation Officers (THPOs) during construction and the completion of a monitoring report following the completion of construction activities;

The ensuing archaeological monitoring will be conducted in compliance with the above referenced provisions.

1.3 Definition of Ground-Disturbing Activities Requiring Archaeological Monitoring

Archaeological monitoring is generally defined as the observation of ground-disturbing construction activities by a qualified archaeologist in order to identify, document, protect, and/or recover information on the cultural resources to avoid adverse effects.

Ground disturbance is defined as activities that compacts or disturbs the ground. Ground-disturbing activities that will require monitoring for this Project include mechanical tree removal and grubbing, scraping, grading, excavating, drilling, trenching, augering and coring.

2 Project Personnel Roles

Qualified Archaeologist (or archaeologist) – A professional archaeologist meeting, at a minimum, the *Secretary of the Interior's (SOI) Professional Qualifications Standards for Archaeologists* (48 Federal Register 44738-44739);

Cultural Resource Compliance Manager – Ocean Wind's defined point-of-contact for construction activities;

Cultural Resources Manager – Archaeological monitor manager, meeting, at a minimum, the *Secretary of the Interior's (SOI) Professional Qualifications Standards for Archaeologists* (48 Federal Register 44738-44739). This person may not be in the field but will manage archaeological monitoring aspects; and

Construction Contractor – Construction team manager or supervisor. There may be more than one Construction Contractor, dependent on the construction activity.

Archaeological Monitor(s) – field archaeologist with education and training in archaeology, supervised by SOI qualified archaeologist.

Tribal Monitor(s) – a Native American with affiliation with affected Tribes and specialized training in cultural resources and monitoring.

3 Training Procedures

A qualified archaeologist will provide on-site archaeological orientation and training in advance of the start of construction to applicable construction workers, including managers and supervisors, Archaeological Monitors and Tribal Monitors. Training will be provided as-needed for new workers as construction continues. The training, which will last no longer than 30 minutes, will outline the steps to be taken in the event of an unanticipated discovery. During the training the qualified archaeologist will:

- Give information and examples of the types of cultural resources that may be encountered in the area, including how to identify stone tools, bone, ceramics, glass, and various wood and metal objects;
- Outline the laws that protect cultural resources;
- Outline applicable penalties for damaging sites; and
- Provide contact information for the qualified archaeologist, the Archaeological Principal Investigator (PI), and any backup.

Individuals attending a training session will sign a sheet indicating the date and time of their attendance, which will be maintained by the qualified archaeologist.

Archaeological monitors and Tribal Monitors must participate in safety training prior to entering construction areas. That training will be provided at regular intervals before and during construction and updated in daily safety meetings. The Construction Contractor will provide a list of personal protective equipment that will be required for archaeological monitors.

4 Monitoring Procedures

The following procedures will be adhered to during archaeological monitoring of the ground-disturbing activities taking place during construction.

Work under the terms of the monitoring plan is to be carried out under the direct supervision of a qualified archaeologist meeting, at a minimum, the *Secretary of the Interior's Professional Qualifications Standards for Archaeologists* (48 Federal Register 44738-44739).

4.1 Coordination with Tribal Monitors

Tribal representatives and/or Tribal Historic Preservation Offices (THPOs) will be notified of construction activities minimally two-weeks in advance to participate in monitoring activities, if desired. Once monitoring has begun, the qualified archaeologist will notify Tribal representatives and/or THPOs who have expressed an intent to have a monitor present each day prior of the starting location for the next day.

4.2 Locations Requiring Monitoring

Six archaeological sites and nine archaeologically sensitive areas were identified during the TARA, completed between 2018 and 2022 (Tables 1 through 3). Additional areas of monitoring may be identified during construction, and is at the discretion of the Cultural and Tribal monitors and contacts.

Table 1: List of Archaeological Sites Identified during the Terrestrial Archaeological Resources Assessment.

Site Name	Number	Date	Size	Project Impacts
B.L. England (Locus 1) (Expansion)	28-Cm-032	Precontact: Late Archaic to Transitional, Middle to Late Woodland	2,695 m^2 (29,012 ft^2)	Site previously determined eligible for the National Register. Site to be avoided and protected, area to be monitored.
GEHB Site 1 (Expansion)	28-Cm-064	Precontact and Historic: Woodland, Late 17th to early 20th century	53 m^2 (173 ft^2)	Site to be avoided and protected, area to be monitored.
Cedar Hollow Historic Site	28-Cm-091	Historic: 18th to 19th century	104 m^2 (1125 ft^2)	Site to be avoided and protected, area to be monitored.
Oyster Creek Paleoindian Spot Find	28-Oc-249	Precontact: Paleoindian	17 m^2 (55 ft^2)	Site considered eligible for the National Register. Site to be avoided and protected, area to be monitored.
Chamberlain Historic Midden	28-Oc-250	Historic: 18th to 20th century	550 m^2 (1,800 ft^2)	Site to be avoided and protected, area to be monitored.
Unnamed Site	28-Oc-055	Possible precontact shell midden (appears to be mislocated in site forms).	Unknown	Adjacent to PAPE, area to be monitored.

Table 2. Summary of Pre-Contact and Historical Archaeological Sensitivity of the Oyster Creek Area of Potential Effects.

Landfall/Route	Pre-Contact Sensitivity	Historical Sensitivity	NJ CRGIS LUCY – Archaeology Grid Designation
Oyster Creek Substation	Moderate	Low	Not Evaluated

Landfall/Route	Pre-Contact Sensitivity	Historical Sensitivity	NJ CRGIS LUCY – Archaeology Grid Designation
Farm Property	Moderate	Moderate	Identified
US Route 9	Low	Moderate	Identified
Bay Parkway	Moderate	Moderate	Identified
Old Main Street	Moderate	High	Identified
Lighthouse Drive	Low	Low	Identified
Nautilus Road	Low	Low	Identified
Holiday Harbor Marina	Low	Moderate	Identified

Table 3. Summary of Pre-Contact and Historical Archaeological Sensitivity of the B.L. England Area of Potential Effects.

Landfall/Route	Precontact Sensitivity	Historic Sensitivity	NJ CRGIS LUCY – Archaeology Grid Designation
B.L. England Substation	High	Low	Eligible
US Route 9 (North Shore Road)	Moderate	High	Identified
Roosevelt Boulevard	Low	Low	Not Evaluated
West Ave – Ocean City	Moderate	Moderate	Not Evaluated and Eligible

The Project proposes to avoid impacts to known sites; however, archaeological monitoring was determined necessary during construction near known archaeological sites, as well as along the proposed cable routes and within roadways deemed to be highly sensitive, based on the sensitivity maps presented in the TARA.

4.3 Temporary Avoidance Measures

This section outlines the proposed avoidance measures to undertake at each of the archaeological sites, where applicable.

4.3.1 Site 28-Cm-032 (B.L. England)- Expanded Boundaries

Site number	28-Cm-032 (B.L. England)
Date	Late Archaic to Transitional and Middle to Late Woodland Periods
Type	Toolmaking/shellfish and mammal processing site; Late Archaic to Transitional and Middle to Late Woodland Periods
Size	2,695 m^2 (29,012 ft^2)
Depth	.5 m (1.5 ft)
Within/Adjacent PAPE	The site, although expanded, is no longer included as part of the PAPE, but is immediately adjacent to the north and west of the PAPE.
Proposed Impacts	Adjacent to the APE. No direct effects.
Protection/Avoidance Measures	Site protection measures and monitoring will occur.

The qualified archaeologist will install snow fencing and signage around the external limits of the site boundary within a 10-foot buffer of the APE and as mapped in the TARA no more than one week prior to construction. The signage will be demarcated with “Restricted Area” printed on corrugated plastic materials. The sign will be double- sided to ensure visibility. The signage will not denote the area as archaeological in nature. The signage and snow fencing will remain in place during construction activities, with the qualified archaeologist removing it within one week of completion of all construction activities within a 1-mile radius for the Project. The Construction Contractor will be responsible for ensuring the fencing remains in place, and should it fall or be removed, the Construction Contractor will notify the qualified archaeologist within 24-hours. Please note, placement of snow fencing and signage is dependent upon approval from the landowner.

The qualified archaeologist will monitor ground-disturbing construction activities within the immediate vicinity, defined necessary by the qualified archaeologist, of the archaeological site.

4.3.2 Site 28-Cm-064 (GEHB Site 1), Expanded Boundaries

Site number	**28-Cm-064 (expansion)**
Date	Woodland Period and Late 17th – Early 20th century
Type	Precontact camp, tool production, and food processing site; historic house midden.
Size	53 m^2 (173 ft^2)
Depth	.5 m (1.5 ft)
Within/Adjacent PAPE	Within the defined PAPE, but between edge of pavement and edge of ROW
Proposed Impacts	The cable may be placed in the road near the site area if this alternate is selected. No direct effects.
Protection/Avoidance Measures	Site protection measures and monitoring will occur.

The qualified archaeologist will install snow fencing and signage around the external limits of the site boundary within a 10-foot buffer of the APE and as mapped in the TARA no more than one week prior to construction. The signage will be demarcated with “Restricted Area” printed on corrugated plastic materials. The sign will be double- sided to ensure visibility. The signage will not denote the area as archaeological in nature. The signage and snow fencing will remain in place during construction activities, with the qualified archaeologist removing it within one week of completion of all construction activities within a 1-mile radius for the Project. The Construction Contractor will be responsible for ensuring the fencing remains in place, and should it fall or be removed, the Construction Contractor will notify the qualified archaeologist within 24-hours. Please note, placement of snow fencing and signage is dependent upon approval from the landowner.

The qualified archaeologist will monitor ground-disturbing construction activities within the immediate vicinity, defined necessary by the qualified archaeologist, of the archaeological site.

4.3.3 Site 28-Cm-091 (Cedar Hollow Historic Site), Newly Identified Site

Site number	**28-Cm-091**
Date	18th – 19th century
Type	House midden
Size	105 m^2 (1125 ft^2)
Depth	0.35-0.55 m (1-1.5 ft)
Within/Adjacent PAPE	Within the defined PAPE, but between edge of pavement and edge of ROW.
Proposed Impacts	The cable may be placed in the road near the site area if this alternate is selected. No direct effects.
Protection/Avoidance Measures	Site protection measures and monitoring will occur.

The qualified archaeologist will install snow fencing and signage around the external limits of the site boundary within a 10-foot buffer of the APE and as mapped in the TARA no more than one week prior to construction. The signage will be demarcated with “Restricted Area” printed on corrugated plastic materials. The sign will be double- sided to ensure visibility. The signage will not denote the area as archaeological in nature. The signage and snow fencing will remain in place during construction activities, with the qualified archaeologist removing it within one week of completion of all construction activities within a 1-mile radius for the Project. The Construction Contractor will be responsible for ensuring the fencing remains in place, and should it fall or be removed, the Construction Contractor will notify the qualified archaeologist within 24-hours. Please note, placement of snow fencing and signage is dependent upon approval from the landowner.

The qualified archaeologist will monitor ground-disturbing construction activities within the immediate vicinity, defined necessary by the qualified archaeologist, of the archaeological site.

4.3.4 Site 28-Oc-055, Unnamed Site

Site number	28-Oc-055
Date	Possible Pre-Contact
Type	Shell midden
Size	Approximately 40 m^2 (430 ft^2)
Depth	Unknown
Within/Adjacent PAPE	Possibly mapped the defined PAPE. Site was not relocated during survey
Proposed Impacts	The cable may be placed in the road and near the site area if this alternate is selected. No direct effects.
Protection/Avoidance Measures	Monitoring will occur.

The qualified archaeologist will monitor ground-disturbing construction activities within the immediate vicinity, defined necessary by the qualified archaeologist, of the archaeological site.

4.3.5 Site 28-Oc-249, Oyster Creek Paleoindian Spot Find

Site number	Site 28-Oc-249,
Date	Paleoindian, c. 12,500 B.P.
Type	Spot find
Size	706 m^2 (7,854 ft^2)
Depth	0-40 cm (1.3 ft)
Within/Adjacent PAPE	Within the PAPE, just outside of the proposed limits of disturbance (LOD), as the cable will be buried in this location via HDD. Entry/exit pit approximately 50 feet east of find.
Proposed Impacts	The site will be avoided. No direct effects.
Protection/Avoidance Measures	Site protection measures and monitoring will occur.

The qualified archaeologist will install snow fencing and signage around the external limits of the site boundary as mapped in the TARA no more than one week prior to construction. The signage will be demarcated with “Restricted Area” printed on corrugated plastic materials. The sign will be double-sided to ensure visibility. The signage will not denote the area as archaeological in nature. The signage and snow fencing will remain in place during construction activities, with the qualified archaeologist removing it within one week of completion of all construction activities within a 1-mile radius for the Project. The Construction Contractor will be responsible for ensuring the fencing remains in place, and should it fall or be removed, the Construction Contractor will notify the qualified archaeologist within 24-hours.

The qualified archaeologist will monitor ground-disturbing construction activities within the immediate vicinity, defined necessary by the qualified archaeologist, of the archaeological site.

4.3.6 Site 28-Oc-250, Chamberlain Historic Midden Site

Site number	Site 28-Oc-250,
Date	Historic, c. late 18th-20th centuries
Type	House midden
Size	550 m² (1,800 ft²)
Depth	15-40 cm (0.5-1.3 ft)
Within/Adjacent PAPE	Within the defined PAPE, but between edge of pavement and edge of ROW.
Proposed Impacts	The cable may be placed in the road if this alternate is selected.
Protection/Avoidance Measures	Site protection measures and monitoring will occur.

The qualified archaeologist will install snow fencing and signage around the external limits of the site boundary within a 10-foot buffer of the APE and as mapped in the TARA no more than one week prior to construction. The signage will be demarcated with "Restricted Area" printed on corrugated plastic materials. The sign will be double- sided to ensure visibility. The signage will not denote the area as archaeological in nature. The signage and snow fencing will remain in place during construction activities, with the qualified archaeologist removing it within one week of completion of all construction activities within a 1-mile radius for the Project. The Construction Contractor will be responsible for ensuring the fencing remains in place, and should it fall or be removed, the Construction Contractor will notify the qualified archaeologist within 24-hours.

The qualified archaeologist will monitor ground-disturbing construction activities within the immediate vicinity, defined necessary by the qualified archaeologist, of the archaeological site.

4.3.7 Archaeological Monitoring Along the Export Cable Routes, Including Open Cut Trench Landings and HDD Locations

The qualified archaeologist will monitor ground-disturbing construction activities within archaeologically sensitive areas along the export cable routes. This includes all areas of the export cable routes except areas along Lighthouse Drive, Nautilus Road, and Roosevelt Boulevard.

4.4 Process for Determining if Monitoring a Construction Activity is Necessary

Ground-disturbing construction activities should assume to be monitored; however, consultation with the qualified archaeologist should occur should there be a question whether monitoring is necessary. Questions regarding whether monitoring is necessary must go through the request for information process before proceeding.

4.5 Responsibilities During Construction

The qualified archaeologist will be responsible for confirming that the proper steps are followed to assess and protect cultural resources. The qualified archaeologist has the authority and responsibility to stop work if any previously unidentified cultural resources are encountered. The Cultural Resource Manager will be responsible for coordinating for coordinating logistics for Archaeological Monitors and Tribal Monitors.

The qualified archaeologist will be present where monitoring is required and will be responsible for the recordation of unanticipated discoveries. The qualified archaeologist will be equipped with:

- A digital camera;
- Global Positioning System (GPS) unit capable of submeter accuracy;
- Monitor’s daily logs;
- Relevant Project contact information;
- Safety evacuation information.

Other equipment will be determined by the Project design and needs.

To minimize the hazards associated with the archaeological monitoring of construction, there will be close coordination between the archaeological monitors and construction personnel. The qualified archaeologist will be responsible for the following tasks:

- Be present during mechanical tree removal, scraping, grading, excavating, trenching, and other ground-disturbing activities in all required monitoring areas in the Project APE.
- Inspect the newly exposed surface as sediment is moved by heavy equipment.
- Identify cultural materials and ascertain whether the material is archaeological.
- Determine the significance of unanticipated discoveries.
- Consult and coordinate with the BOEM, NJ HPO, and Tribal representatives and/or THPOs in order to mitigate unanticipated discoveries.
- Coordinate with relevant construction personnel when unanticipated discoveries are made.

If cultural remains, or possible human remains are noted, construction activities will be halted within the immediate vicinity of the discovery, in an area defined sufficient by the qualified archaeologist. Construction may proceed in other areas of the Project APE.

Archaeological monitoring will not be required once all surface and subsurface ground-disturbing activity in a construction area is completed. Equipment or vehicles traveling over previously disturbed surfaces will not require monitoring. Routine travel on existing or disturbed areas will not be monitored for cultural resources.

Blading, scraping, grading, trenching, or excavating at a depth beyond the previously disturbed area will be monitored for cultural resources, even within previously graded or bladed areas, where the potential exists for impacting intact subsurface deposits.

4.6 Responsibilities for Reporting

Qualified archaeologists will maintain monitoring records, photographs, and digital data, and will maintain daily logs of Project-related monitoring activities comprising the following:

- Date, time of work, and amount of time spent at a construction monitoring location;
- Area of work;
- Type of work, equipment present, and name of construction crew being monitored;

- Documentation of successful resource avoidance, including a map showing locations of excavations, surface structures, topography, and identified archaeological deposits within the APE;
- Activities for which there are circumstances that limit or prevent visual examination of Project excavations (including delimiting those areas on a Project area map), cultural resource problems, non-compliances, or other concerns;
- Identification of an unanticipated discovery, steps taken to protect the discovery, and documentation of notifications (name, agency, time, and notes); and
- Color digital photographs taken (as appropriate) to document construction and monitoring activities and submitted as attachments to the daily log.

Qualified archaeologists will prepare and provide their monitoring logs daily to the Cultural Resources Manager, who will prepare and provide bi-weekly summary reports on the progress or status of cultural resources-related activities during active construction.

- The bi-weekly reports will summarize construction progress, monitoring (including monitor name, dates worked, finds, issues, etc.), and status of cultural resources-related issues.
- Bi-weekly reports will include photographs of the activities as well as a look-ahead schedule of upcoming activities.
- These reports will also include the appropriate state archaeological isolate or site forms for finds identified under the monitoring program.
- Site forms for any newly discovered properties will include recommendations for National Register of Historic Places (NRHP) eligibility and Project effect.

The Cultural Resources Manager will submit bi-weekly reports to Ocean Wind, BOEM, NJ HPO, and Tribal representatives and/or THPOs via email. BOEM will be notified of all unanticipated finds within 24-hours of discovery via email.

4.7 Detailed Procedures

This section includes detailed information regarding the construction and post-construction tasks to be performed by the qualified archaeologist and other parties, as well as the procedure for documenting and reporting unanticipated discoveries made during construction.

4.7.1 Construction Tasks

While construction activities are ongoing, the qualified archaeologist will observe ground-disturbing activities. If an unanticipated discovery is made and that find is determined significant by the qualified archaeologist, construction work within the site boundary will halt temporarily.

In the event of an unanticipated discovery, the Terrestrial Archaeology Post-Review Discovery Plan will be followed. If the discovery is recommended eligible for the NRHP, the qualified archaeologist will consult with the appropriate agency archaeologist. No construction work will occur at the discovery location until agency concurrence is made and the relevant data recovery is completed.

4.7.2 Post-Construction Tasks

Once the qualified archaeologist has reviewed the condition of the site and documented damage (if any), site-defining, snow fencing and signage will be removed.

5 Artifact Collection and Curation

If artifacts are collected, they will be prepared for curation at the state designated curatorial facility, or as otherwise directed by the NJ HPO and in consultation with BOEM and the Tribal representatives and/or THPOs.

6 Reporting

6.1 Daily Monitoring Logs

All qualified archaeologists will keep daily logs. These logs will capture the Project name and number, which GPS system unit was used, the camera used and associated photograph numbers, the monitor's and any visiting personnel's names, the company whose work is being monitored, the location of the area(s) monitored, the actions monitored (excavation, drilling, etc.), the number of sites (if any) that were monitored and their Smithsonian trinomial, any sites or cultural material discovered while monitoring that day, any safety incidents, and a narrative for the daily activities. In-field recordation will be made digitally for reporting purposes.

6.2 Bi-Weekly Progress Reports

The Cultural Resources Manager will complete a bi-weekly progress report, sent via email, BOEM, NJ HPO, and Tribal representatives and/or THPOs. This progress report will summarize the past two weeks' daily logs and will give a brief outlook for the following two weeks' archaeological monitoring activities. Unexpected discoveries should be noted in the progress report but should not be the primary form of communication for an unexpected discovery (see the Terrestrial Archaeology Post Review Discovery Plan for additional notification procedures).

6.3 Technical Reports

When construction activities have ceased and there is no longer a need for archaeological monitoring, a technical report will be prepared. This report will synthesize all monitoring activities, including photographs of sites before, during, and after construction. For any unanticipated discoveries, the report will cover the treatment activity completed (including excavation summaries if applicable) and any necessary site updates or new site forms created due to ground-disturbing activities.

Technical reports will abide by relevant agency guidelines, and a draft will be submitted within 30 days of archaeological monitoring completion.

7 Federal, State, Tribal, and Project Contacts

7.1 Federal Contacts

Bureau of Ocean Energy Management
Sarah Stokely
Lead Historian and Section 106 Team Lead
Bureau of Ocean Energy Management
Office of Renewable Energy Programs
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Sterling, Virginia 20166
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Sarah.Stokely@boem.gov

7.2 New Jersey State Historic Preservation Office

Katherine J. Marcopul
Deputy State Historic Preservation Officer
501 East State Street
P.O. Box 420, Mail Code 501-04B
Trenton, New Jersey 08609
609-940-4312

7.3 New Jersey State Police and County Medical Examiner Offices

New Jersey State Police
Office of Forensic Sciences
Forensic Anthropology Unit
NJ Forensic Technology Center
1200 Negron Drive - Horizon Center
Hamilton, New Jersey 08691
Phone: (609) 584-5054 x5656

Cape May County Medical Examiner Office
Dr. Eric Duval and Dr. Charles Siebert Jr.
County Medical Examiner
1175 DeHirsch Avenue
Woodbine, New Jersey 08270
Phone: (609) 861-3355

Ocean County Medical Examiner Office
County Medical Examiner
P.O. Box 2191, Sunset Avenue
Toms River, New Jersey 08754-2191
Phone: (732) 341-3424

7.4 Tribal Contacts

Absentee-Shawnee Tribe of Indians of Oklahoma
Mr. Devon Frazier
Tribal Historic Preservation Officer
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dfrazier@astribe.com

The Delaware Nation
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Historic Preservation Director
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Delaware Tribe of Indians
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Nanticoke Lenni-Lenape Tribal Nation
Mark Gould
Principal Chief/Chairman
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The Narragansett Indian Tribe
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Ramapough Lenape Indian Nation
Steven Burton89
New Jersey Commission on American Indian Affairs, Commission Member, Representing Ramapough Lenape Indian Nation
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Shawnee Tribe
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(631) 566-0486

Stockbridge-Munsee Community Band of Mohican Indians
Mr. Jeffrey Bendremer
Tribal Historic Preservation Officer

Stockbridge-Munsee Mohican Tribal Historic Preservation Extension Office
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Williamstown, Massachusetts 01267
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thpo@mohican-nsn.gov

7.5 Project Contacts

Ocean Wind
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Ocean Wind
TBD
Cultural Resources Compliance Manager

HDR
Kimberly Smith
Cultural Resources Lead
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ATTACHMENT 6 – POST-REVIEW DISCOVERY PLAN FOR SUBMERGED CULTURAL RESOURCES FOR THE OCEAN WIND 1 OFFSHORE WIND FARM FOR LEASE OCS A-0498 CONSTRUCTION AND OPERATIONS PLAN

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Post-Review Discovery Plan for Submerged Cultural Resources for the Ocean Wind 1 Offshore Wind Farm for Lease Area OCS A-0498 Construction and Operations Plan

Ocean Wind 1 Offshore Wind Farm

AUTHORED BY

JOSEPH GRINNAN, MA, RPA, BENJAMIN C. WELLS, MA, RPA, AND JEFFREY M. ENRIGHT, MA, RPA

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1. Introduction

Ocean Wind LLC (Ocean Wind) proposes to construct and operate the Ocean Wind 1 Offshore Wind Farm (Project) within the Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Area OCS A-0498 (Lease Area). The Project consists of the Ocean Wind 1 Offshore Wind Farm and two unique offshore export cable route (ECR) corridors, which traverse federal and state waters. The BL England ECR Corridor has a proposed landfall near Ocean City, New Jersey, while the two Oyster Creek ECR corridors have a proposed landfall near Lacey Township, New Jersey. Ocean Wind has submitted a Construction and Operations Plan (COP) for the Project to BOEM to support the development, operation, and eventual decommissioning of Project infrastructure, including offshore wind turbines, offshore substations, array cables, substation interconnector cables, and offshore export cables. SEARCH provided technical expertise to Ocean Wind's environmental consultant, HDR Engineering, Inc. (HDR), by providing a Qualified Marine Archaeologist (QMA) in accordance with Lease Agreement Stipulation Addendum C Section 2.1.1.2.

SEARCH developed this Post-Review Discovery Plan (PRDP) to assist Ocean Wind and its contractors to preserve and protect potential cultural resources from adverse impacts caused by Project construction, operation and maintenance, and decommissioning activities. The PRDP sets forth guidelines and procedures to be used in the event potential submerged cultural resource are encountered during bottom disturbing activities and assists Ocean Wind in its compliance with Section 106 of the National Historic Preservation Act (NHPA) (Title 54 U.S.C. § 306108), Native American Graves Protection and Repatriation Act (Title 25 U.S.C. § 3001 et seg.), Lease OCS A-0498 Lease Stipulations, and other relevant state and local laws as applicable. This PRDP is subject to revisions based on consultations with interested parties pursuant to Section 106 of the National Historic Preservation Act or the Act's implementing regulations at 36 CFR Part 800.

2. Roles and Responsibilities

Implementation of the provisions and procedures in the PRDP will require the coordinated efforts of Ocean Wind and their contractors during all construction, operations and maintenance, and decommissioning activities with the potential to impact the seafloor. The following sections identify key participants in the PRDP and outlines their roles and responsibilities.

2.1 Ocean Wind

Implementation of the provisions and procedures outlined in this plan is ultimately the responsibility of Ocean Wind or its designee, who will be responsible for the following:

- Ensuring procedures and policies outlined in the PRDP and PRDP training materials are implemented;
- Identifying a responsible party within Ocean Wind tasked with overseeing implementation of the PRDP during all project and contractor activities;
- Developing cultural resource and PRDP awareness training programs for all project staff and contractors;
- Requiring all project and contractor staff complete cultural resource and PRDP awareness training;
- Coordinating and facilitating communication between the QMA, project staff, and contractors if a potential cultural resource is encountered during project activities; and
- Participating in and/or facilitating consultations with state and federal agencies (BOEM, New Jersey Historic Preservation Office [NJ HPO], etc…), federally recognized Tribes'/Tribal Nations' Tribal Historic Preservation Offices (THPOs), and other consulting parties, as appropriate.

2.2 Qualified Marine Archaeologist

Ocean Wind's QMA to provide cultural resource advisory services during implementation of the PRDP. The QMA will be responsible for the following:

- Assist Ocean Wind with the development and implementation of the procedures outlined in the PRDP;
- Assist Ocean Wind in developing a cultural resource and PRDP awareness training program and informational graphic;
- Review and document potential submerged cultural resources identified by the project and/or contractor staff;
- Assist Ocean Wind with the Section 106 consultation process that may arise as a result of an unanticipated submerged cultural resource; and
- Conduct archaeological investigation of unanticipated submerged cultural resources following coordination with appropriate consulting parties.

3. Training and Orientation

Ocean Wind will develop a training and orientation program for Project and contractor staff on cultural resources and PRDP awareness prior to the start of bottom disturbing activities. The training will be sufficient to allow Project and contractor staff to identify common types of marine cultural resources and implement the PRDP procedures. The training will be delivered as a standalone training and/or combined with the Project's or contractors' general health and safety (H&S) or environment, health, and safety (EHS) induction training. The training program may include, but not be limited to, the following elements:

- A review of applicable state and federal cultural resource laws and regulations;
- Characteristics of common types of submerged cultural resources found on the Atlantic Outer Continental Shelf (e.g. wooden shipwrecks, metal shipwrecks, downed aircraft, post-Contact artifacts, pre-Contact artifacts, bone and faunal remains, etc.);
- How to identify potential submerged cultural resources during bottom disturbing activities; and
- Procedures to follow and parties to notify if potential submerged cultural resources/materials are encountered during project activities.

The QMA will develop draft cultural resources and PRDP awareness training in coordination with Ocean Wind. The training program will be provided to BOEM, and the NJ HPO for review and comment before the training program is finalized. In additional to the training program, the QMA will generate an informational graphic summarizing the PRDP and the materials discussed in the cultural resources and PRDP awareness training program. The informational graphic will include:

- Images of common types of submerged cultural resources and materials;
- A flow chart depicting the PRDP reporting process;
- A notice to all employees of their stop work authority if potential cultural resources are encountered; and
- Contact information for the Ocean Wind staff responsible for overseeing implementation of the PRDP and the QMA.

The informational graphic will be placed in a conspicuous location on each project and contractor vessel where workers can see it and copies will be made available to project and/or contractor staff upon request.

4. Procedures for when Cultural Material are Observed

To support BOEM's efforts to identify historic properties within the Project's Area of Potential Effects (APE), Ocean Wind conducted an extensive marine archaeological resources assessment (MARA) of the APE. The MARA identified 19 potential submerged cultural resources (Targets 01-19) and 16 ancient submerged landform features (ASLFs) (Targets 20-35) within the APE. Ocean Wind anticipates avoidance of Targets 01-12, 14, and 16-19 and the associated recommended avoidance buffers. Ocean Wind anticipates avoidance of Targets 21-26, 28-31, and 33-35 is not possible. Ocean Wind anticipates construction activities may extend into the avoidance buffers for Targets 13 and 15, but would avoid the actual targets. Additionally, as the final design is not known, the degree of adverse effects to Targets 21-26, 28-31, and 33-35 is currently unknown. Ocean Wind is developing a Mitigation Framework to aid in avoiding, minimizing, and/or mitigating adverse effects upon historic properties.

Even with the extensive preconstruction marine archaeological surveys, it is impossible to ensure that all cultural resources have been identified within the APE. Even at sites that have been previously identified and assessed, there is a potential for the discovery of previously unidentified archaeological components, features, or human remains that may require investigation and assessment. Furthermore, identified historic properties may sustain effects that were not originally anticipated. Therefore, a procedure has been developed for the treatment of unanticipated discoveries that may occur during site development.

The implementation of the final PRDP will be overseen by Ocean Wind and a QMA who meets or exceeds the Secretary of the Interior's Professional Qualifications Standards for Archaeology [48 FR 44738-44739] and has experience in conducting HRG surveys and processing and interpreting data for archaeological potential [BOEM 2020]. See Figure 1 for a flow chart of the communications and notification plan for unanticipated discoveries.

If unanticipated submerged cultural resources are discovered, the following steps should be taken:

1. Per Lease Stipulation 4.2.7.1, all bottom-disturbing activities in the immediate area of the discovery shall cease and every effort will be made to avoid or minimize impacts to the potential submerged cultural resource(s).
2. The project or contractor staff will immediately notify Ocean Wind of the discovery.
3. Ocean Wind will notify the QMA and provide them with sufficient information/documentation on the potential find to allow the QMA to evaluate the discovery and determine if the find is a cultural resource. If necessary, the QMA may request to visit the find site or the vessel that recovered the cultural material to inspect the find. If the find is a cultural resource, the QMA will provide a preliminary assessment as to its potential to be a historic property as defined in 36 CFR Part 800.
4. Per Lease Stipulation 4.2.7.1, BOEM shall be notified of the potential submerged cultural resource within 24 hours of the discovery. Ocean Wind shall also notify the State Historic Preservation Officer (SHPO) of New Jersey, the State Archaeologist, and the Tribal Historic Preservation Officers (THPOs) or other designated representatives of the consulting tribal governments.
5. Within 72 hours of being notified of the discovery, Ocean Wind shall issue a report in writing to BOEM providing available information concerning the nature and condition of the potential submerged cultural resource and observed attributes relevant to the resource's potential eligibility for listing in the National Register of Historic Places (NRHP).
6. Ocean Wind shall consult with BOEM, as feasible, to obtain technical advice and guidance for the evaluation of the discovered cultural resource.
7. If the impacted resource is determined by BOEM to be NRHP eligible, a mitigation plan shall be prepared by Ocean Wind for the discovered cultural resource. This plan must be reviewed by BOEM prior to submission to the NJ HPO and representatives from consulting federally recognized

Tribes/Tribal Nations for their review and comment. The NJ HPO and Tribes/Tribal Nations will review the plan and provide comments and recommendations within a one week, with final comments to follow as quickly as possible.

8. Per Lease Stipulation 4.2.6, Ocean Wind may not impact a known archaeological resource in federal waters without prior approval from BOEM. No development activities in the vicinity of the cultural resource will resume until either a mitigation plan is executed or, if BOEM determines a mitigation plan is not warranted, BOEM provides written approval to Ocean Wind to resume bottom disturbing activities. For discoveries in state waters, Ocean Wind will not impact a known archaeological resource with prior approval from BOEM, and the NJ HPO. If suspected human remains are encountered, the below procedures, which comply with the Advisory Council on Historic Preservation's (ACHP) *Policy Statement Regarding Treatment of Burial Sites, Human Remains and Funerary Objects*, should be followed.

1. All work in the near vicinity of the human remains shall cease and reasonable efforts should be made to avoid and protect the remains from additional impact. Encountered potential material shall be protected, which may include keeping the remains submerged in an onboard tank of sea water or other appropriate material.
2. The Onboard Representative shall immediately notify the County Medical Examiner, State Archaeologist, the Forensic Anthropology Unit of the New Jersey State Police, and Ocean Wind as to the findings.
3. Ocean Wind will notify the QMA and provide them with sufficient information/documentation on the potential find to allow the QMA to evaluate the discovery and determine if the find is a cultural resource. If necessary, the QMA may request to visit the vessel to inspect the potential human remains. If the find is a cultural resource, the QMA will provide a preliminary assessment. The QMA will document and inventory the remains and any associated artifacts, and assist in coordinating with federal, state, and local officials.
4. A plan for the avoidance of any further impact to the human remains and/or mitigative excavation, reinternment, or a combination of these treatments will be developed in consultation with the State Archaeologist, the NJ HPOBOEM, and appropriate Indian tribes or closest lineal descendants. All parties will be expected to respond with advice and guidance in an efficient time frame. Once the plan is agreed to by all parties, the plan will be implemented.

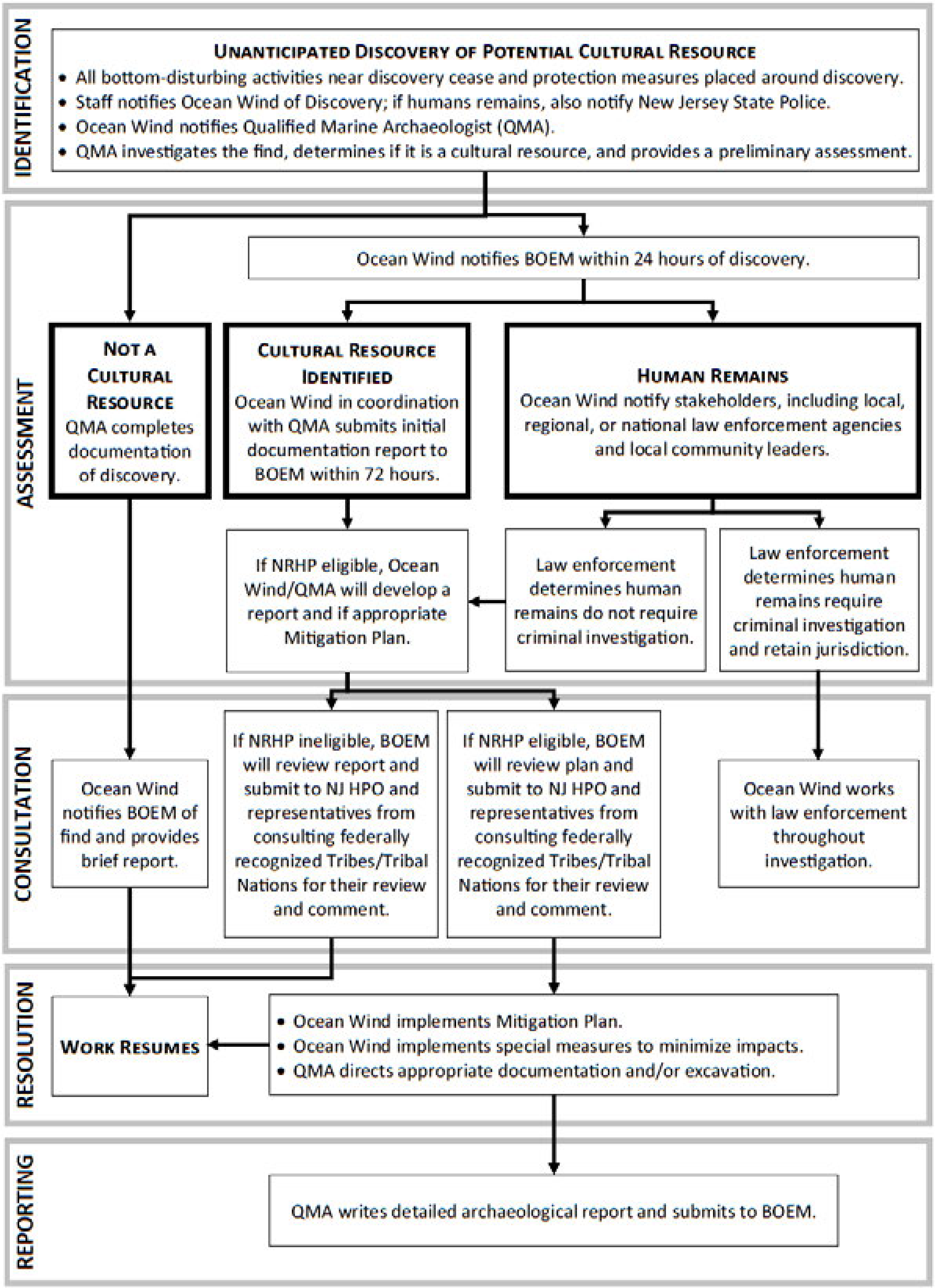

Figure 1. Communications and notification plan for unanticipated discoveries.

5. Archaeological Investigation of a Submerged Unanticipated Discovery

Archaeological investigation of a submerged unanticipated discovery may be necessary in order to evaluate the find, determine its eligibility for listing in the NRHP, and/or assess any construction impacts that may have occurred. The following is a recommended procedure for complying with the PRDP and providing the BOEM, and NJ HPO with the necessary information to make informed decisions to approve continuation of bottom disturbing activities. After each step, consultation among the appropriate parties will occur.

1. Initial assessment of unanticipated discovery via a refined HRG survey and/or ROV investigation (Phase Ia reconnaissance survey).
    a. May result in no further recommended action (i.e., target is not a historic property) or additional investigation.
2. Develop an avoidance zone based upon Step 1.
    a. Minimally, construction activity will remain outside of the avoidance zone for a period of time necessary to allow archaeological investigation, if required.
    b. Determine whether construction activity can remain outside of the avoidance zone permanently.
3. Identify the source, delineate the site boundary, and assess potential impacts that led to the unanticipated discovery (Phase Ib identification).
    a. Accomplished utilizing archaeological/scientific diving and/or ROV investigation.
    b. May result in no further recommended action (i.e., target is not a historic property) or additional investigation.
4. Determine eligibility for listing in the NRHP (Phase II NRHP evaluation).
    a. Accomplished utilizing archaeological/scientific diving.
    b. May require extensive excavation.
    c. May require archival research.
5. Develop a strategy to resolve adverse effects to the historic property that occurred as a result of the unanticipated discovery and to minimize or mitigate potential future adverse effects as construction proceeds.
6. On-site monitoring of bottom disturbing activities at the location.

Not all of these steps may be necessary, and the appropriate course of action will be determined at the time of discovery and in consultation with BOEM, and if applicable, NJ HPO.

6. Notification List

Contacts and a communication plan will be updated and provided during training.

Ocean Wind Katharine Perry Environmental Manager 917-524-4633	Bureau of Ocean Energy Management Sarah Stokely Lead Historian and Section 106 Team Lead Office of Renewable Energy Programs 45600 Woodland Road, VAM-OREP Sterling, Virginia 20166	New Jersey State Historic Preservation Office 501 E. State Street Trenton, NJ 08609 609-984-0176

Ocean Wind Compliance Manager TBD	The Shinnecock Indian Nation Ms. Shavonne Smith Director, Shinnecock Environmental Department PO Box 5006 Southampton NY 11969 Phone: (631) 283-6143 ShavonneSmith@shinnecock.org Jeremy Dennis, Junior THPO P.O. Box 2338 Southampton NY 11968 jeremynative@gmail.com (631) 566-0486	The Narragansett Indian Tribe Mr. John Brown Tribal Historic Preservation Officer P.O. Box 268 Charlestown, RI 02813 Phone: (401).364-1100 tashtesook@aol.com
Eastern Shawnee Tribe of Oklahoma Mr. Brett Barnes Cultural Preservation Director 70500 East 128 Road, Wyandotte, OK 74370 Phone: (918) 238-5151	The Delaware Nation Ms. Carissa Speck Historic Preservation Director P.O. Box 825 Anadarko, OK 73005 Phone: (405).247-2448 Ext. 1403 cspeck@delawarenation-nsn.gov	Lenape Tribe of Delaware 4164 N. Dupont Hwy., Suite 6 Dover, DE 19901-1573 302-730-4601
Delaware Tribe of Indians Ms. Susan Bachor Historic Preservation Representative Delaware Tribe Historic Preservation Office 126 University Circle Stroud Hall, Rm. 437 East Stroudsburg PA 18301 610.761.7452 sbachor@delawaretribe.org	Absentee-Shawnee Tribe of Indians of Oklahoma Mr. Devon Frazier Tribal Historic Preservation Officer 2025 South Gordon Cooper Drive Shawnee, OK 74801 405.275.4030 x6243 dfrazier@astribe.com	Stockbridge-Munsee Community Band of Mohican Indians Mr. Nathan Allison Tribal Historic Preservation Officer Stockbridge-Munsee Mohican Tribal Historic Preservation Extension Office 86 Spring Street Williamstown, MA 01267 Phone: (413).884-6029 nathan.allison@mohican-nsn.gov
Shawnee Tribe Ms. Tonya Tipton Tribal Historic Preservation Officer P.O. Box 189 29 S Hwy 69A Miami, OK 74355 Phone: (918).542-4030 x124 tonya@shawnee-tribe.com	Nanticoke Indian Association, Inc. Natasha Carmine 27073 John J Williams Highway Millsboro, DE 19966 info@nanticokeindians.org 302.945.3400	Nanticoke Lenni-Lenape Tribal Nation Mark Gould Principal Chief/Chariman 18 E Commerce Street Bridgeton, NJ 08302 tribalcouncil@nlltribe.com 856.455.6910

Powhatan Renape Nation Barabara Jefferson New Jersey Commission on American Indian Affairs, Commission Member, Representing Powhatan Renape Tribe NJ Commission on Indian Affairs, PO Box 300 Trenton, NJ 08625 609.633.9627	Ramapough Lenape Indian Nation Steven Burton89 New Jersey Commission on American Indian Affairs, Commission Member, Representing Ramapough Lenape Indian Nation NJ Commission on Indian Affairs, PO Box 300 Trenton, NJ 08625 609.633.9627	Ramapough Mountain Indians Dwaine Perry Chief 189 Stag Hill Road Mahwah, NJ 07430
New Jersey State Police Office of Forensic Sciences Forensic Anthropology Unit NJ Forensic Technology Center 1200 Negron Drive - Horizon Center Hamilton, NJ 08691 Phone: (609) 584-5054 x5656	Cape May County Medical Examiner Office Dr. Eric Duval and Dr. Charles Siebert Jr. County Medical Examiner 1175 DeHirsch Avenue Woodbine, NJ 08270 Phone: (609) 861-3355	Ocean County Medical Examiner Office County Medical Examiner P.O. Box 2191, Sunset Avenue Toms River, NJ 08754-2191 Phone: (732) 341-3424

7. References Cited

Advisory Council on Historic Preservation's (ACHP)

2007 *Policy Statement Regarding Treatment of Burial Sites, Human Remains and Funerary Objects*. https://www.achp.gov/sites/default/files/policies/2018-06/ACHPPolicyStatementRegardingTreatmentofBurialSitesHumanRemainsandFuneraryObjects0207.pdf, Digital article accessed December 9, 2021.

Bureau of Ocean Energy Management (BOEM)

2020 *Guidelines for Providing Archaeological and Historical Property Information Pursuant to 30 CFR Part 585.* United States Department of the Interior, Office of Renewable Energy Programs.

ATTACHMENT 7 – POST-REVIEW DISCOVERY PLAN FOR TERRESTRIAL RESOURCES FOR THE OCEAN WIND 1 OFFSHORE WIND FARM FOR LEASE AREA OCS A-0498 CONSTRUCTION AND OPERATIONS PLAN

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Post-Review Discovery Plan for Terrestrial Resources for the Ocean Wind 1 Offshore Wind Farm for Lease Area OCS A-0498 Construction and Operations Plan

Ocean Wind 1 Offshore Wind Farm

AUTHORED BY

HDR

WWW.HDRINC.COM

NOVEMBER 2022

1. Introduction

Ocean Wind LLC (Ocean Wind), an affiliate of Ocean Wind Power North America LLC (Ocean Wind) is developing the Ocean Wind 1 Offshore Wind Farm Project (Project) pursuant to the Bureau of Ocean Energy Management (BOEM) requirements for the commercial lease of submerged lands for renewable energy development on the outer continental shelf (Lease Area OCS-A 0498).

The purpose of the Project is to develop an offshore wind generation project within the BOEM Lease Area, to deliver competitively priced renewable energy and additional capacity to meet State and regional renewable energy demands and goals.

The Project includes up to 98 wind turbine generators (WTGs), up to three offshore alternating current substations, array cables linking the individual turbines to the offshore substations, substation interconnector cables linking the substations to each other, offshore export cables, an onshore export cable system, two onshore substations, and connections to the existing electrical grid in New Jersey (underground cables or overhead transmission lines would be required to connect each onshore substation to the existing grid). The WTGs and offshore substations, array cables, and substation interconnector cables will be located in Federal waters approximately 13 nautical miles (nm, 15 statute miles) southeast of Atlantic City. The offshore export cables will be buried below the seabed surface within Federal and State waters. The onshore export cables, substations, and grid connections are intended to be located in Ocean, and Cape May Counties, New Jersey. The Project location is depicted in Figure 1-1. The Project will be installed beginning in 2023 and operational in 2024.

Section 106 of the National Historic Preservation Act (Section 106, 54 USC 306108) requires federal agencies to take into account the effects of an undertaking on historic properties listed in or eligible for the National Register of Historic Places (NRHP). As the lead federal agency for this undertaking, BOEM has the responsibility for compliance with the NHPA and other federal statutes, regulations, and guidance relating to the protection of historic properties. Similarly, the State of New Jersey has promulgated regulations and guidance related to the protection of historic properties, including the properties listed in the State Register of Historic Places (SRHP). Ocean Wind is committed to the protection of historic properties in accordance with federal and state statues, regulations, and appropriate guidance.

To support BOEM's efforts to identify historic properties within the Project's Area of Potential Effects (APE), Ocean Wind has undertaken cultural resources studies to identify historic properties that may be affected by construction and operation of the Project. No archaeological properties listed in, eligible for, or recommended as eligible for inclusion in the NRHP or SRHP have been identified within the APE for terrestrial archaeological resources, and a majority of the APE has been previously disturbed by prior anthropogenic activity. Notwithstanding these conditions, Ocean Wind recognizes that it is possible that significant and unanticipated archaeological resources and/or human remains may be discovered during construction of onshore facilities, primarily during excavation. Ocean Wind also recognizes the importance of complying with federal, state, and municipal laws and regulations regarding the treatment of human remains, if any are discovered.

This Terrestrial Post-Review Discovery Plan (PRDP) outlines the protocol/steps for dealing with potential unanticipated discoveries of cultural resources, including human remains, during the construction of the proposed Project.

The Protocol:

1. Presents to regulatory and review agencies the protocol the Lessee and its contractors and consultants will follow to prepare for and potentially respond to unanticipated cultural resource (i.e., terrestrial archaeological) discoveries; and

2. Provides guidance and instruction to Ocean Wind personnel and its contractors and consultants as to the proper procedures to be followed in the event of an unanticipated cultural resource (i.e., terrestrial archaeological) discovery.

The following terms are used throughout the Protocol:

- The Facility: The Facility collectively refers to all components of the onshore portions of the Project.

- Unanticipated Discovery/Unanticipated Cultural Resource Discovery: Any indications of the presence of archaeological materials including historic-period or pre-contact Native American artifacts, stone features, animal bone, and/or human remains. Common historic-period artifacts encountered may include bottles/glass, pottery/ceramics, stone foundations, hand-dug wells, brick, nails, miscellaneous metal fragments, or charcoal or ash-stained soils. Common pre-contact Native American artifacts encountered may include arrowheads/spearheads, stone (chert or “flint”) chips or flakes, charcoal or ash-stained soils, rough gray, black, or brown pottery, and other stone tools/artifacts of obvious human origin.

- Potential Human Remains: Any indications of potential human remains, such as bones or bone fragments, that cannot definitely be determined to be non-human.

- Preliminary Area of Potential Effect (PAPE): All areas of potential soil disturbance associated with the construction and operation of the proposed Facility.

- Cultural Resources Compliance Manager (CRCM): The Lessee’s designated on-site staff person responsible for monitoring compliance with permitting conditions and commitments during construction.

- Archaeologist: The Lessee’s Secretary of the Interior (SOI) qualified cultural resources consultant. Review of any potential unanticipated discoveries will be conducted under the supervision of a Registered Professional Archaeologist (RPA).

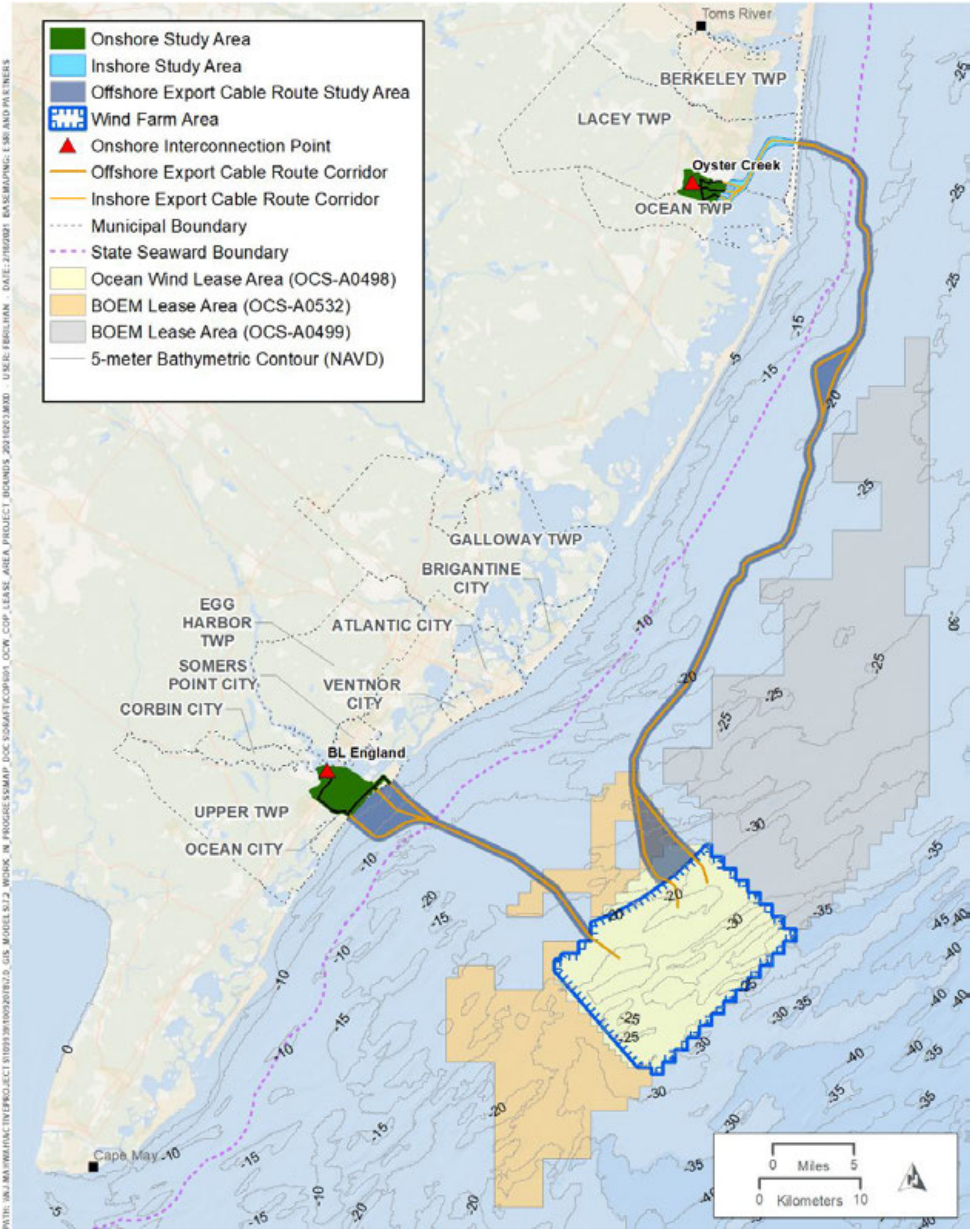

Figure 1-1. Lease Area and Project boundaries

2. Laws, Regulations, Standards, and Guidelines Relating to Unanticipated Discoveries of Archaeological Resources and/or Human Remains

- Section 106 of the National Historic Preservation Act of 1966, as amended (54 USC 300101) and Advisory Council on Historic Preservation (ACHP) implementing regulations (36 CFR 800);
- Secretary of the Interior's Standards for Archeology and Historic Preservation (48 CFR 44716-42);
- ACHP Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects (2007);
- Native American Graves Protection and Repatriation Act (NAGPRA)(25 USC 3001 et seq.);1 and
- New Jersey Register of Historic Places Act (New Jersey Administrative Code, Section 7:4).

3. Training and Orientation

The identification of archaeological resources, human remains, and burial sites is facilitated by training and orientation. All Project inspectors, resident engineers, and construction supervisors working on the Project's onshore excavation activities will be given basic training to facilitate their identification of archaeological sites, artifacts, features, and human remains prior to the start of Project-related excavation or construction activities. The training will be given by a SOI qualified archaeologist[2]. Additional training will be conducted on an as-needed basis (e.g., for new construction supervisors) during Project construction.

The purpose of this training will be to review Ocean Wind's to provide an overview of the general cultural history of the Project area, so that both Ocean Wind employees and contractors will be aware of the types of archaeological resources that may be encountered in the field. In addition, the training program will emphasize the protocols to be followed, as outlined in this PRDP, regarding actions to be taken and notification required in the event of an unanticipated discovery of archaeological resources and/or human remains.

4. Cultural Resources Compliance Manager

Prior to the start of excavation or other ground-disturbing activities, Ocean Wind will designate a Cultural Resources Compliance Manager (CRCM) to coordinate compliance activities described in the PRDP including:

- Maintaining records related to unanticipated discoveries of archaeological resources and/or human remains, including records relating to the notification of appropriate parties, consultation, archaeological investigations, work stoppages, avoidance areas, and treatment or disposition of unanticipated discoveries; and
- Coordinating training in accordance with Section 3 of the PRDP, including maintaining records of the qualifications of the archaeologist conducting the training, the names of employees or contractors that have completed the training, and the date the training was completed.

The CRCM will serve as the point-of-contact for all activities conducted in accordance with the PRDP and will have authority to stop work as needed to comply with the PRDP.

[1] Pursuant to 43 CFR Part 10, NAGPRA applies to human remains, sacred objects, and items of cultural patrimony (described as "cultural items" in the statute) located on federal or tribal lands or in the possession and control of federal agencies or certain museums. The Project's onshore infrastructure will not occupy federal or tribal lands. Notwithstanding the limits of NAGPRA's applicability, the principles described in NAGPRA and its implementing regulations will serve as guidance should remains or associated artifacts be identified as Native American, and to the extent such principles and procedures are consistent with any other applicable laws, guidelines, statutes, and requirements.

[2] As used in this PRDP, an "archaeologist" is an archaeologist who meets the Secretary of the Interior's Professional Qualification Standards for Archaeology (48 FR 44738 – 44739, September 1983).

5. Unanticipated Discovery Procedures

Although unlikely, there is the potential that undocumented archaeological resources may be inadvertently discovered during the course of Project construction activities. The procedures described in this section provide protocols for the inadvertent discovery of archaeological resources and the treatment of human remains during onshore construction. Ocean Wind will consult BOEM and other parties as necessary to determine if oversight of ground clearing activities by a SOI Qualified Archaeologist is warranted and the specific project locations where oversight is necessary based on the potential sensitivity for an unanticipated archaeological discovery.

5.1 Procedures for Unanticipated Archaeological Discoveries

1. SOI qualified professional archaeologist will initially monitor all construction activities that could potentially impact archaeological deposits. Monitoring will be discontinued as soon as the archaeologist is satisfied that final construction will not disturb important deposits.
2. In the event that suspected archaeological resources are discovered during a construction activity, that activity shall immediately be halted until it can be determined whether the archaeological resources may represent a potentially significant site.
3. The employee(s) and/or contractor(s) will immediately notify the CRCM of the suspected unanticipated discovery.
4. The CRCM will direct ground-disturbing activities to be halted in an appropriate vicinity of the discovery. The area of work stoppage will be adequate to provide for the security, protection, and integrity of the potential resource. Vehicles, equipment, and unauthorized personnel will not be permitted to access the discovery site. At minimum, the immediate area of any terrestrial archaeological discovery will be protected by a temporary barrier and the location will be marked on Project maps as a restricted area.
5. The CRCM will notify an archaeologist who will in turn be responsible for determining whether a site visit is required. That determination may be made by viewing photographs of any object or soil discolorations sent to the archaeologist in combination with a verbal description from the CRCM.
6. If the archaeologist determines a site visit is not required as the reported discovery of archaeological resources is determined by the archaeologist to not be a potentially significant archaeological resource, the archaeologist will notify the CRCM who will then notify the employee(s) and/or contractor(s) to resume work.
7. If the archaeologist determines that a site visit is necessary, the site visit will be conducted within 48 hours of notification by the CRCM.
8. If a site visit is necessary, the archaeologist will conduct limited investigations to make a preliminary identification and assessment of the find. This may include photos, measurements, and limited hand excavation. The archaeologist will provide a summary report and initial recommendations within 72 hours of completing the site visit.
9. The CRCM will provide the qualified archaeologist's summary report and initial recommendations to the New Jersey State Historic Preservation Office (NJSHPO), and (as appropriate)[3] the Absentee-Shawnee Tribe of Indians of Oklahoma, The Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, Shawnee Tribe, Stockbridge-Munsee Community Band of Mohican Indians, Narragansett Indian Tribe, Shinnecock Indian Nation, Lenape Tribe of Delaware , Nanticoke Indian Association, Inc., Nanticoke Lenni-Lenape Tribal Nation, Powhatan Renape Nation, Ramapough Lenape Indian Nation, and Ramapough Mountain Indians.

[3] Notification of and consultation with the Indian Tribes is appropriate when archaeological resources may be related to Native American use or occupation of the area.

10. Ocean Wind will consult with appropriate Parties to determine the treatment of the site. As necessary, and in consultation with the appropriate Parties, Ocean Wind may direct the archaeologist to conduct additional archaeological investigations and/or evaluate the site's eligibility for inclusion in the NRHP and SRHP.
11. Work in the vicinity of the resource will proceed once a Treatment Plan has been approved by the NJSHPO or the site is determined to be ineligible for the NRHP or SRHP.

Duration of any work stoppages will be contingent upon the significance of the identified archaeological resource(s) and consultation with appropriate Parties to determine the appropriate measures to avoid, minimize, or mitigate any adverse effects to the site.

5.2 Procedures for the Unanticipated Discovery of Human Remains

Treatment and disposition of any human remains that may be discovered will be managed in a manner consistent with NAGPRA (see footnote 1) and the ACHP's 2007 *Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects*. At all times, human remains will be treated with the utmost dignity and respect.

1. In the event that suspected human remains or a burial site are discovered during a construction activity, that activity shall immediately be halted.
2. The employee(s) and/or contractor(s) will immediately notify the CRCM of the suspected unanticipated discovery of human remains.
3. The CRCM will immediately direct any ground-disturbing activities to be halted within a minimum of 100 feet of the discovery. The immediate area of any human remains or suspected human remains will be protected by a temporary barrier and the location will be marked on Project maps as a restricted area.
4. The CRCM will notify the New Jersey State Police and the Medical Examiner with jurisdiction in the county and will arrange for inspection of the site.
5. The Medical Examiner and law enforcement will make an official determination on the nature of the remains, being either forensic or archaeological.
6. If the remains are determined to be forensic in nature, the Medical Examiner and law enforcement will notify Ocean Wind when work in the area may resume.
7. If human remains are determined to be archaeological and Native American, the CRCM will contact the Parties, and the remains will be left in place and protected from further disturbance until a plan for their avoidance or removal can be developed in coordination with the landowner and Parties. Results of this consultation will be documented in writing. Avoidance is the preferred option and remains will only be removed following written concurrence from the NJSHPO.
8. If human remains are determined to be archaeological and non-Native American, the CRCM will contact the NJSHPO, and the remains will be left in place and protected from further disturbance until a plan for their avoidance or removal can be developed in coordination with the landowner and NJSHPO. Results of this consultation will be documented in writing. Avoidance is the preferred option and remains will only be removed following written concurrence from the NJSHPO Avoidance is the preferred choice.
9. In all cases, due care will be taken in the excavation and subsequent transport and storage of the remains to ensure their security and respectful treatment.

6. Notification List

Contacts and a communication plan will be updated and provided during training.

Ocean Wind Katharine Perry Environmental Manager 917-524-4633	Bureau of Ocean Energy Sarah Stokely Lead Historian and Section 106 Team Lead Bureau of Ocean Energy Management Office of Renewable Energy Programs 45600 Woodland Road, VAM-OREP Sterling, Virginia 20166	New Jersey State Historic Preservation Office 501 E. State Street Trenton, NJ 08609 609-984-0176
Ocean Wind Compliance Manager TBD	The Shinnecock Indian Nation Ms. Shavonne Smith Director, Shinnecock Environmental Department PO Box 5006 Southampton NY 11969 Phone: (631) 283-6143 ShavonneSmith@shinnecock.org Jeremy Dennis, Junior THPO P.O. Box 2338 Southampton NY 11968 jeremynative@gmail.com (631) 566-0486	The Narragansett Indian Tribe Mr. John Brown Tribal Historic Preservation Officer P.O. Box 268 Charlestown, RI 02813 Phone: (401).364-1100 tashtesook@aol.com
Eastern Shawnee Tribe of Oklahoma Mr. Brett Barnes Cultural Preservation Director 70500 East 128 Road, Wyandotte, OK 74370 Phone: (918) 238-5151	The Delaware Nation Ms. Carissa Speck Historic Preservation Director P.O. Box 825 Anadarko, OK 73005 Phone: (405).247-2448 Ext. 1403 cspeck@delawarenation-nsn.gov	Lenape Tribe of Delaware 4164 N. Dupont Hwy., Suite 6 Dover, DE 19901-1573 302-730-4601

Delaware Tribe of Indians Ms. Susan Bachor Historic Preservation Representative Delaware Tribe Historic Preservation Office 126 University Circle Stroud Hall, Rm. 437 East Stroudsburg PA 18301 610.761.7452 sbachor@delawaretribe.org	Absentee-Shawnee Tribe of Indians of Oklahoma Mr. Devon Frazier Tribal Historic Preservation Officer 2025 South Gordon Cooper Drive Shawnee, OK 74801 405.275.4030 x6243 dfrazier@astribe.com	Stockbridge-Munsee Community Band of Mohican Indians Mr. Nathan Allison Tribal Historic Preservation Officer Stockbridge-Munsee Mohican Tribal Historic Preservation Extension Office 86 Spring Street Williamstown, MA 01267 Phone: (413).884-6029 nathan.allison@mohican-nsn.gov
Shawnee Tribe Ms. Tonya Tipton Tribal Historic Preservation Officer P.O. Box 189 29 S Hwy 69A Miami, OK 74355 Phone: (918).542-4030 x124 tonya@shawnee-tribe.com	Nanticoke Indian Association, Inc. Natasha Carmine 27073 John J Williams Highway Millsboro, DE 19966 info@nanticokeindians.org 302.945.3400	Nanticoke Lenni-Lenape Tribal Nation Mark Gould Principal Chief/Chairman 18 E Commerce Street Bridgeton, NJ 08302 tribalcouncil@nlltribe.com 856.455.6910
Powhatan Renape Nation Barabara Jefferson New Jersey Commission on American Indian Affairs, Commission Member, Representing Powhatan Renape Tribe NJ Commission on Indian Affairs, PO Box 300 Trenton, NJ 08625 609.633.9627	Ramapough Lenape Indian Nation Steven Burton89 New Jersey Commission on American Indian Affairs, Commission Member, Representing Ramapough Lenape Indian Nation NJ Commission on Indian Affairs, PO Box 300 Trenton, NJ 08625 609.633.9627	Ramapough Mountain Indians Dwaine Perry Chief 189 Stag Hill Road Mahwah, NJ 07430
New Jersey State Police Office of Forensic Sciences Forensic Anthropology Unit NJ Forensic Technology Center 1200 Negron Drive - Horizon Center Hamilton, NJ 08691 Phone: (609) 584-5054 x5656	Cape May County Medical Examiner Office Dr. Eric Duval and Dr. Charles Siebert Jr. County Medical Examiner 1175 DeHirsch Avenue Woodbine, NJ 08270 Phone: (609) 861-3355	Ocean County Medical Examiner Office County Medical Examiner P.O. Box 2191, Sunset Avenue Toms River, NJ 08754-2191 Phone: (732) 341-3424

ATTACHMENT 8 – MITIGATION FUNDING AMOUNTS PROPOSED BY SIGNATORIES AND CONSULTING PARTIES

The mitigation measures proposed in Stipulation III have been developed by individuals who meet the qualifications specified in the SOI's Qualifications Standards for Archaeology, History, Architectural History, and/or Architecture (36 CFR 61). The proposed mitigation measures consider the nature, scope, and magnitude of adverse effects caused by the Project, the qualifying characteristics of each historic property that would be affected. The following funding amounts were considered by signatories, invited signatories, and consulting parties for historic properties mitigation measures based on budgets proposed by lessee for each mitigation effort. These budgets are good faith estimates, based on the experience of these qualified consultants with similar activities and comparable historic properties. The proposed level of funding is appropriate to accomplish the identified preservation goals and result in meaningful benefits to the affected properties, resolving adverse effects.

- Marine APE
  - $2,217,238 for mitigation to resolve adverse effects at the 13 ASLFs (Targets 21–26, 28–31, and 33–35), including Pre-construction Geoarchaeology ($1,875,758), Open Source GIS and Story Maps ($150,000), ASLF Post-Construction Seafloor Inspection ($1,540,000), and Ethnographic Study ($191,480).

The mitigation measures outlined in the MOA for Absecon Lighthouse, Atlantic City Boardwalk (Atlantic City), and Lucy the Margate Elephant (NHL) as well as for multi-property mitigation have been developed by individuals who meet the qualifications specified in the SOI's Qualifications Standards for Archeology, History, Architectural History, and/or Architecture (36 CFR 61) in consultation with the consulting parties.

- $55,000 for mitigation of adverse effects at the Absecon Lighthouse through:
  - Contribution to support planned, preservation-related rehabilitation activities at the lighthouse.
- $140,000 for mitigation of adverse effects at the Atlantic City Boardwalk through:
  - Contribution to support planned, preservation-related improvements to the boardwalk.
- $170,000 for mitigation of adverse effects at Lucy the Margate Elephant (NHL) through:
  - Contribution to support planned, preservation-related visitor center upgrades and site improvements.
- $175,000 to draft the following multi-property and multi-county mitigation measures:
  - Historic context addressing early 20th century New Jersey Shore Hotels to resolve adverse effects to Brigantine Hotel, Atlantic County, Ritz-Carlton Hotel, Atlantic County, and Flanders Hotel, Cape May County.
  - Historic context addressing mid-20th century New Jersey High-Rises to resolve adverse effects to Riviera Apartments, Atlantic City and Vassar Square Condominiums, Atlantic County.
  - Historic context addressing Boardwalks of the New Jersey Shore, with Surveys and Evaluations of Atlantic City Boardwalk, Ocean City Boardwalk, and Wildwood Boardwalk to resolve adverse effects to the Atlantic City Boardwalk and Ocean City Boardwalk.

These mitigation measures for the Ocean City Boardwalk, Ocean City Music Pier, Atlantic City Convention Hall (NHL), Flanders Hotel, U.S. Lifesaving Station #35, North Wildwood Lifesaving Station, Hereford Inlet Lighthouse, Brigantine Hotel, Ritz-Carlton Hotel, Riviera Apartments, Vassar Square Condominiums, 114 S Harvard Avenue, Great Egg Coast Guard Station, and U.S. Coast Guard

Station #119, were proposed by lessee and circulated by BOEM in HPTPs to consulting parties. These mitigation measures have been developed by individuals who meet the qualifications specified in the SOI's Qualifications Standards for Archeology, History, Architectural History, and/or Architecture (36 CFR 61).

- $140,000 for mitigation of adverse effects at the Ocean City Boardwalk.
- $145,000 for mitigation of adverse effects at the Ocean City Music Pier.
- $170,000 for mitigation of adverse effects at the Atlantic City Convention Hall (NHL).
- $50,000 for mitigation of adverse effects at the Flanders Hotel.
- $55,000 for mitigation of adverse effects at U.S. Lifesaving Station #35.
- $55,000 for mitigation of adverse effects at the North Wildwood Lifesaving Station.
- $50,000 for mitigation of adverse effects at the Hereford Inlet Lighthouse.
- $65,000 for mitigation of adverse effects at the Brigantine Hotel.
- $65,000 for mitigation of adverse effects at the Ritz-Carlton Hotel.
- $70,000 for mitigation of adverse effects at the Riviera Apartments.
- $70,000 for mitigation of adverse effects at the Vassar Square Condominiums.
- $55,000 for mitigation of adverse effects at 114 S Harvard Avenue.
- $45,000 for mitigation of adverse effects at the Great Egg Coast Guard Station.
- $45,000 for mitigation of adverse effects at U.S. Coast Guard Station #119.

ATTACHMENT B
FIGURES

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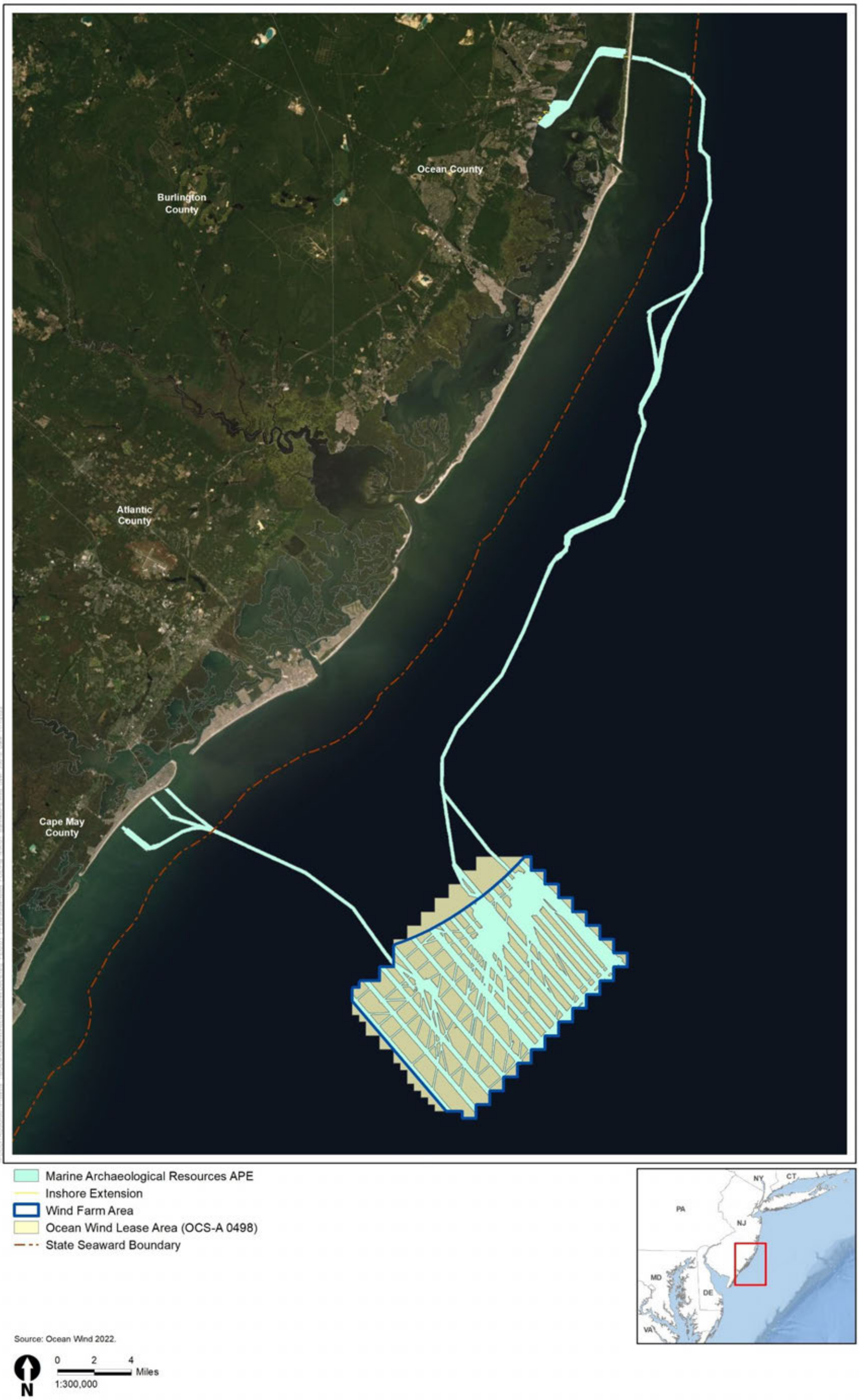

Figure 1 Marine Archaeological Resources APE for Activities within the Lease Area

Figure 2 Marine Archaeological Resources APE for Activities within the Oyster Creek Export Cable Route Corridor

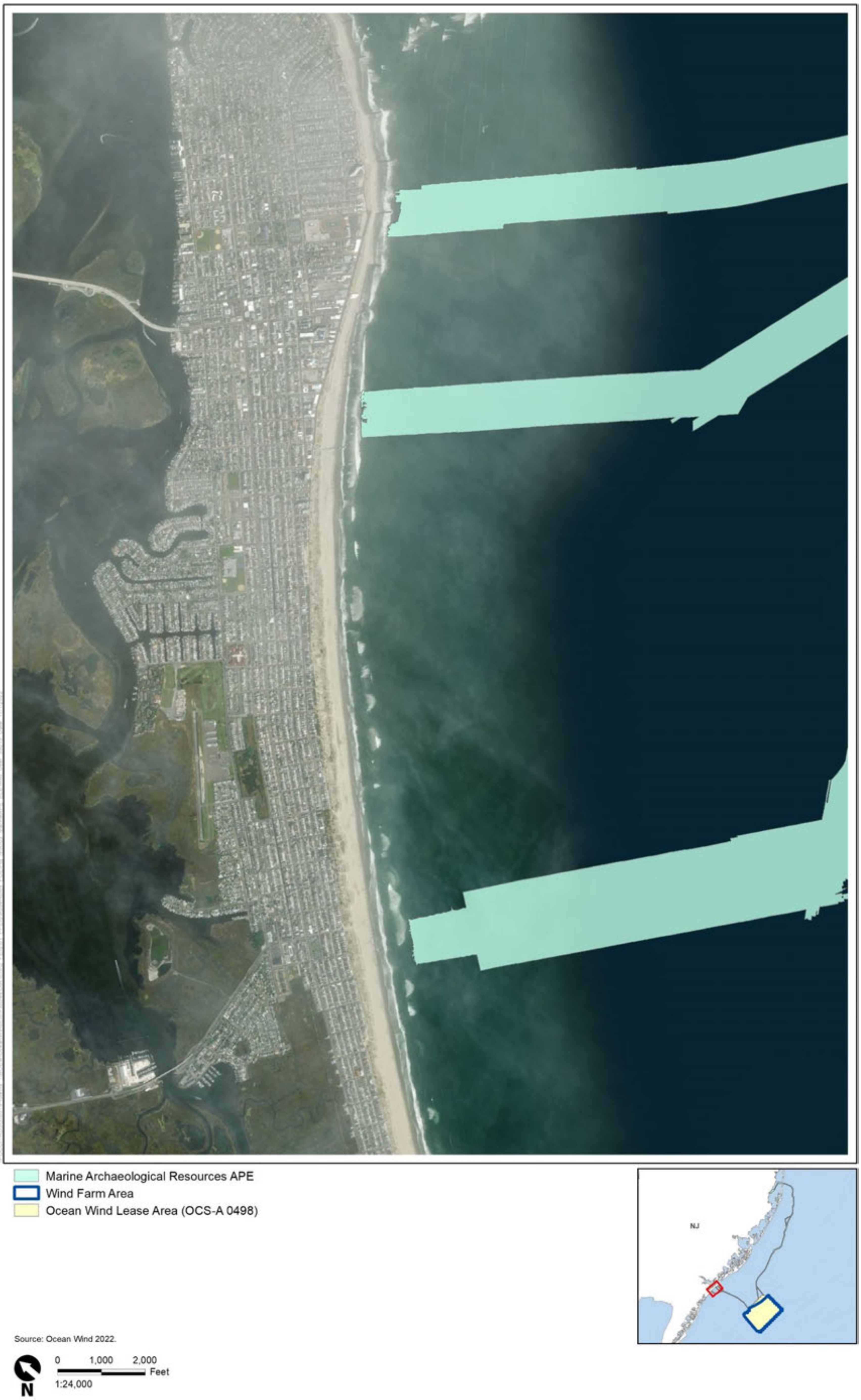

Figure 3 **Marine Archaeological Resources APE for Activities within the BL England Export Cable Route Corridor**

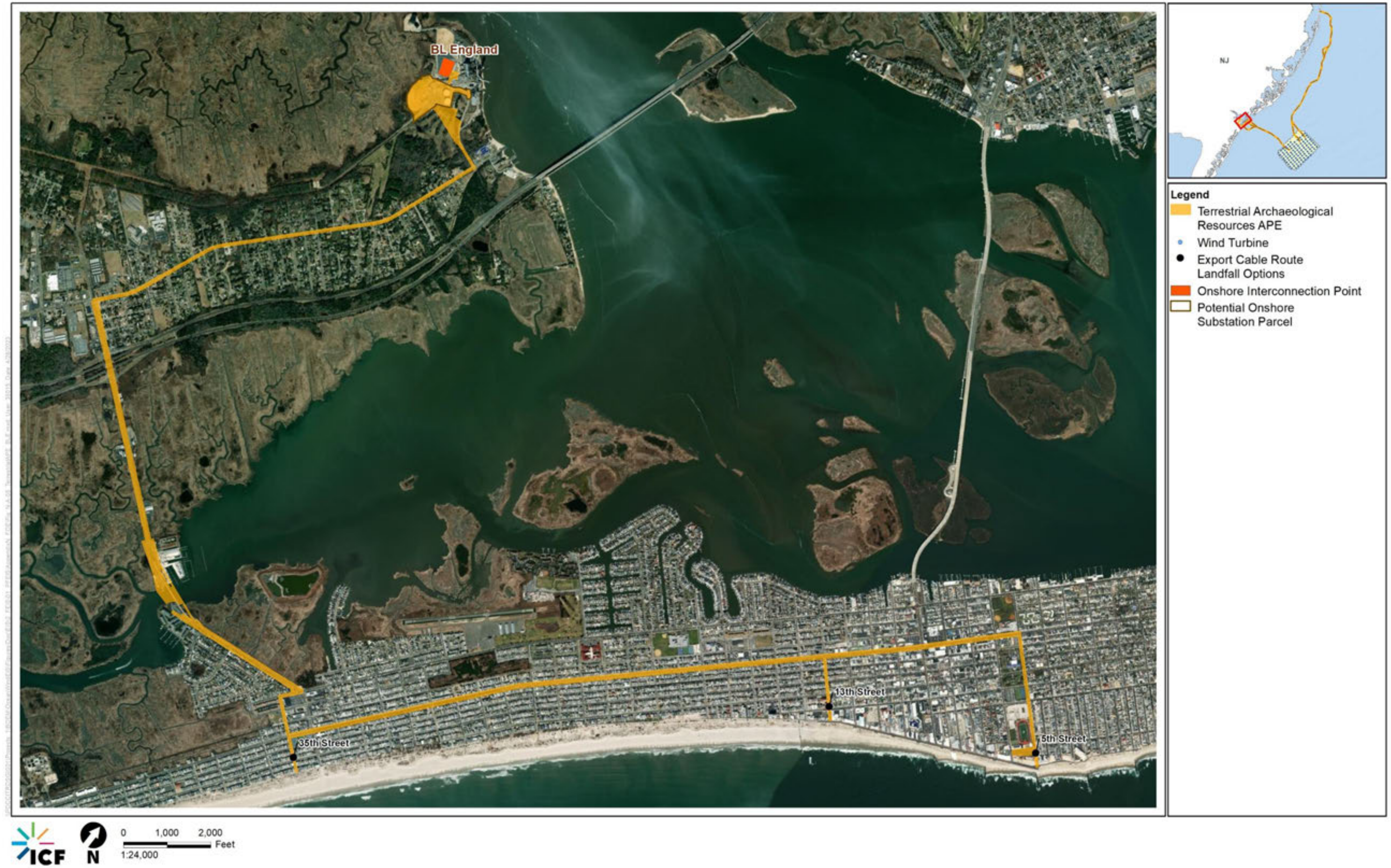

Figure 4 Terrestrial Archaeological Resources APE with Onshore Cable and Landfall Site Alternatives for BL England

Figure 5 Terrestrial Archaeological Resources APE with Onshore Cable and Landfall Site Alternatives for Oyster Creek

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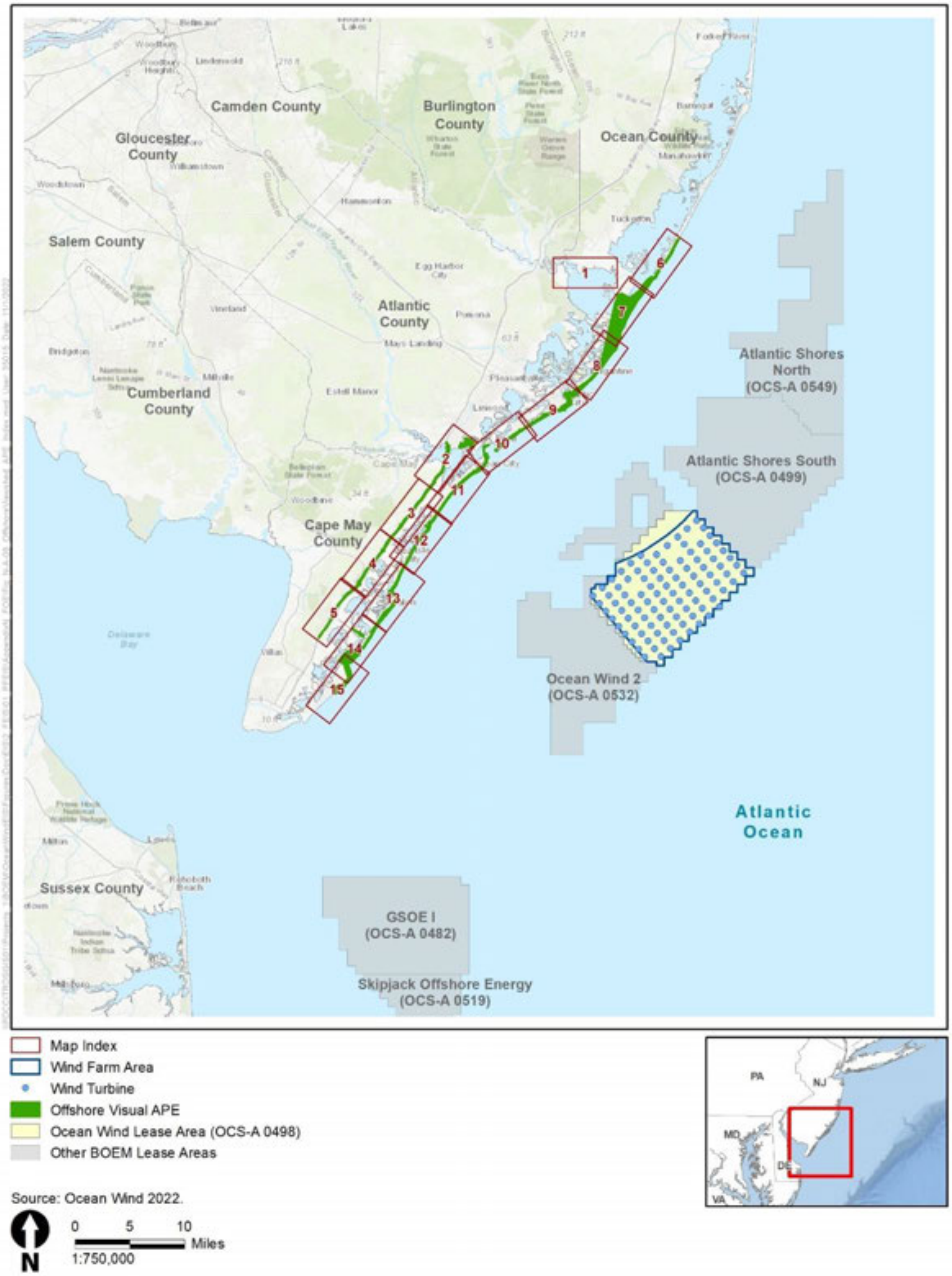

Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Index

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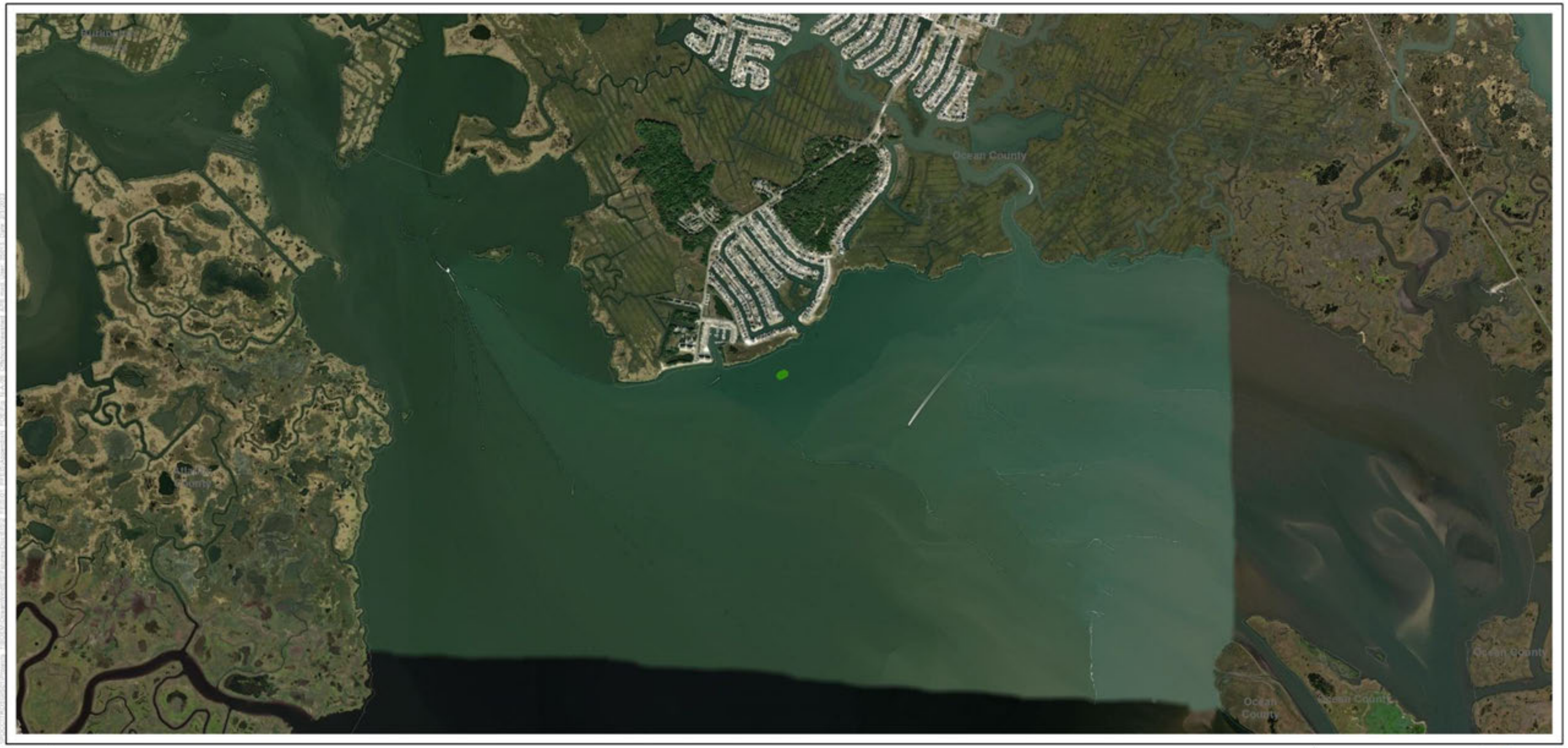

Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 1

Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 2

Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

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Sheet: 3 of 15

Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 3

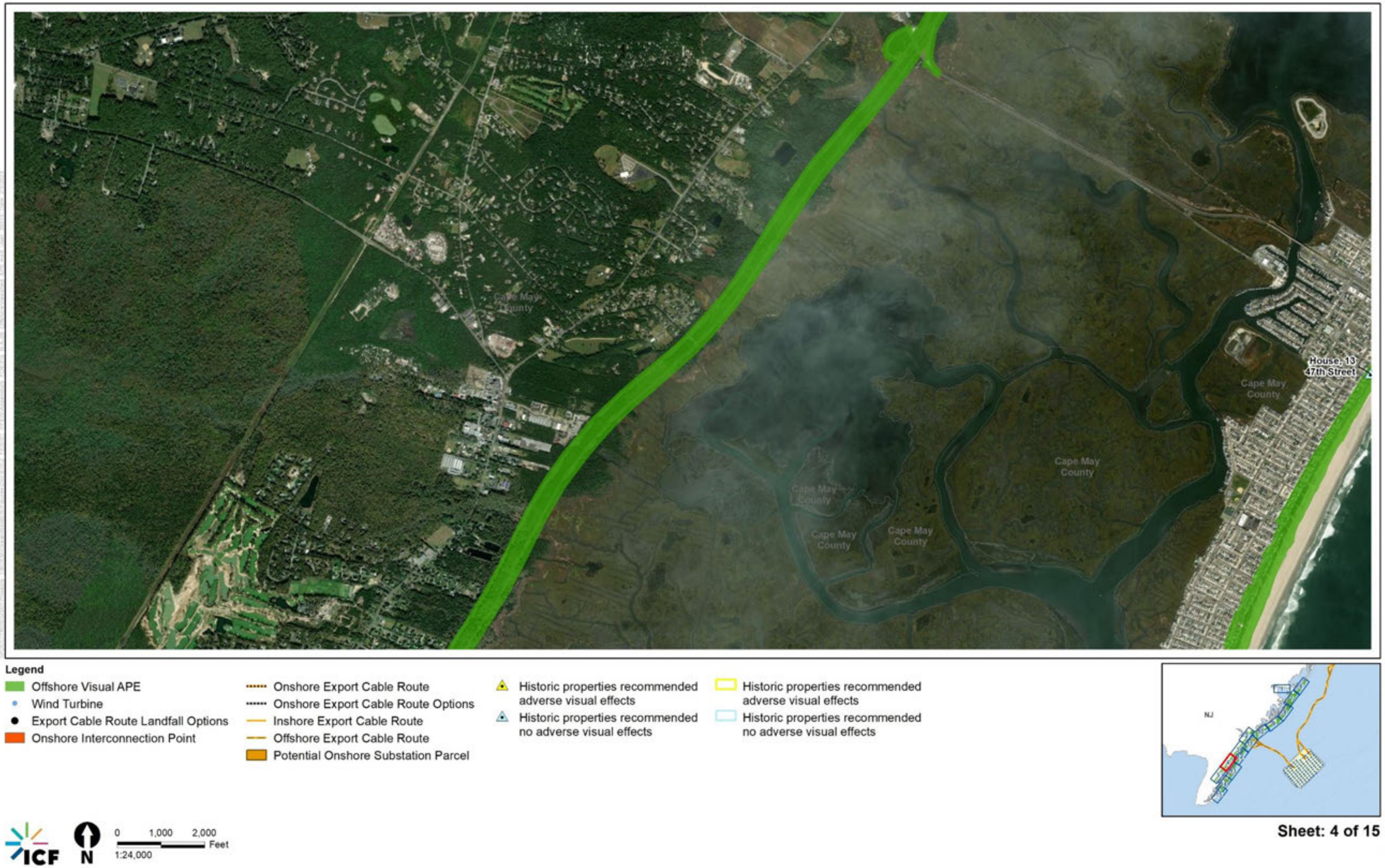
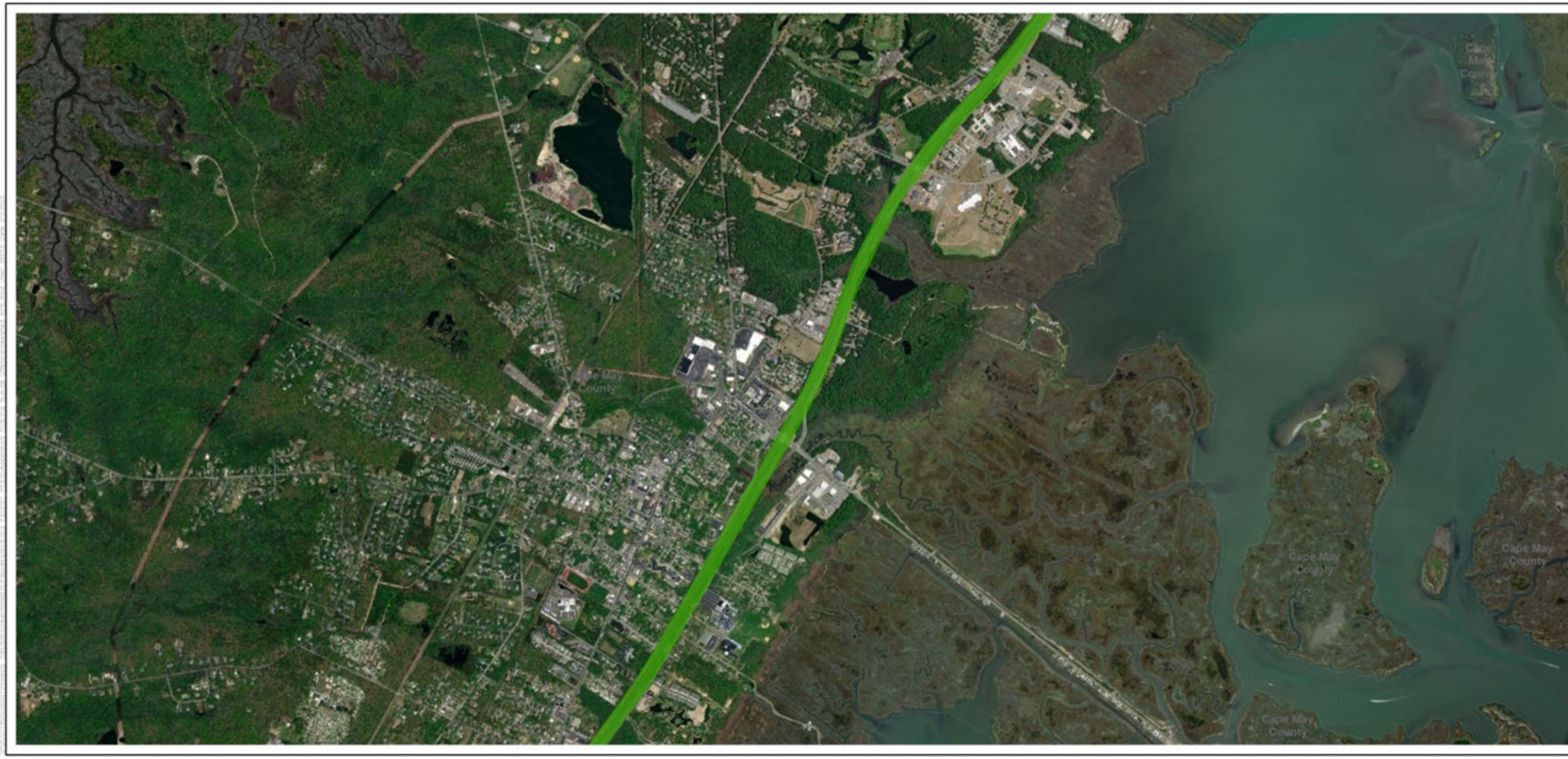


Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 4



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

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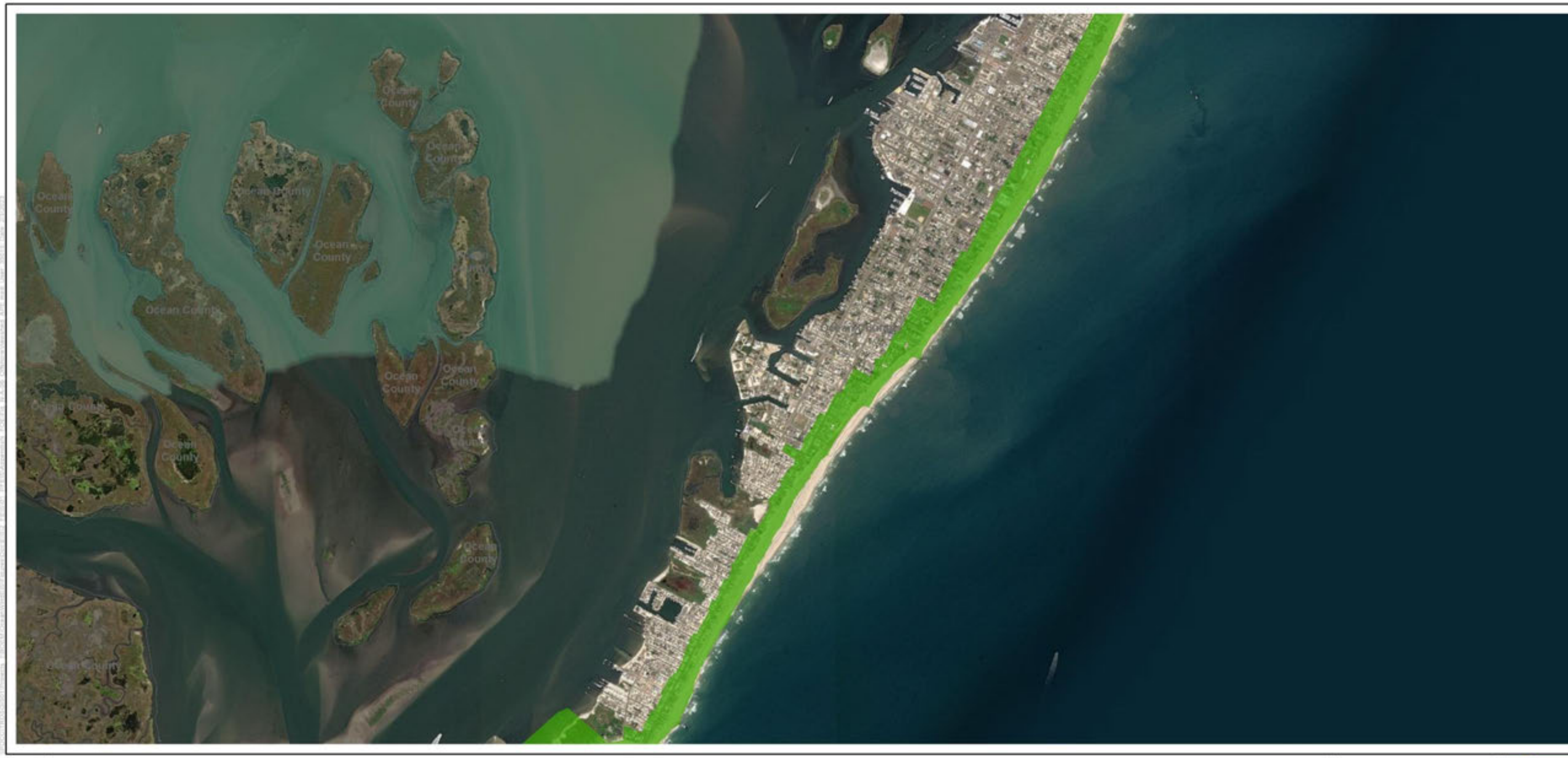
Sheet: 5 of 15

Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 5



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects
- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 6 of 15

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Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 6

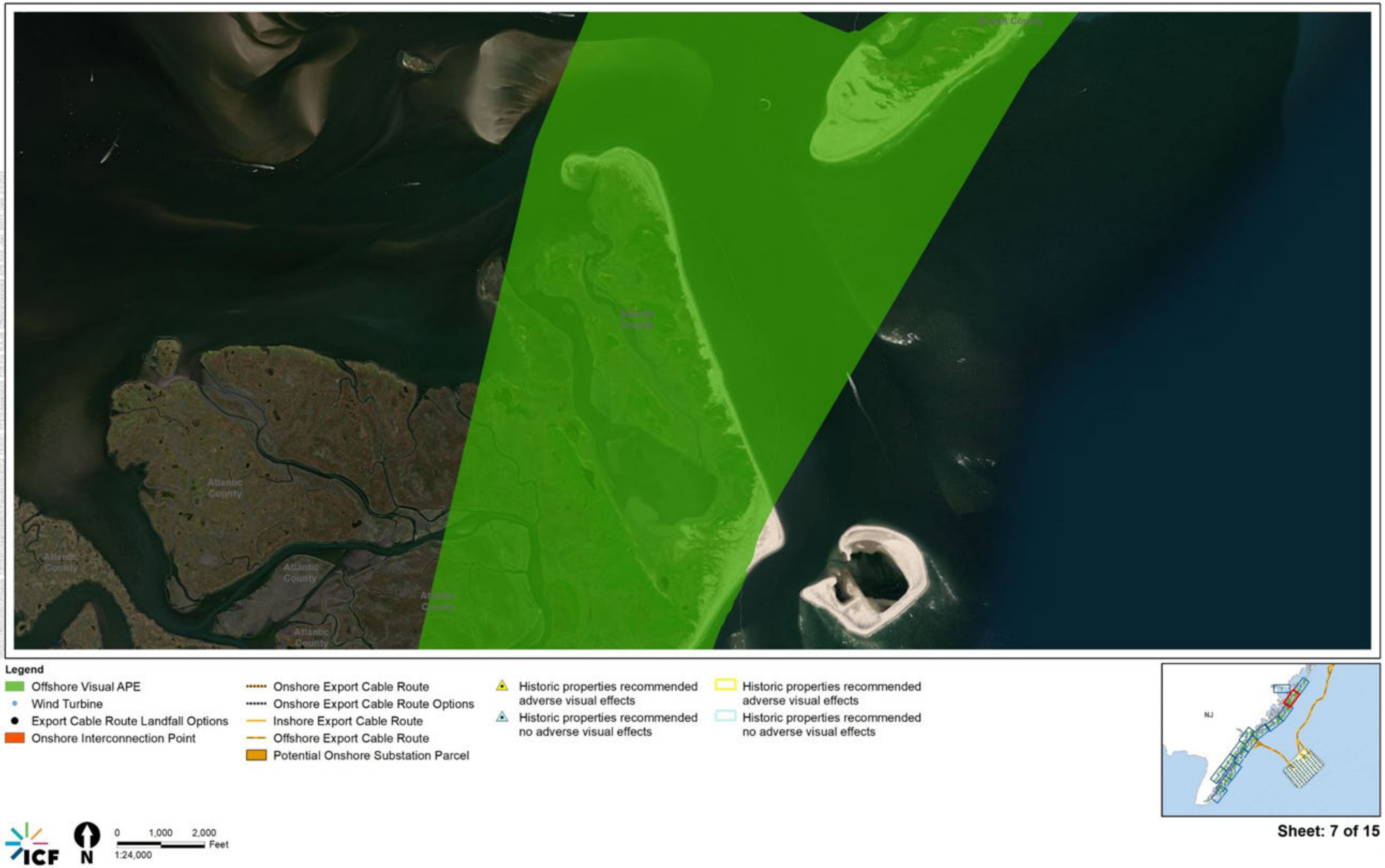


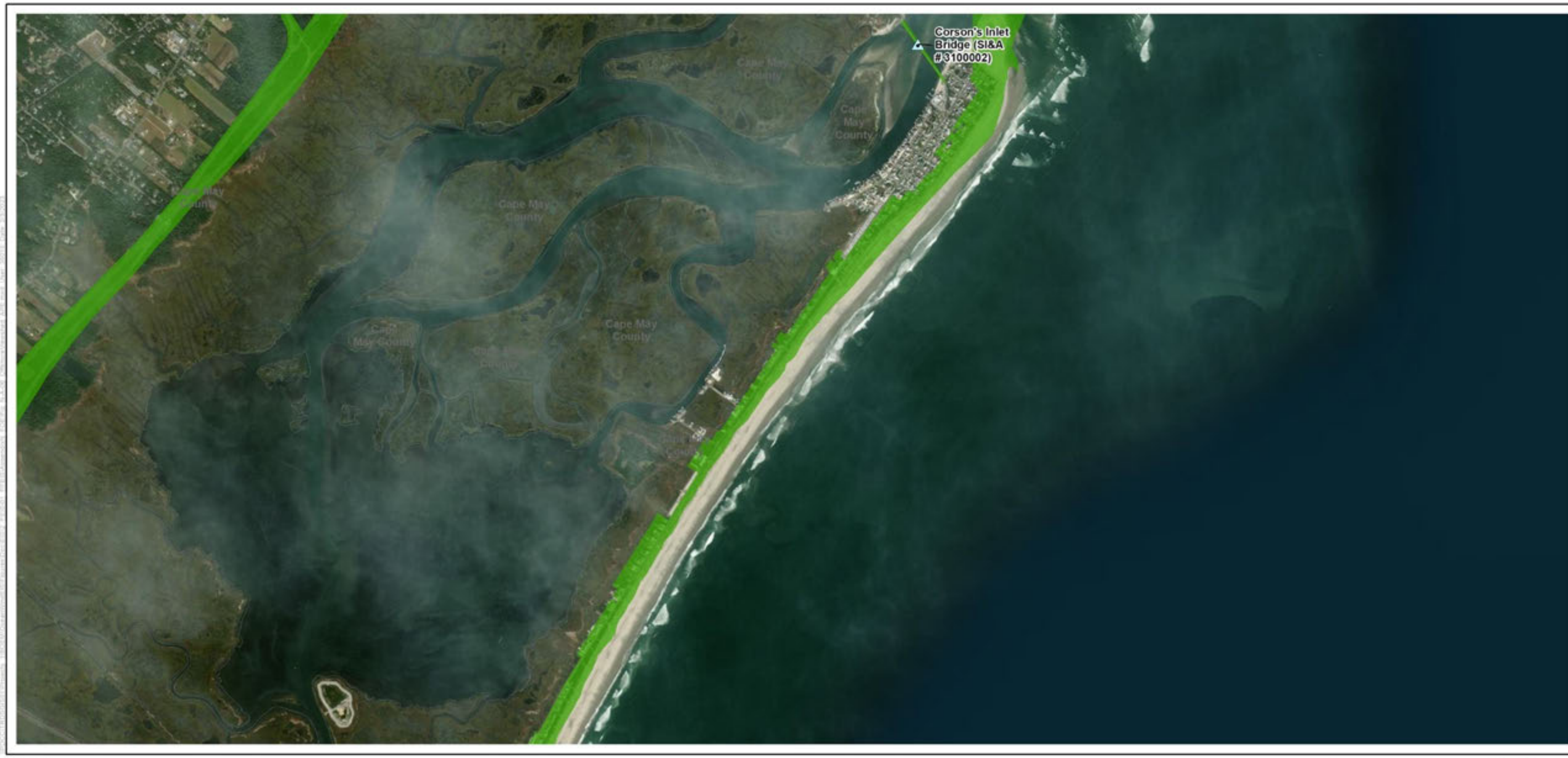
Figure 6 **Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 7**

Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 8

Figure 6 **Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 9**

Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 10

Figure 6 **Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 11**



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
- Onshore Export Cable Route
- Onshore Export Cable Route Options
- Inshore Export Cable Route
- Offshore Export Cable Route
- Potential Onshore Substation Parcel
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- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 12 of 15

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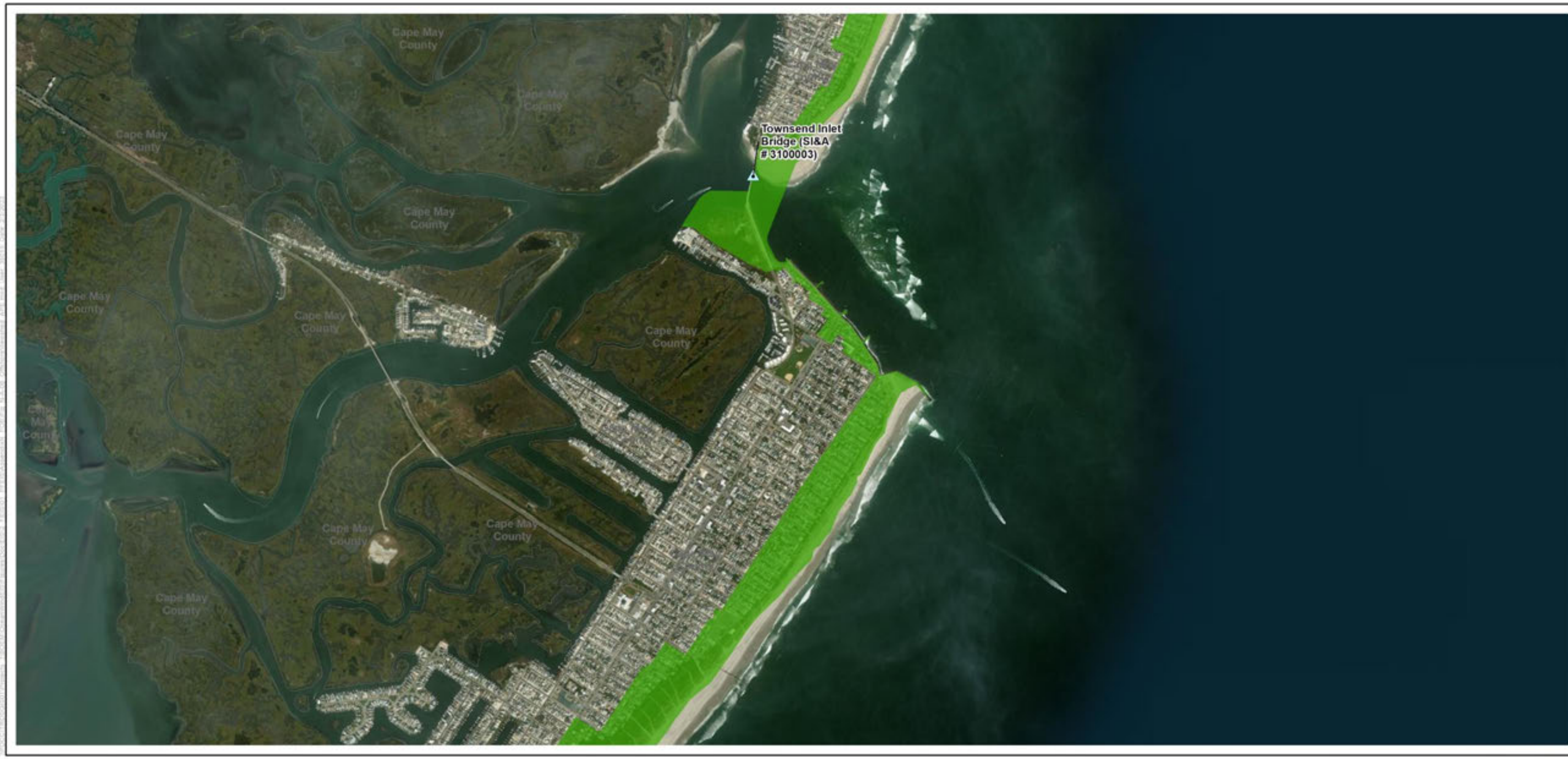
Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 12



Legend

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- Wind Turbine
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- Offshore Export Cable Route
- Potential Onshore Substation Parcel
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- Historic properties recommended adverse visual effects
- Historic properties recommended no adverse visual effects

Sheet: 13 of 15

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0 1,000 2,000 Feet
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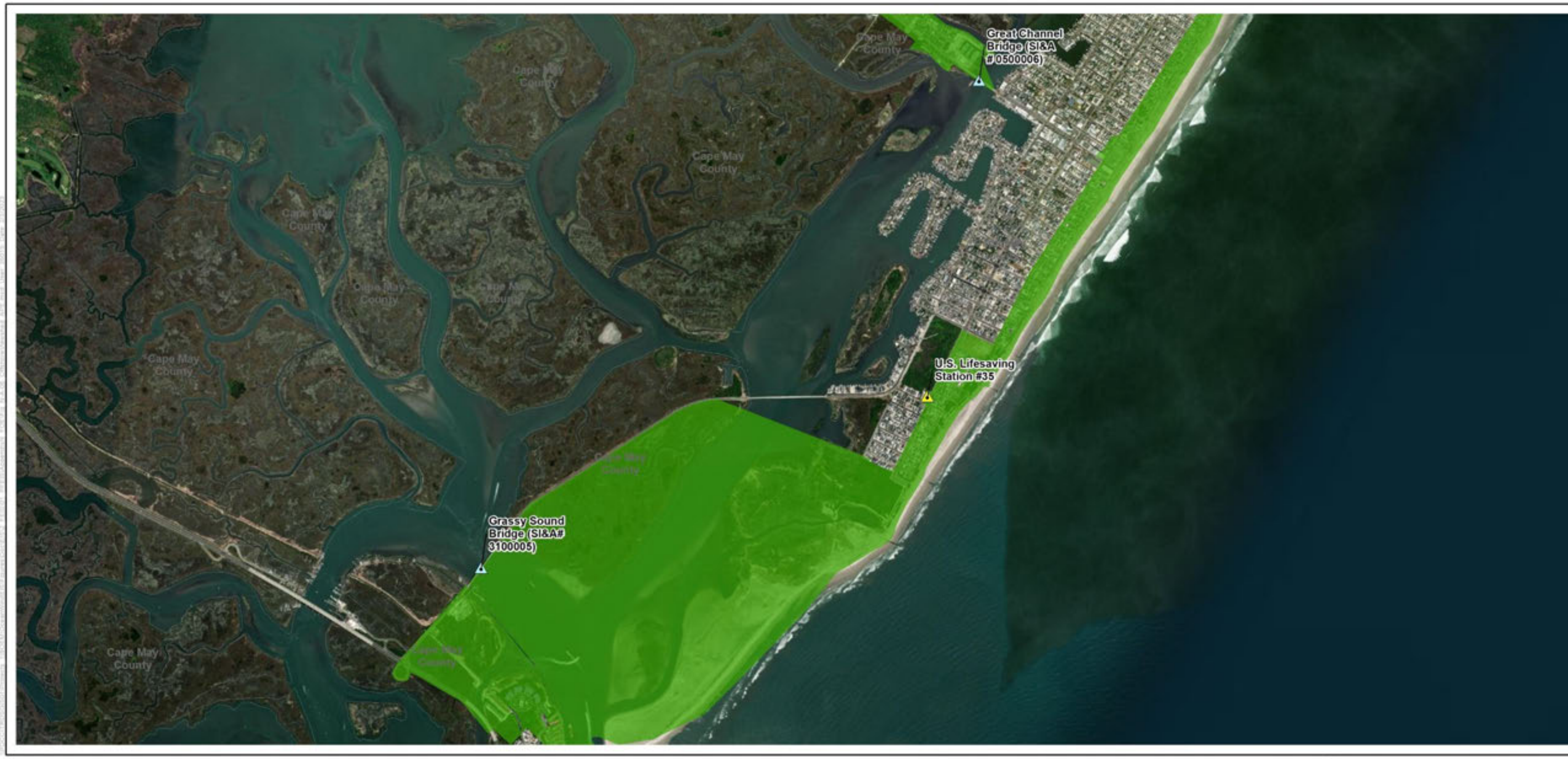
Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 13



Legend

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- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
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- Offshore Export Cable Route
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Sheet: 14 of 15

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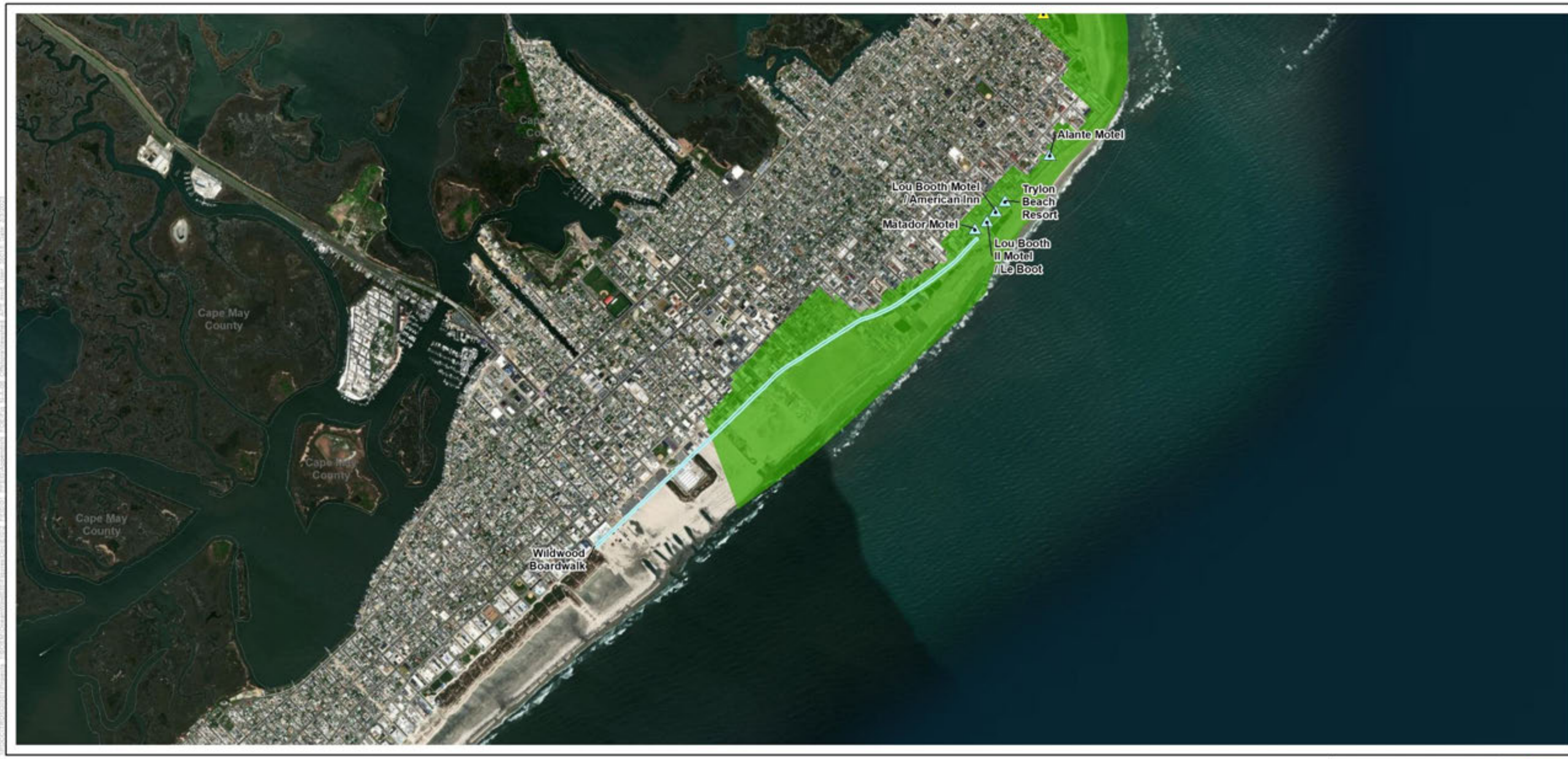
Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 14



Legend

- Offshore Visual APE
- Wind Turbine
- Export Cable Route Landfall Options
- Onshore Interconnection Point
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- Onshore Export Cable Route Options
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- Potential Onshore Substation Parcel
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Sheet: 15 of 15

Figure 6 Offshore Visual APE with Historic Properties Adversely Affected and Foreseeable Future Project Areas—Sheet 15

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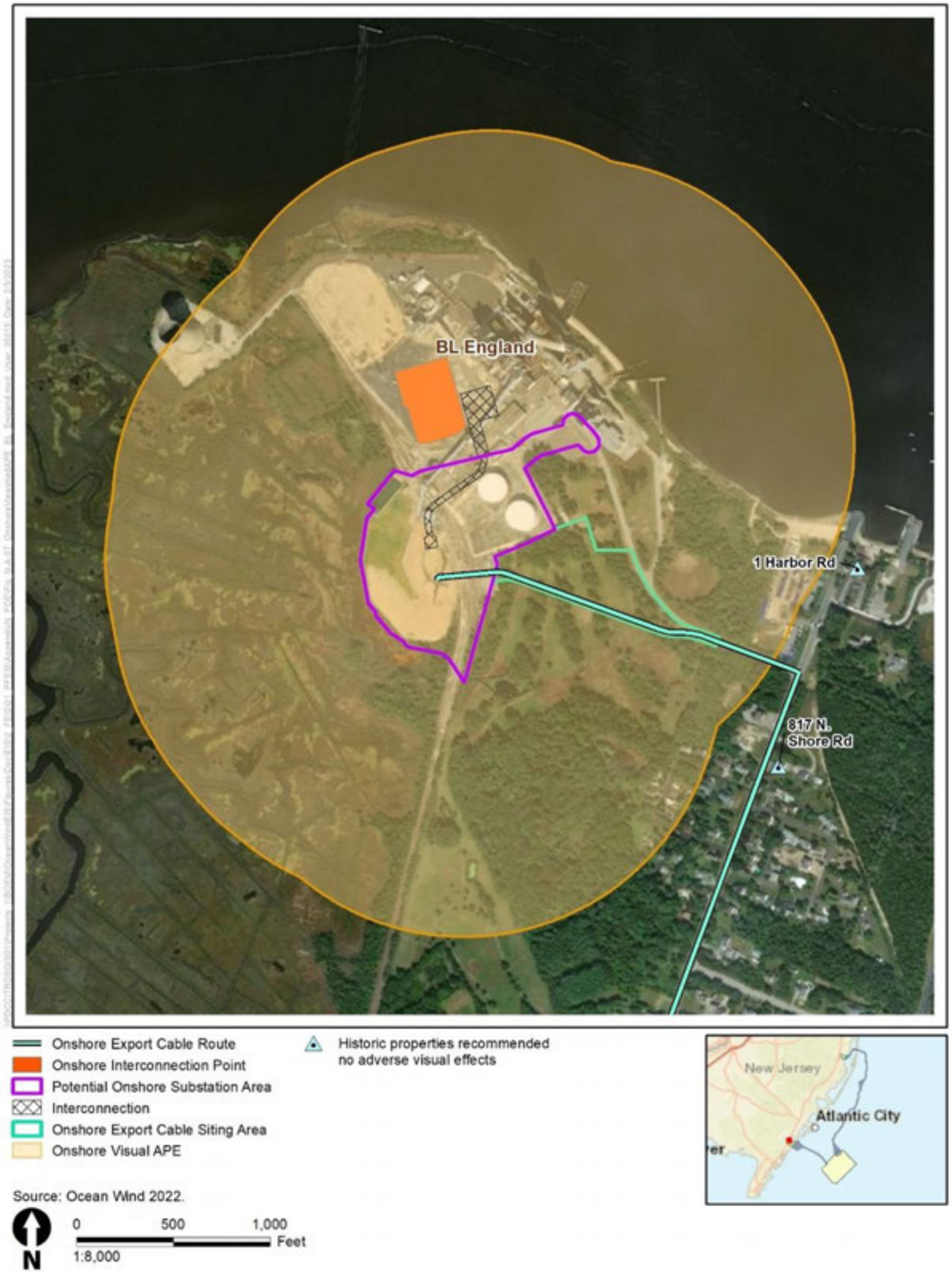

Figure 7 Onshore Visual APE for BL England Substation

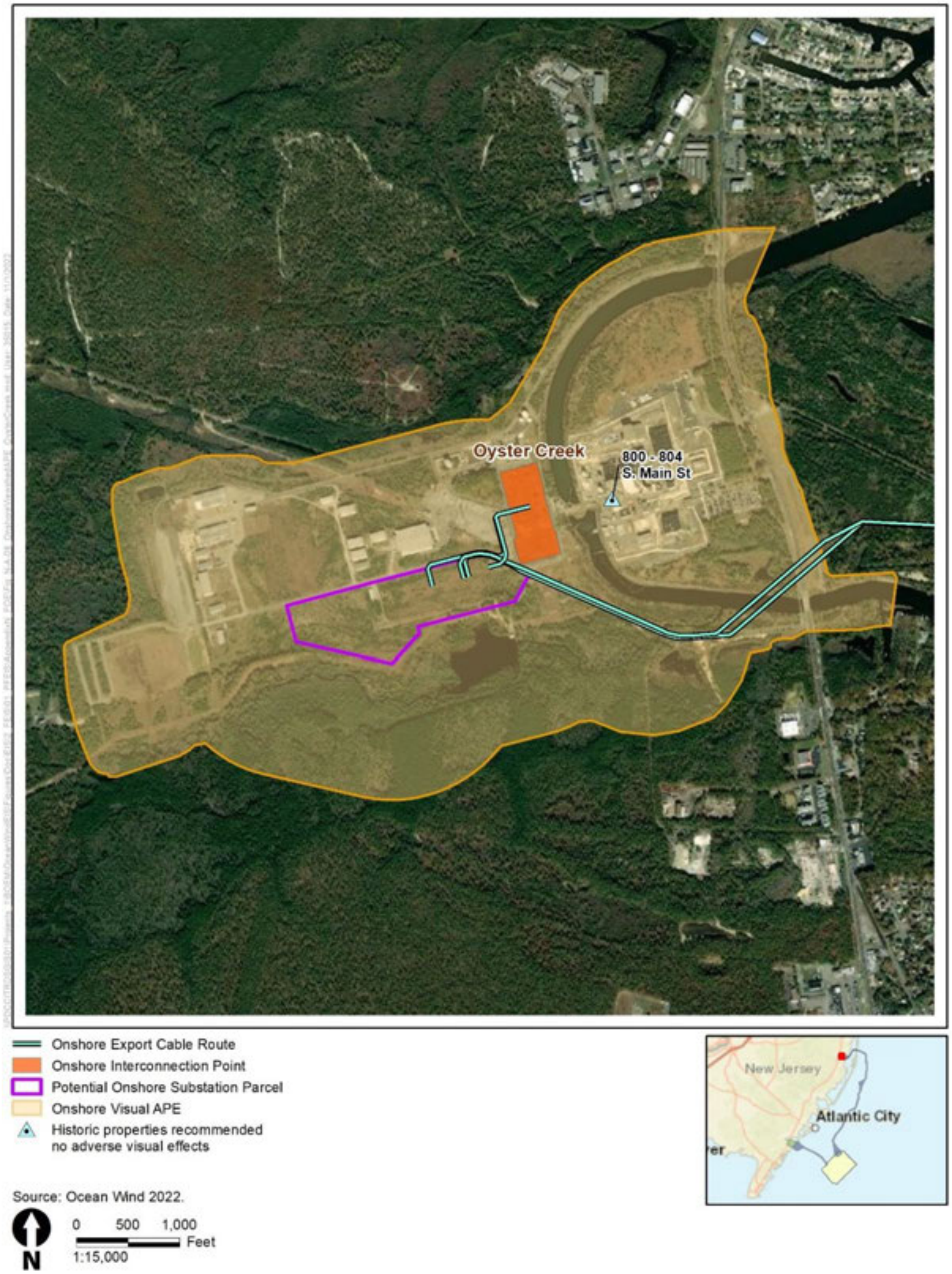

Figure 8 Onshore Visual APE for Oyster Creek Substation

ATTACHMENT C
ENTITIES INVITED TO BE CONSULTING PARTIES

The following is a list of governments and organizations that BOEM contacted and invited to be a consulting party to the NHPA Section 106 review of the Ocean Wind Project. During the consultations, additional parties were made known to BOEM and were added as they were identified.

Participants in the Section 106 Process	Invited Consulting Parties
SHPOs and State Agencies	NJDEP, Historic Preservation Office
	NJDEP, Office of Historic Sites & Parks
	NJDLPS, Marine Service Bureau
	New Jersey Casino Reinvestment Development Authority
	New Jersey Historic Trust
Federal Agencies	ACHP
	NOAA
	USCG
	USEPA
	USFWS
	National Park Service
	National Park Service, Region 1
Federally Recognized Tribes	Absentee-Shawnee Tribe of Indians of Oklahoma
	Delaware Tribe of Indians
	Eastern Shawnee Tribe of Oklahoma
	Shawnee Tribe
	The Delaware Nation
	The Narragansett Indian Tribe
	The Rappahannock Tribe
	The Shinnecock Indian Nation
	Wampanoag Tribe of Gay Head (Aquinnah)
Non-Federally Recognized Tribes	Lenape Indian Tribe of Delaware
	Nanticoke Indian Association, Inc.
	Nanticoke Lenni-Lenape Tribal Nation
	Nanticoke Lenni-Lenape Tribe
	Powhatan Renape Nation
	Ramapough Lenape Indian Nation
	Ramapough Mountain Indians
Local Governments	Absecon City
	Atlantic City
	Atlantic County
	Atlantic County, Department of Regional Planning and Development
	Avalon Borough

Participants in the Section 106 Process	Invited Consulting Parties
	Barnegat Light Borough
	Barnegat Township
	Beach Haven Borough
	Brigantine Beach City
	Cape May City
	Cape May County
	Cape May Point Borough
	Dennis Township
	Eagleswood Township
	Egg Harbor City
	Egg Harbor Township
	Galloway Township
	Hamilton Township
	Hammonton Town
	Harvey Cedars Borough
	Linwood City
	Little Egg Harbor Township
	Long Beach Township
	Longport Borough
	Lower Township
	Margate City
	Middle Township
	North Wildwood City
	Ocean City
	Ocean County
	Pleasantville City
	Sea Isle City
	Ship Bottom Borough
	Somers Point City
	Stafford Township
	Stone Harbor Borough
	Surf City Borough
	Tuckerton Borough
	Upper Township
	Ventnor City
	West Cape May Borough
	West Wildwood Borough
	Wildwood City
	Wildwood Crest Borough
	Woodbine Borough

Participants in the Section 106 Process	Invited Consulting Parties
Nongovernmental Organizations or Groups	Absecon Historical Society
	Absecon Lighthouse
	Atlantic City Convention Center
	Atlantic County
	Atlantic County Historical Society
	Avalon History Center
	Barnegat Light Museum
	Barnegat Lighthouse State Park
	Brigantine Beach Historical Museum
	Cape May Lighthouse
	Caribbean Motel
	Converse Cottage
	Donald & June Feith
	Dr. Edward H. Williams House
	Eagleswood Historical Society
	Emlen Physick Estate
	Flanders Condominium Association
	Friends of Barnegat Lighthouse
	Friends of the Cape May Lighthouse
	Friends of the World War II Tower
	Greater Cape May Historic Society
	Greater Egg Harbor Township Historical Society
	Hereford Inlet Lighthouse
	Historic Cold Spring Village
	Legacy Vacation Resorts
	Linwood Historical Society
	Long Beach Island Historical Association
	Long Beach Island Historical Association
	Longport Historical Society
	Madison Hotel
	Max Gurwicz Enterprises
	Museum of Cape May County
	New Jersey Lighthouse Society
	New Jersey Maritime Museum
	Ocean City Historical Museum
	Ocean City Music Pier
	Ocean County Historical Society
	Patriots for the Somers Mansion
	Preservation New Jersey
	Raphael-Gordon House

Participants in the Section 106 Process	Invited Consulting Parties
	Ritz Condominium Association
	Rutgers University, Department of Marine and Coastal Sciences, School of Environmental and Biological Sciences
	Save Lucy Committee, Inc.
	Stone Harbor Museum
	The Museum of Cape May County
	The Noyes Museum of Art
	Tuckerton Historical Society
	Vassar Square Condominium Association
	Wildwood Crest Historical Society
	Wildwood Historical Society

ATTACHMENT D
CONSULTING PARTIES TO THE OCEAN WIND PROJECT

The following is a current list of consulting parties to the NHPA Section 106 review of the Ocean Wind Project, as of May 9, 2023.

Government or Organization	Participating Consulting Parties	Contact
SHPOs and State Agencies	NJDEP, Historic Preservation Office	Katherine Marcopul, Administrator and Deputy Historic Preservation Officer
	NJDEP, Office of Historic Sites & Parks	Mark Texel, Administrator
	New Jersey Historic Trust	Dorothy Guzzo, Executive Director
Federal Agencies	ACHP	Christopher Daniel, Federal Property Management Section, Program Analyst Chris Koeppel, Federal Property Management Section, Assistant Director
	USACE	Naomi Handell, Regulatory Program Manager, USACE North Atlantic Division Brian Anthony, Biologist, Regulatory Branch, USACE Philadelphia District Ann Marie Dilorenzo, Division Section 408 Coordinator, USACE North Atlantic Division Juan Carlos Corona, Philadelphia District Section 408 Coordinator
	USCG	Matt Creelman, District 5 Agency Point of Contact Jerry Barnes, District 5 Waterways Stephen West, Headquarters George Detweiler, Headquarters Jen Doherty, Sector Delaware Bay Jordan Marshall, Sector Delaware Bay
	USEPA	Abbey States, Human Health Risk Assessor Mark Austin, Team Leader, Environmental Reviews
	National Park Service	Mary Krueger, Energy Specialist for the Northeast Region Kathy Schlegel, Historical Landscape Architect
	U.S. Naval History and Heritage Command	Dr. Alexis Catsambis, Underwater Archaeology Branch
Federally Recognized Tribes	Delaware Nation	Debora Dotson, President of Executive Committee Carissa Speck, Historic Preservation Director
	Delaware Tribe of Indians	Susan Bachor, Archaeologist, Delaware Tribe Historic Preservation Office Representative
	Stockbridge-Munsee Community Band of Mohican Indians	Jeff Bendremer, PhD, Tribal Historic Preservation Officer Graig Kroening, Jr., Vice President

Government or Organization	Participating Consulting Parties	Contact
	The Shinnecock Indian Nation	Bryan Polite, Chairman Shavonne Smith, Director, Shinnecock Environmental Department Jeremy Dennis, Junior Tribal Historic Preservation Officer Kelly Dennis, Council of Trustees Peter Running Deer Silva Rebecca Genia Tela Troge
	Wampanoag Tribe of Gay Head (Aquinnah)	Cheryl Andrews-Maltais, Chairwoman Bettina Washington, Tribal Historic Preservation Officer Lael Echo-Hawk, General Counsel Al Clark, Vice-Chair Kevin Devine, Tribal Council Person
Local Governments	Atlantic County	Gerald DelRosso, County Administrator Frances Brown, Senior Planner
	Cape May City	Warren Coupland, Historic Preservation Commission Chairperson
	Cape May County	William Cook, Special Council, Cultural Heritage Partners Jessica Krauss, Special Council, Cultural Heritage Partners
	Harvey Cedars Borough	Daina Dale, Municipal Clerk Jonathan Oldham, Mayor Paul Rice, Commissioner
	Linwood City	Mary Cole, Deputy Municipal Clerk Leigh Ann, Napoli Municipal Clerk, Registrar of Vital Statistics
	Margate City	Roger McLarnon, Planner, Zoning Officer James M. Rutala, Rutala Associates, LLC
	North Wildwood City	Michael J. Donohue, Blaney Donohue & Weinberg, P.C. Nicholas Long, City Administrator
	Ocean City	George Savastano, Business Administrator Doug Bergen, Public Information Officer Dottie McCrosson, City Solicitor
	Sea Isle City	George Savastano, Business Administrator Shannon Romano, Municipal Clerk
	Somers Point City	Jason Frost, City Administrator
	Stafford Township	Mathew von der Hayden, Township Administrator Rachel Giolitto, Confidential Assistant to the Mayor
Nongovernmental Organizations or Groups	Absecon Lighthouse	Jean Muchanic, Executive Director
	Flanders Condominium Association	Peter Voudouris, President

Government or Organization	Participating Consulting Parties	Contact
	Garden State Seafood Association	Scot Mackey, Trenton Representative
	Long Beach Island Historical Association	Ronald Marr, President
	House at 114 South Harvard Avenue, Ventnor City, New Jersey	Donald & June Feith, Property Owner
	Ritz Condominium Association	Gordon Pherribo, President of the Board
	Rutgers University, School of Environmental and Biological Sciences	Oscar Schofield, Chair, Rutgers Department of Marine and Coastal Sciences
	Save Lucy Committee, Inc.	Richard Helfant, Executive Director James Rutala, Rutala Associates
	The Noyes Museum of Art	Michael Cagno, Executive Director
	Vassar Square Condominiums	Paul Snyderman, President, Board of Trustees

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ATTACHMENT E
ADDENDUM TO THE FINDING OF ADVERSE EFFECT FOR HADDON HALL/RESORTS CASINO HOTEL

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Ocean Wind 1 Offshore Wind Farm

Addendum to the Finding of Adverse Effect for Haddon Hall/Resorts Casino Hotel, 1121 Boardwalk, Atlantic City, New Jersey

May 2023

U.S. Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs

TABLE OF CONTENTS

1.1. Summary

The Bureau of Ocean Energy Management (BOEM) prepared this summary in response to additional information received from a consulting party in April 2023 and to augment the Finding of Adverse Effect Report associated with the identification and evaluation of effects to historic properties for the Ocean Wind 1 project (Project) pursuant to Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations, "Protection of Historic Properties" (36 CFR Part 800). In April 2023, a consulting party requested information from BOEM regarding the property identified as the Resorts Casino Hotel located at 1121 Boardwalk in Atlantic City, New Jersey. The consulting party asked BOEM if this property could be a potential historic property in the Project's visual area of potential effects (APE) for offshore project components and, if yes, whether it could be visually adversely affected. In consideration of comments received from this consulting party, BOEM confirmed this property is in the offshore visual APE (Appendix A). BOEM, then requested confirmation from the Lessee, Ocean Wind LLC (Ocean Wind), regarding whether this property was surveyed during the Ocean Wind's previous intensive above-ground property surveys, which had been completed as a requirement for their Construction and Operations Plan (COP) submittal. BOEM also requested additional information on the property's historic significance and its eligibility for listing in the National Register of Historic Places (NRHP) if it was not previously surveyed.

Ocean Wind clarified that this property was not previously surveyed due to several factors. The current hotel, now operating as Resorts Casino Hotel, was previously called Haddon Hall. The New Jersey Historic Preservation Office (NJHPO), in its online GIS system called LUCY Cultural Resources GIS, identified this property as demolished and a previously contributing element within the NJHPO-identified Atlantic City Boardwalk District. Subsequent field verification by Ocean Wind in April 2023 determined that Haddon Hall is extant, having only been modified but not demolished as part of the opening of the current Resorts Casino Hotel in 1976. Haddon Hall is now the current Oceans Tower associated with the Resorts Casino Hotel.

Based on this additional information and as summarized in this Addendum, BOEM has determined that it will consider this property, Resorts Casino Hotel, as potentially eligible for listing in the NRHP and that it will be visually adversely affected. BOEM, with the assistance of Ocean Wind , believes it is appropriate to resolve the adverse effect to this property with measures analogous to similarly situated properties (i.e., the Ritz-Carlton), namely through the development of an historic context study that analyzes early 20th century hotels located in the visual APE, to include the Resorts Casino Hotel, and by providing funding in the amount of $65,000 to a project-specific mitigation fund established to resolve visual adverse effects attributed to this Project.

BOEM summarizes here within this Addendum to the *Finding of Adverse Effect for the Ocean Wind 1 Construction and Operations Plan* (FOE) the following information associated with the Resorts Casino Hotel:

- a description of the historic property;
- a statement of significance for this property (pursuant to 36 CFR 800.4(c));
- an evaluation of this property for NRHP eligibility (pursuant to 36 CR 800.4(c)(2));
- a description of BOEM's finding of adverse effect to this property; and
- a description of resolution measures to resolve the adverse effect to this property.

The following reports previously documented the historic properties within the visual Area of Potential Effect (APE) for the Project: the Historic Resources Visual Effects Assessment (HRVEA); the Cumulative Historic Resources Visual Effects Assessment (CHRVEA); the Finding of Adverse Effects (FOE); and the Environmental Impact Statement (EIS) for the Project (COP Volume III, Appendix F-3; Ocean Wind 2023a; BOEM 2023a, 2023b, 2023c). BOEM has determined amendments to the HRVEA and CHRVEA are not necessary as this Addendum addresses the additional information related to Resorts Casino Hotel including its NRHP-eligibility and the potential adverse effects.

1.2. Project Background

BOEM is the lead federal agency responsible for the decision on whether to approve, approve with modifications, or disapprove the Project's construction and operations plan (COP) pursuant to 43 United States Code 1332(3). To further inform that decision, ICF serves a third-party contractor to assist BOEM in its compliance with NHPA Section 106. On August 15, 2019, BOEM received a COP from Ocean Wind proposing an offshore wind energy project within Lease Area OCS-A 0498 offshore New Jersey. In addition, Ocean Wind submitted updates to the COP on March 13, 2020, September 24, 2020, March 24, 2021, November 16, 2021/December 10, 2021, October 14, 2022, and April 24, 2023. In its COP, Ocean Wind is proposing the construction, operation, and eventual decommissioning of a minimum 1,100-MW wind energy project consisting of offshore wind turbine generators (WTGs) and their foundations, offshore substations (OSS) and their foundations, scour protection for foundations, inter-array cables linking the individual turbines to the OSS, substation interconnector cables linking the substations to each other, offshore export cables and an onshore export cable system, onshore substations, and connections to the existing electrical grid in New Jersey. At their nearest points, WTG and OSS components of the Project would be approximately 13 nautical miles (15 statute miles) southeast of Atlantic City, New Jersey. Offshore Project elements would be on the Outer Continental Shelf, with the exception of a portion of the offshore export cables within state waters. Ocean Wind is utilizing a project design envelope (PDE) in its COP, which represents a reasonable range of design parameters that may be used for the Project. In reviewing the PDE, BOEM is analyzing the maximum-case scenario that could occur from any combination of the contemplated parameters. This includes alternatives that may require phased identification of historic properties in the marine APE. BOEM's analysis and review of the PDE may result in the approval of a project that is constructed within that range or a subset of design parameters within the proposed range.

1.3. Visual Area of Potential Effect (APE)

The APE for visual effects analysis (hereafter visual APE) includes the viewshed from which renewable energy structures—whether offshore or onshore—would be visible. Offshore, the visual APE includes a boundary of 40 miles radial distance from the Wind Farm Area, which is the approximate maximum theoretical distance—a distance that does not factor in certain environmental factors such as weather or environmental conditions—at which the WTGs could be visible (COP Volume III, Appendix F-3, page 23; Ocean Wind 2023). However, subsequent desktop analysis, visualizations, and field verification determined that the actual visibility of Wind Farm Area infrastructure beyond 25 miles is unlikely (COP Volume III, Appendix F-3, page 23; Ocean Wind 2023). See Finding of Effect (FOE) Attachment B, Figure 6, Sheets 1–16.

Geographic information system analysis and subsequent field investigation delineated the visual APE methodically through a series of steps, beginning with the maximum theoretical distance WTGs could be visible. This was determined by first considering the visibility of a WTG from the water level to the tip of an upright rotor blade at a height of 906 feet. The analysis then accounted for how distance and environmental conditions impede visibility as the distance increases between the viewer and WTGs (i.e., by a 40-mile distance, even blade tips would be below the sea level horizon line). The mapping effort then removed all areas with obstructed views toward WTGs, such as those views impeded by intervening topography, vegetation, and structures. Areas with unobstructed views of offshore Project elements then constituted the APE. FOE Attachment B, Figure 6 Map Index, also depicts reasonably foreseeable future project areas for consideration of cumulative effects within the APE.

Onshore, the visual APE includes a 0.25-mile boundary around the BL England substation location (see FOE Attachment B, Figure 7) and a minimum 0.25-mile boundary around the Oyster Creek substation location (see FOE Attachment B, Figure 8). Any overhead lines would fall within these boundaries (COP Volume III, Appendix F-3, page 19; Ocean Wind 2023a). All other elements would be underground and would not be visible.

BOEM confirmed Resorts Casino Hotel is in the offshore visual APE (see Appendix A).

1.4. Description of the Historic Property – Haddon Hall; Currently Operating as Part of the Resorts Casino Hotel

Haddon Hall, 1121 Boardwalk, Atlantic City

Haddon Hall at 1121 Boardwalk in Atlantic City, New Jersey, is located in this Project's visual APE. It is an E-plan hotel completed in phases from 1920 to1929 and executed in the Beaux Arts style. The main tower block is 15 stories with a central 3-story penthouse level; it was completed in 1929. Two flanking projecting blocks, 12 stories tall, were built in 1921–1922 as additions to an earlier iteration of the hotel, a frame building constructed in 1896. While some of the building's exterior is covered in a smooth stucco in 2023, contemporary photography and newspaper descriptions indicate the concrete and steel building originally had a red brick, Indiana limestone, and granite exterior with terra cotta details. Some of these original exterior materials are still visible, albeit painted. Typical of Philadelphia-based architecture firm of Rankin and Kellogg, who designed the 1920s building components, Haddon Hall's Beaux Arts design includes exterior walls featuring inset decorative detailing, quoins, pilasters, string courses, dentil molding at cornice levels, and roof-line balustrades (Ocean Wind 2023b).

1.5. Historic Context and Significance

As described in the survey form produced by Ocean Wind (Appendix B), extant components of Haddon Hall are now part of the Resorts Casino Hotel, the first casino-hotel in Atlantic City and the first legal casino outside of the state of Nevada. The oldest extant portions of the hotel date to 1920-1921 and include the two-story arcade along the Boardwalk, extending between South North Carolina and Mansion Avenues. The hotel expanded following its merger with the neighboring Chalfonte Hotel (no longer extant) immediately southwest of Haddon Hall and across South North Carolina Avenue. Construction on the "Boardwalk wing," a 12-story addition built by the George A. Fuller Company of New York began in 1921 and had been completed by the summer of 1922. An addition was erected on the Mansion Avenue side of the hotel between 1924-1925, which included a corridor entrance connecting Haddon Hall to the Chalfonte. The original central frame section of Haddon Hall (1896) was demolished in 1928 to allow for the construction of the current central block, designed by Philadelphia architects Rankin & Kellogg. New

York-based Turner Construction won the building contract and broke ground in October 1928. The new Haddon Hall was completed in 1929.

During World War II, the owners of what was then known as Chalfonte-Haddon Hall leased the buildings to the Army between 1943-1946, as was typical among beachfront hotels. Haddon Hall was retrofitted to serve as a medical facility and along with the Chalfonte, Traymore, and other Atlantic City hotels, was part of the Thomas England General Hospital. Nicknamed “Camp Boardwalk,” Haddon Hall served as the Thomas England General Hospital’s main building and could house approximately 2,000 patients. By 1945, the hospital was the largest in the United States specializing in amputations and neurosurgery.

Upon its return to the Leeds & Lippincott Company, Chalfonte-Haddon Hall was re-opened to the public. With talk of gaming legalization in Atlantic City, Resorts International (formed in 1968), purchased Leeds & Lippincott Company and its hotels, renovating Haddon Hall in preparation for the passage of the 1976 gaming referendum. Haddon Hall, known from that point as the Resorts Casino Hotel, re-opened in 1978 as a hotel/casino. The Chalfonte Hotel, unable to meet the minimum room requirement to be converted into a gaming hotel, was demolished in 1980. The site was redeveloped as parking for the Resorts Casino Hotel. In 2002, the Rendezvous Tower was constructed, replacing a Ramada Inn on the site. The new tower opened in 2004.

Several components of local and regional history are associated with the Haddon Hall, including its association with pre-World War II, pre-gambling-era development in Atlantic City, its Beaux-Art architectural style, and its use as a World War II hospital. Recorded use of the property began with a Quaker rooming house in 1869, followed by construction of a 400-person capacity hotel in 1896, and then the development of Haddon Hall by Leeds & Lippincott Company in the 1920s in response to the growing popularity of Atlantic City as a resort area. Haddon Hall is an example of a Beaux Arts-style high-rise hotel designed by Philadelphia-based architects Rankin & Kellogg. Rankin & Kellogg’s portfolio includes 72 buildings, primarily residential and commercial types executed in the Beaux Arts style. Finally, as the main building within the Thomas England General Hospital established in World War II, Haddon Hall was associated with advanced amputation and neurosurgery operations and rehabilitation, which bears additional research.

1.6. National Register of Historic Places Eligibility

The extant 1920s components of Haddon Hall were designed by the Philadelphia-based architecture firm of Rankin and Kellogg; the firm was responsible for the central tower block, its two flanking wings, and two-story arcade building. The building is associated with both the development of Atlantic City as a seaside resort and the use of Atlantic City hotels for the Thomas England General Hospital during World War II. Thus, Haddon Hall is significant under Criterion A for Commerce and, potentially, with additional research, Health/Medicine. The hotel is not known to be associated with historically important persons; therefore, it is not significant under Criterion B. The hotel is associated with Philadelphia-based architects Rankin & Kellogg, who designed several local landmarks, including the Camden County Courthouse and Jail, and United States Post Office and Custom House in Camden, New Jersey. Haddon Hall is an example of the firm’s Beaux Arts designs; the building holds significance under Criterion C for Architecture. The hotel is not likely to yield information important to prehistory or history; thus, it is not significant under Criterion D. (Ocean Wind 2023b). While Haddon Hall has been subject to modifications through the years, including the addition of a porte cochere entrance on its primary elevation and modifications to the two-story arcade building, main tower block, and flanking projecting wings, which impact its integrity of design, materials, and workmanship, enough of the hotel design and materials are extant to be able to convey the building's significance under Criterion A and C. It is therefore recommended Eligible for inclusion in the NRHP at the local level, with significant periods including 1921–1929, reflecting its construction period, and 1943–1946, reflecting its use as a hospital during World War II. (Ocean Wind 2023b).

The HRVEA identified historic properties in the visual APEs consistent with the *Programmatic Agreement Among The U.S. Department of the Interior, Bureau of Ocean Energy Management, The State Historic Preservation Officers of New Jersey and New York, The Shinnecock Indian Nation, and The Advisory Council on Historic Preservation Regarding Review of Outer Continental Shelf Renewable Energy Activities Offshore New Jersey and New York Under Section 106 of the National Historic Preservation Act* (Programmatic Agreement) which was executed on June 3, 2016. This Addendum specifically applies Stipulation I.D. of the Programmatic Agreement, treating the Resorts Casino Hotel as potentially eligible for inclusion in the NRHP unless BOEM determines, and the SHPOs agree, that the property is ineligible (Ocean Wind 2023b). This NRHP eligibility in this Addendum addresses Haddon Hall only and further analysis will be needed to determine the NRHP-eligibility for Resorts Casino Hotel. The proposed mitigation measures for this property including the historic context for early 20th century hotels will provide additional information needed to determine if it is eligible for listing in the NRHP.

1.7. Project Effects

BOEM finds that Resorts Casino Hotel will be visually adversely affected by the project and will require resolution of these effects.

Haddon Hall, now part of the Resorts Casino Hotel, is on the Atlantic City Boardwalk with the main hotel block extending north-northwest from the shoreline. The hotel block rising behind the commercial Boardwalk block is oriented to maximize the number of rooms on its narrow, deep lot. The ocean-facing elevation of this block is nine bays wide. In addition to southeast elevation windows, most windows on the southwest elevation of the projecting wings and the central tower block will have a view of the Wind Farm Area (WFA). The building's siting and orientation are important to its Criterion A significance for Commerce. While architectural elements oriented toward the WFA have been subject to modification, most notably at the two-story arcade building, conspicuous views southeast toward the WFA from guest rooms in the hotel will alter the character-defining setting of the building. (Ocean Wind 2023b).

Because of Resorts Casino Hotel's close proximity to the Ritz-Carlton Hotel, BOEM believes that the cumulative impacts on each of the two properties would be very similar. Therefore, BOEM has determined that the Resorts Casino Hotel will be cumulatively visually adversely affected by the Project. Cumulative impacts on the Ritz-Carlton Hotel are discussed in section N.3.1.3.5 of the FOE.

1.8. Resolution Measures

BOEM believes that it is appropriate to resolve the adverse effect to the Resorts Casino Hotel through analogous measures for similarly-situated properties, namely, the development of an historic context study that analyzes early 20th century hotels located in the visual APE, including the Resorts Casino Hotel, and a requirement for Ocean Wind to fund in the amount of $65,000 to a project-specific mitigation fund established specifically for visual adverse effects attributed to this Project.

1.9. References Cited

Bureau of Ocean Energy Management (BOEM). 2023a. *Ocean Wind 1 Offshore Wind Farm Final Environmental Impact Statement*. May. OCS EIS/EA BOEM 2023-020. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Washington, D.C.

Bureau of Ocean Energy Management (BOEM). 2023b. *Appendix N. Finding of Adverse Effect for the Ocean Wind 1 Construction and Operations Plan* in *Ocean Wind 1 Offshore Wind Farm Final Environmental Impact Statement*. May. OCS EIS/EA BOEM 2023-020. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Washington, D.C.

Bureau of Ocean Energy Management (BOEM). 2023c. *Cumulative Historic Resources Visual Effects Analysis – Ocean Wind Offshore Wind Farm Project*. May. Prepared by ICF, Fairfax, VA. Prepared for U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Washington, D.C.

Ocean Wind LLC (Ocean Wind). 2023a. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Ocean Wind LLC (Ocean Wind). 2023b. *Ocean Wind Intensive-Level Architectural Survey of Haddon Hall, 1121 Boardwalk, Atlantic City, New Jersey*. May. Prepared for Bureau of Ocean Energy Management, Washington, D.C.

APPENDIX A
OFFSHORE VISUAL AREA OF POTENTIAL EFFECT FOCUSED ON RESORTS CASINO HOTEL


Absecon Lighthouse
Federal Building and Post Office (Demolished)
Atlantic City Boardwalk
Holmhurst Hotel (Demolished)
Morton Hotel (Demolished)
Claridge Hotel
Blenheim Hotel (Demolished)
Central Pier
Warner Theatre (façade)
Shelburne Hotel
Ritz-Carlton Hotel
Atlantic City Convention Hall
The Knife and Fork Restaurant
The Strand Apartments
The Marine Apartments
Riviera Apartments
Vassar Square Condominiums
Raphael-Gordon House
Ventnor City Hall
Legend
Offshore Visual APE
Wind Turbine
Export Cable Route Landfall Options
Onshore Interconnection Point
Onshore Export Cable Route
Onshore Export Cable Route Options
Inshore Export Cable Route
Offshore Export Cable Route
Potential Onshore Substation Parcel
Historic properties recommended adverse visual effects
Historic properties recommended no adverse visual effects
Historic properties recommended adverse visual effects
Historic properties recommended no adverse visual effects
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1:24,000
Sheet: 9 of 15

APPENDIX B
INVENTORY FORM FOR HADDON HALL/RESORTS CASINO HOTEL

Ocean Wind 1
An Ørsted & PSEG project

May 3, 2023

Sarah Stokely
Lead Historian and Section 106 Team Lead
Renewable Energy Program
Bureau of Ocean Energy Management
1849 C Street, NW
Washington, DC 20240

Dear Sarah:

Ocean Wind LLC (Ocean Wind), a subsidiary of Ørsted Wind Power North America LLC, proposes to construct and operate the Ocean Wind Offshore Wind Farm Project (Project) off the coast of New Jersey. Ocean Wind is developing the Project pursuant to the Bureau of Ocean Energy Management (BOEM) requirements for the commercial lease of submerged lands for renewable energy development on the outer continental shelf (Lease Area OCS-A 0498). Ørsted has contracted HDR Engineering, Inc. (HDR) to provide environmental support for the project. HDR has subcontracted SEARCH, Inc. (SEARCH) to support cultural resources assessments.

BOEM is currently undergoing environmental review of Ocean Wind's Construction and Operations Plan (COP) under the National Environmental Policy Act and is consulting on this undertaking pursuant to the National Historic Preservation Act. Appendix F of the COP is the *Ocean Wind Visual Effects on Historic Properties Report*, also known as the *Historic Resources Visual Effects Assessment* (HRVEA), completed by the SEARCH/HDR team in March 2021, with revisions completed through January 2023. This document includes visual effects evaluations for historic properties that are either listed in or eligible for the National Register of Historic Places (NRHP). In coordination with the New Jersey Historic Preservation Office (NJHPO), BOEM established a preliminary area of potential effects (PAPE) for the Project, and SEARCH/HDR conducted a thorough review of the PAPE to identify historic properties requiring evaluation in the HRVEA. Historic properties were identified through review of NJHPO files, and through a historic resources survey conducted for the project. Historic resources survey results are presented in the *Architectural Intensive Level Survey, Ocean Wind Offshore Windfarm, New Jersey Report* completed by SEARCH/HDR in September 2021, with revisions completed in October 2022.

During the course of Section 106 consulting party meetings, a consulting party informed the SEARCH/HDR team of a historic-age resource that SEARCH/HDR then determined was inadvertently omitted from the 2021 survey and 2022 updates. SEARCH/HDR did not include this property in the survey because the property was indicated in the NJHPO's online GIS system called LUCY Cultural Resources GIS[1] as a demolished resource within the NJHPO-identified Atlantic City Boardwalk Historic District. The resource was recorded on April 20, 2023. SEARCH/HDR conducted research, completed an NJHPO Inventory Form, and made an NRHP eligibility recommendation for the resource.

[1] https://www.arcgis.com/home/item.html?id=44ce3eb3c53349639040fe205d69bb79.

The resource recorded is Haddon Hall, currently operating as part of the Resorts Casino Hotel at 1121 Boardwalk in Atlantic City, Atlantic County.

Following is a brief summary and NRHP recommendation for Haddon Hall. Its inventory form with detailed information is appended to this letter.

Haddon Hall, 1121 Boardwalk, Atlantic City

Haddon Hall at 1121 Boardwalk is an E-plan hotel completed in 1922–1929 and executed in the Beaux Arts style. The main tower block is 15 stories with a central 3-story penthouse level; it was completed in 1929. Two flanking projecting blocks, 12 stories tall, were built in 1921–1922 as additions to an earlier iteration of the hotel, a frame building constructed in 1896. While some of the building's exterior is covered in a smooth stucco in 2023, contemporary photography and newspaper descriptions indicate the concrete and steel building originally had a red brick, Indiana limestone, and granite exterior with terra cotta details. Some of these original exterior materials are still visible, albeit painted. Typical of Philadelphia-based architecture firm of Rankin and Kellogg, who designed the 1920s building components, Haddon Hall's Beaux Arts design includes exterior walls featuring inset decorative detailing, quoins, pilasters, string courses, dentil molding at cornice levels, and roof-line balustrades.

The extant 1920s components of Haddon Hall were designed by the Philadelphia-based architecture firm of Rankin and Kellogg; the firm was responsible for the central tower block, its two flanking wings, and two-story arcade building. The building is associated with both the development of Atlantic City as a seaside resort and the use of Atlantic City hotels for the Thomas England General Hospital during World War II. Thus Haddon Hall is significant under Criterion A for Entertainment/Recreation and (potentially, with additional research) Health/Medicine. The hotel is not known to be associated with historically important persons; therefore, it is not significant under Criterion B. The hotel is associated with Philadelphia-based architects Rankin & Kellogg, who designed several local landmarks, including the Camden County Courthouse and Jail, and United States Post Office and Custom House in Camden, New Jersey. Haddon Hall is an example of the firm's Beaux Arts designs; the building holds significance under Criterion C for Architecture. The hotel is not likely to yield information important to prehistory or history; thus, it is not significant under Criterion D.

While Haddon Hall has been subject to modifications through the years, including its porte cochere entrance addition on its primary elevation and modifications to the two-story arcade building, which impact its integrity of design, materials, and workmanship, enough of the hotel design and materials are extant to be able to convey the building's significance under Criterion A and C. It is therefore recommended **Eligible** for inclusion in the NRHP at the local level, with significant periods including 1921–1929, reflecting its construction period, and 1943–1946, reflecting its use as a hospital during World War II.

Haddon Hall is on the Atlantic City Boardwalk with the main hotel block extending north-northwest from the shoreline. The hotel block rising behind the commercial Boardwalk block is oriented to maximize the number of rooms on its narrow, deep lot. The ocean-facing elevation of this block is nine bays wide. In addition to southeast elevation windows, most windows on the southwest elevation of the projecting wings and the central projecting tower block will have a view of the Wind Farm Area (WFA). The building's siting and orientation are important to its Criterion A significance for Commerce. While architectural elements oriented toward the WFA have been subject to modification, most notably at the two-story arcade building, conspicuous views southeast toward the WFA from guest rooms in the hotel will alter the character-defining setting of the building. As a result, it is recommended that the Project will have an Adverse Effect on Haddon Hall.

If BOEM has any questions about the information presented here, please do not hesitate to contact myself, Katharine Perry at (917) 524-4633 or KAPER@orsted.com.

Finally, Ørsted requested that the SEARCH/HDR team conduct an additional analysis of the list of demolished resources in the NJHPO's LUCY Cultural Resources GIS to confirm whether all other resources on the demolished list were, in fact, no longer extant. As outlined in the attached memorandum, this analysis confirmed that no other extant properties on that list meet the criteria for intensive-level survey.

Sincerely,

Katharine Perry
Permitting Manager, Ocean Wind 1

BASE FORM

Historic Sites #:

Property Name: Haddon Hall

Street Address: *Street #:* 1121 (Low) ___ (High) *Apartment #:* ___ (Low) ___ (High)

Prefix: ___ *Street Name:* Boardwalk *Suffix:* ___ *Type:* ___

County(s): Atlantic **Zip Code:** 08401

Municipality(s): Atlantic City **Block(s):** 60

Local Place Name(s): ___ **Lot(s):** 14

Ownership: Private **USGS Quad(s)** Atlantic City

Description:
Please see Exterior Description on Building Attachment Form.

Registration and Status Dates:

National Historic Landmark: ___
SHPO Opinion: ___
National Register: ___
Local Designation: ___
New Jersey Register: ___
Other Designation: ___
Determination of Eligibility: ___
Other Designation Date: ___

Photograph:

Survey Name: **OCEAN WIND INTENSIVE-LEVEL ARCHITECTURAL SURVEY** Date: May 3, 2023

Surveyor: **Ann Keen (HDR), Liz Blackwell (SEARCH)**

Organization: **HDR and SEARCH**

BASE FORM

Historic Sites #:

Location Map:

Service Layer Credits: World Topographic Map: State of New Jersey, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA

Site Map:

Service Layer Credits: World Imagery: Maxar

Bibliography/Sources:

Atlantic City Gazette-Review
1920 "The Haddon Hall Arcade." June 26, 1920:4.
1921a "Leeds & Lippincott and The Leeds Company." Display ad. February 2, 1921:4.
1921b "May Span Street From Chalfonte to Haddon Hall." December 2, 1921:1.
1924 "New Additions to Shore Hotel." July 26, 1924:1.

Atlantic City Sunday Press the Sunday Gazette
1928a "Will Enlarge Haddon Hall." April 1, 1928:13.
1928b "$5,500,000 Job To Start Soon." September 16, 1928:13.

Atlantic Foto Service
1929 "Completion." [Photograph]. Philadelphia: Rankin & Kellogg/ Doe Collection, 33-P-038-008. July 4, 1929. Image courtesy Philadelphia Architects and Buildings. Available online at https://www.philadelphiabuildings.org/pab/app/im_display.cfm/504329?ProjectId=1B50E3AE-69BE-4232-B7494729A7A3F686, accessed April 2023.

IrishBrigade.com
n.d. Resorts Was Formerly WWII Military Hospital Thomas England General Hospital. Available online at https://www.irishbrigade.com/blogs/http-www-irishbrigade-com-blogs/resorts-was-formally-wwii-military-hospital-thomas-england-general-hospital, accessed April 2023.

BASE FORM

Historic Sites #:

Philadelphia Architects and Buildings
2023 "Rankin & Kellogg (fl. 1891-1903 and 1925-1943)." Available online at https://www.philadelphiabuildings.org/pab/app/ar_display.cfm?ArchitectId=A1137, accessed April 2023.

Press of Atlantic City
1921 "Twelve Story Addition For Haddon Hall." October 4, 1921:1.
1925 "Hundreds of Thousands of Dollars Spend to Get Hotels Ready for Rush: Great Chalfonte-Haddon Hall Addition." April 11, 1925:2.

Resorts Casino Hotel
2023 "Atlantic City's First Casino – A Resorts AC History." Available online at https://resortsac.com/history/#:%7E:text=Before%20becoming%20Resorts%20International%20in,opened%20its%20doors%20for%20business, accessed April 2023.

Additional Information:
Additional Information

More Research Needed? ☒Yes ☐No

INTENSIVE LEVEL USE ONLY

Attachments Included: ☒ Building ☐ Structure ☐ Object ☐ Bridge ☐ Landscape ☐ Industry

Within Historic District? ☐ Yes ☒ No

Status: ☐ Key-Contributing ☐ Contributing ☐ Non-Contributing

Associated Archaeological Site/Deposit? ☐ Yes
(Known or potential Sites – if yes, please describe briefly)

Survey Name: **OCEAN WIND INTENSIVE-LEVEL ARCHITECTURAL SURVEY** Date: May 3, 2023
Surveyor: **Ann Keen (HDR), Liz Blackwell (SEARCH)**
Organization: **HDR and SEARCH**

BUILDING ATTACHMENT

Historic Sites #:

Common Name:	Resorts Casino Hotel		
Historic Name:	Haddon Hall		
Present Use:	Residential Activity, Transient		
Historic Use:	Residential Activity, Transient		
Construction Date:	1920, 1921, 1924, 1928	**Source:**	Press of Atlantic City 1921, Atlantic City Gazette-Review 1924, Resorts Casino Hotel 2023
Alteration Date(s):	1976–1978	**Source:**	Resorts Casino Hotel 2023
Designer:	Rankin & Kellogg	**Physical Condition:**	Good
Builder:	George A. Fuller Company, Turner Construction	**Remaining Historic Fabric:**	Medium
Style:	Beaux Arts		
Form:	Other: High Rise	**Stories:**	15
Type:	Other	**Bays:**	21
Roof Finish Materials:	Unknown		
Exterior Finish Materials	Brick, stone, terra cotta, stucco		

Exterior Description:
Haddon Hall at 1121 Boardwalk is an E-plan hotel completed in 1922–1929 and executed in the Beaux Arts style. The main tower block is 15 stories with a central 3-story penthouse level; it was completed in 1929. Two flanking projecting blocks, 12 stories tall, were built in 1921–1922 as additions to an earlier iteration of the hotel, a frame building constructed in 1896. While some of the building's exterior is covered in a smooth stucco in 2023, contemporary photography and newspaper descriptions indicate the concrete and steel building originally had a red brick, Indiana limestone, and granite exterior with terra cotta details. Some of these original exterior materials are still visible, albeit painted. Typical of Beaux Arts design, exterior walls feature inset decorative detailing, quoins, pilasters, string courses, dentil molding at cornice levels, and roof-line balustrades. Residential-level windows are 1/1 sash. Windows in the lower levels are a mix of multi-light sash, horizontal sliders with rounded-arch mixed transoms; some windows have been infilled. The porte cochere on the southwest elevation is not original; it does not appear in contemporary photography from the 1920s.

A two-story commercial wing along the boardwalk was completed in 1921, also built as an addition to the 1896 iteration of Haddon Hall. Commercial space on the first level was arcaded, but many of the rounded-arch openings have been infilled. Rounded-arch windows on the second-story promenade are replacement. Limestone, brick, and terra cotta components visible on the exterior of this two-story building reflect how the exterior of the main hotel blocks used to appear.

Interior Description:
Not Applicable.

Survey Name:	**OCEAN WIND INTENSIVE-LEVEL ARCHITECTURAL SURVEY**	Date:	May 3, 2023
Surveyor:	**Ann Keen (HDR), Liz Blackwell (SEARCH)**		
Organization:	**HDR and SEARCH**		

BUILDING ATTACHMENT

Historic Sites #:

Setting:
Haddon Hall is part of **Error! Reference source not found.**located on the north side of the Boardwalk, between South Pennsylvania Avenue and South North Carolina Avenue in Atlantic City, Atlantic County. Other buildings in the immediate area vary in scale and include restaurants, hotels, and casinos. Directly across South North Carolina from Haddon Hall is a paved parking lot where the Chalfonte Hotel was located until 1980, when it was demolished.

ELIGIBILTY WORKSHEET

Historic Sites #:

History:
Atlantic City is located on Absecon Island, where the Lenni-Lenape tribe often visited to fish and collect shells they used as currency. Jeremiah Leeds built the first structure on the island in 1785, and his descendant had built seven permanent dwellings by 1850 (Town Square Publications 2010). The city incorporated in 1854 and rail development soon followed. The city grew quickly in the late nineteenth century as a resort town located near New York and Philadelphia. Unlike primarily residential communities on the New Jersey Shore, Atlantic City development included businesses, recreational spaces, and tourist attractions like theaters and the Boardwalk. Half of the Boardwalk was destroyed in the Great Atlantic Hurricane of 1944. The city's popularity continued through the mid-twentieth century. but diminished in the 1950s when air travel allowed vacationers more options (ACFPL 2021). Atlantic City was heavily damaged by the Ash Wednesday Storm of 1962, which flooded and destroyed beachfront properties and roads and caused major coastline loss (NPS 2019). Another wave of large-scale development followed the city's gambling legalization in 1976 (ACFPL 2021).

The Resorts Casino Hotel was the first casino-hotel in Atlantic City, and the first legal casino outside of the state of Nevada. Originally named Haddon Hall, the extant components of the hotel were constructed in stages beginning in 1920–1921. The oldest extant component of Haddon Hall is the two-story arcade along the Boardwalk, between South North Carolina and Mansion Avenues (*Atlantic City Gazette-Review* 1920:4). The hotel complex expanded following its merger with the neighboring Chalfonte Hotel (no longer extant), immediately southwest of Haddon Hall across South North Carolina Avenue (*Atlantic City Gazette-Review* 1921a:2; *Atlantic City Gazette-Review* 1921b:1). Construction on the "Boardwalk wing," a 12-story addition built by the George A. Fuller Company of New York, began construction in 1921 and was completed in the summer of 1922 (*Press of Atlantic City* 1921:1). Similarly, the hotel constructed an addition on the Mansion Avenue side of the building between 1924–1925, including a corridor entrance connecting the Haddon Hall to the Chalfonte (*Atlantic City Gazette-Review* 1924:1; *Press of Atlantic City* 1925:2). The central frame section of Haddon Hall (built in 1896) was demolished in 1928 to allow for the construction of the current central block, which was designed by Philadelphia architects Rankin & Kellogg (*Atlantic City Sunday Press the Sunday Gazette* 1928a:13). The project was awarded to New York-based Turner Construction, and broke ground in October 1928 (*Atlantic City Sunday Press the Sunday Gazette* 1928b:13). It was completed in 1929.

Like many beachfront hotels, what was then known as Chalfonte-Haddon Hall leased its buildings to the Army between 1943 and 1946, where it was nicknamed "Camp Boardwalk." Haddon Hall was retrofitted to serve as a medical facility, and with the Chalfonte, Traymore, and other Atlantic City hotels, it was officially known as the Thomas England General Hospital. Haddon Hall was noted as the hospital's main building. The Haddon Hall section of the hospital had capacity for approximately 2,000 patients. By 1945, the hospital was the largest in the United States specializing in amputations and neurosurgery (IrishBrigade.com n.d.)

Upon its return to the Leeds & Lippincott Company, Chalfonte-Haddon Hall was re-opened to the public. With talk of gaming legalization in Atlantic City, Resorts International (formed in 1968), purchased Leeds & Lippincott Company and its hotels, renovating Haddon Hall in preparation for the passage of the 1976 gaming referendum. Haddon Hall, known from that point as the Resorts Casino Hotel, re-opened in 1978 as a hotel/casino. The Chalfonte Hotel, unable to meet the minimum room requirement to be converted into a gaming hotel, was demolished in 1980. The site was redeveloped into parking for the Resorts Casino Hotel. In 2002, the Rendezvous Tower was constructed, replacing a Ramada Inn on the site. The new tower opened in 2004 (Resorts Casino Hotel 2023; Olshan 2001:25).

ELIGIBILTY WORKSHEET

Historic Sites #:

Significance:
1121 Boardwalk is associated with pre-World War II, pre-gambling-era development Atlantic City. The location of a Quaker rooming house beginning in 1869. Expansion took place over the years, culminating in construction of a hotel with a 400-person capacity on the site in 1896. This iteration of Haddon Hall was expanded between 1920 and 1928 to include a two-story arcade and promenade along the Boardwalk and two 12-story wing additions. Haddon Hall was developed by Leeds & Lippincott Company, which expanded the hotel in response to the growing popularity of Atlantic City as a resort area, and commissioned the replacement of the 1896 central building with a 16-story concrete and steel structure capped by a 3-story penthouse structure. Extant components of Haddon Hall were designed by the Philadelphia-based architecture firm of Rankin & Kellogg.

The Resort Casino Hotel is an example of a Beaux Arts-style high-rise hotel designed by Philadelphia-based architects Rankin & Kellogg. Rankin & Kellogg's portfolio includes 72 buildings, primarily residential and commercial types executed in the Beaux Arts style.

As the main building associated with the Thomas England General Hospital during World War II, Haddon Hall was associated with advanced amputation and neurosurgery operations and rehabilitation, which bears additional research.

Eligibility for New Jersey and National Registers: ☒ Yes ☐ No **National Register Criteria:** ☒ A ☐ B ☒ C ☐ D

Level of Significance ☒ Local ☐ State ☐ National

Justification of Eligibility/Ineligibility:
The extant 1920s components of Haddon Hall were designed by the Philadelphia-based architecture firm of Rankin and Kellogg. The firm was responsible for the central tower block, its two flanking wings, and two-story arcade building. The building is associated with both the development of Atlantic City as a seaside resort and the use of Atlantic City hotels for the Thomas England General Hospital during World War II. Thus Haddon Hall is significant under Criterion A for Commerce and (potentially, with additional research) Health/Medicine. The hotel is not known to be associated with historically important persons; therefore, it is not significant under Criterion B. The hotel is associated with Philadelphia-based architects Rankin & Kellogg, who designed several local landmarks, including the Camden County Courthouse and Jail, and United States Post Office and Custom House in Camden, New Jersey. Haddon Hall is an example of the firm's Beaux Arts designs; the building holds significance under Criterion C for Architecture. The hotel is not likely to yield information important to prehistory or history; thus, it is not significant under Criterion D.

Haddon Hall has been subject to modifications through the years, including its porte cochere entrance addition on its primary elevation and modifications to the two-story arcade building, impacting its integrity of design, materials, and workmanship. However, enough of the hotel design and materials are extant to be able to convey the building's significance under Criterion A and C. It is therefore recommended Eligible for inclusion in the NRHP at the local level, with significant periods including 1921–1929, reflecting its construction period, and 1943–1946, reflecting its use as a hospital during World War II.

ELIGIBILTY WORKSHEET

Historic Sites #:

For Historic Districts Only:

Property Count: Key Contributing: _________ Contributing: _________ Non-Contributing: _________

For Individual Properties Only:

List the completed attachments related to the property's significance:

Narrative Boundary Description:
The survey boundary includes the entire legal parcel associated with the building at 1121 Boardwalk.

CONTINUATION SHEET

Historic Sites #:

ADDITIONAL PHOTOGRAPHS

Photo Description:
Resorts Casino Hotel, 1121 Boardwalk, view to the northeast. 2004 tower on left, Haddon Hall on right.

Photo Description:
Resorts Casino Hotel entrance at Haddon Hall, 1121 Boardwalk, view to the southeast.

Survey Name: **OCEAN WIND INTENSIVE-LEVEL ARCHITECTURAL SURVEY** Date: May 3, 2023
Surveyor: **Ann Keen (HDR), Liz Blackwell (SEARCH)**
Organization: **HDR and SEARCH**

CONTINUATION SHEET

Historic Sites #:

ADDITIONAL PHOTOGRAPHS

Photo Description:
Haddon Hall, 1121 Boardwalk, view to the northeast.

Photo Description:
Haddon Hall, 1121 Boardwalk, view to the southeast.

Survey Name: **OCEAN WIND INTENSIVE-LEVEL ARCHITECTURAL SURVEY** Date: May 3, 2023
Surveyor: **Ann Keen (HDR), Liz Blackwell (SEARCH)**
Organization: **HDR and SEARCH**

CONTINUATION SHEET

Historic Sites #:

Figure 1. Sketch rendering of the 12-story addition to Haddon Hall, 1921 (*Press of Atlantic City* 1921:1)

CONTINUATION SHEET

Historic Sites #:

Figure 2. Photograph commemorating the completion of Haddon Hall project, 1929 (Atlantic Foto Service 1929).

Appendix O. Responses to Comments on the Draft Environmental Impact Statement

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TABLE OF CONTENTS

LIST OF TABLES

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O.1. Introduction

On June 24, 2022, BOEM published a notice of availability for the Ocean Wind 1 Offshore Wind Farm EIS, consistent with the regulations implementing NEPA (42 USC 4321 et seq.), to assess the potential impacts of the Proposed Action and alternatives. The Draft EIS was made available in electronic form for public viewing at https://www.boem.gov/renewable-energy/ state-activities/ocean-wind-1, and hard copies or electronic copies were delivered to other entities as specified in Appendix K of the Draft EIS. The NEPA review process requires agencies to allow the public the opportunity to comment on a Draft EIS. The notice of availability initiated a 45-day public comment period for the Draft EIS. BOEM extended the public comment period by 15 days. The comment period closed on August 23, 2022. This appendix describes the Draft EIS public comment processing methodology and definitions, includes responses to comments received on the Draft EIS, and describes where specific updates to the Final EIS can be found in the document.

O.2. Objective

BOEM reviewed and considered all written and oral public submissions received during the Draft EIS public review and comment period. BOEM's goal was to identify comments to be addressed in this Final EIS and to categorize those comments based on the applicable resource areas or NEPA topics. This categorization scheme allowed subject matter experts to review comments directly related to their areas of expertise and allowed BOEM to generate statistics based on the resource areas or NEPA topics addressed in each of the comments. All public comment submissions received can be viewed online at http://www.regulations.gov by typing "BOEM-2022-0021" in the search field.

O.3. Methodology

O.3.1 Terminology

The following terminology is used throughout this appendix:

- Submission: The entire content submitted by a single person or group at a single time. For example, a 10-page letter from a citizen, an email with a portable document format (PDF) attachment, and a transcript of an oral comment given at a public hearing meeting were each considered to be a submission.
- Comment: A specific statement within a submission that expresses a sender's specific point of view, concern, question, or suggestion. A comment can consist of more than once sentence, as long as those grouped sentences express a single idea. One submission may contain many comments.
- Substantive Comment: Draft EIS submissions were reviewed to identify and categorize "substantive" comments. To be substantive, a comment must relate to the reasonably foreseeable impacts of the Proposed Action, alternatives, or cumulative actions and do one or more of the following:
    - Question (with supporting rationale) the accuracy of information in the Draft EIS
    - Question (with supporting rationale) the adequacy of, methodology for, or assumptions used for the environmental analysis
    - Present new information relevant to the analysis
    - Present reasonable alternatives or mitigation measures other than those analyzed in the Draft EIS
    - Present or cause modifications to alternatives or mitigation measures analyzed in the Draft EIS
    - Correct factual errors in the content of the Draft EIS

- General Comment: General comments are comments other than substantive comments. General comments may: (1) express interest or concern regarding an impact topic without providing specific comments on the information, methods, or findings presented in the Draft EIS, (2) express general support for or opposition to the proposed Project, or (3) comment on a topic unrelated to the proposed Project.

O.3.2 Comment Submittals

Federal agencies, state/local/tribal governments, and the general public had the opportunity to provide comments on the Draft EIS via the following mechanisms:

- Electronic submissions via www.regulations.gov on docket number BOEM-2022-0021;
- Hard-copy comment letters submitted to BOEM via traditional mail; and
- Comments submitted verbally at each of the public hearings.

BOEM held three online public hearings via Zoom to solicit verbal comments to inform preparation of the Final EIS. The hearings were free and open to the public with no reservations required. Locations and dates of these hearings are outlined in Table O.3-1.

Table O.3-1 Public Hearings

Date	Time	Location
July 14, 2022	1:00 p.m. Eastern Time	Zoom Webinar
July 20, 2022	5:00 p.m. Eastern Time	Zoom Webinar
July 26, 2022	5:00 p.m. Eastern Time	Zoom Webinar

All submissions initially provided by methods other than www.regulations.gov, including the transcripts of comments recorded at each public hearing listed in Table O.3-1, were uploaded to the docket. Each submission, including testimony by individual speakers at the public hearings listed in Table O.3-1, was assigned a unique identification number. That unique Submission ID was retained throughout the comment management process, for both submissions and the individual comments within those submissions.

O.3.3 Comment Processing

BOEM downloaded and reviewed all submissions from regulations.gov. These submissions were provided in Hypertext Markup Language (html) format, while attachments provided by stakeholders as part of their regulations.gov submission were typically provided in PDF or Microsoft Word format. Text from all formats was parsed, coded, and exported into a single Microsoft Excel file that served as the primary submission database. In cases where an attachment did not contain comments specific to the docket for the Ocean Wind 1 Draft EIS, the attachment was retained separately for BOEM reference as applicable, linked to the main body of the submission through the unique Submission ID. Examples of this type of attachment include copies of comment letters that were originally submitted during the scoping period, copies of comment letters that were originally submitted on another docket, or attached photos, published reports, news articles, or other secondary material. The submission database also included information about each submission, including the submitter’s contact information, submission date, and whether the submitter was a government entity or agency.

Each submission and all oral testimony were read to identify individual substantive and general comments (as defined under Section O.3.1, *Terminology*). Each comment was parsed, coded, and exported to a spreadsheet that served as the master comment database. Each comment then received a unique comment ID number, tied to the Submission ID. For example, the fourth comment identified in regulations.gov submission 0001 was identified as BOEM-2022-0021-0001-0004.

Substantive comments from cooperating agencies and the lessee were organized by agency or organization and are presented verbatim in Sections O.4 and O.5. Other agency, stakeholder, and public comments were each assigned to one section of the Draft EIS, based on the document's table of contents, or to a general topic such as "NEPA/Public Involvement Process." Substantive comments are presented verbatim in Section O.6. General comments are summarized in Section O.7 and the specific comments that contributed to a comment summary are identified by comment number.

O.4. Responses to Cooperating Agency Comments on the Draft EIS

O.4.1 Cooperating Federal Agencies

O.4.1.1. Advisory Council on Historic Preservation

Table O.4-1 Responses to Comments from the Advisory Council on Historic Preservation (Letter No. 1273)

Comment from Advisory Council on Historic Preservation	Response
Previous Consulting Party Concerns – As part of prior consultation meetings, several consulting parties raised questions and concerns regarding the BOEM's identification of historic properties within the Area of Potential Effect (APE), particularly within the Visual APE. The DEIS materials, specifically Appendix N, does not appear to provide context for how those prior concerns were responded to and/or addressed. While responses to the comments may be reflected in the DEIS, we encourage the BOEM, as part of its response to the DEIS comments and as part of the upcoming consultation meeting, address the reconciliation of those comments. These efforts are critical to the BOEM exhibiting how it has complied with the Standards for developing environmental documents to comply with Section 106, as described in 36 CFR § 800.8(c)(1).	BOEM has provided multiple opportunities to Section 106 consulting parties to review information about the Project and provide their comments on the Project and shared information. This includes the distribution of the following: the complete terrestrial archaeological resources report, complete marine archaeological resources report, complete historic resources visual effects assessment, complete cumulative visual effects assessment report, and a technical memorandum detailing the delineation of the APE for the Project on March 21, 2022; and the supplemental architectural intensive-level survey report on April 1, 2022. Ocean Wind revised the distributed technical reports for BOEM based on consulting party comments and information from the revised versions of these reports is included in the Final EIS. BOEM will distribute the Final EIS to consulting parties on May 26, 2023.

Comment from Advisory Council on Historic Preservation	Response
Cumulative Effects – The ACHP appreciates the BOEM's analysis of the cumulative visual effects of the undertaking on historic properties as it relates to other offshore wind energy development activities proposed in surrounding lease areas. As indicated in previous and ongoing offshore wind consultations, the ACHP sees this analysis as a pivotal component when assessing and justifying the agency and applicant's rationale for determining and resolving effects to historic properties. To that end, the BOEM's analysis identified that the undertaking will result in cumulative visual effects on those historic properties already being adversely affected by visual effects; however, the discussion on how the BOEM has considered the cumulative effects in addition to those effects occurring directly from the undertaking is unclear. We recommend that further consideration and discussion be given to the overall nexus of effects on the affected historic properties and that this is reflected in DEIS analysis and in the proposed resolution measures.	BOEM's analysis of cumulative visual effects in the Draft EIS is supported by a cumulative historic resources visual effects analysis, which was distributed to consulting parties, including ACHP, on March 21, 2022. This document describes the approach for analysis, including assessment of cumulative visual effects only on historic properties adversely affected by the proposed Project. This approach is taken as a means of addressing the degree to which the proposed Project contributes to cumulative effects by percentage, relative to the other planned projects with potential to contribute adverse effects on the historic property. BOEM incorporated revisions to the historic resources visual effects assessment and VIA into the Final EIS analysis of affected historic properties. These revisions may trigger additional revisions to the cumulative historic resources visual effects analysis. As part of these revisions, BOEM will continue to work with consulting parties to ensure their input is reflected in the proposed resolution measures to be included in the Final EIS, including the Memorandum of Agreement attached to Appendix N.
Phased Identification – Pursuant to 36 CFR § 800.4(b)(2), the BOEM has also determined the need to phase and defer identification and assessment of effects related to the inshore cable route extensions and onshore cable routes added in March 2022 and associated with Oyster Creek landfall until after the execution of the MOA and issuance of the FEIS. As drafted, the agreement does not effectively delineate the process that BOEM and the applicant will follow to complete identification and assessment of effects and any subsequent resolution measures. The current draft folds the proposed phased and deferred process into the mitigation stipulation, which could result in confusion during implementation. The ACHP recommends separating out this requirement into its own stipulation that can inform any additional resolution efforts associated with affected historic properties.	BOEM has revised Memorandum of Agreement Stipulation I.A.1 to remove reference to phased identification. A new stipulation has been inserted as IV to address phased identification and assessment separate from measures to mitigate adverse effects. The new stipulation addresses the process BOEM and Ocean Wind will follow for phased identification, including the approach for consultation with Section 106 consulting parties for resolution measures if historic properties are identified and adverse effects assessed through the phased identification process.

Comment from Advisory Council on Historic Preservation	Response
Mitigation Measures – At this time, the ACHP does not have any substantive comments on the proposed mitigation measures for those historic properties that will be adversely affected; however, we encourage the BOEM to continue refining and detailing the specifics of the treatment plans with consulting parties to the greatest degree possible. The ability of the BOEM to reach agreement on the scope, limiting parameters, and timing associated with the proposed mitigation measures, will afford a more productive and focused consultation as well as avoid potential disagreement process on the finalized treatment plans.	Draft historic property treatment plans were provided in Appendix N as attachments to the draft Section 106 Memorandum of Agreement. BOEM has continued coordination with consulting parties through the Section 106 review process. Updated historic property treatment plans are provided in Appendix N of the Final EIS. BOEM intends to continue to refine the specifics of individual historic property treatment plans with relevant consulting parties in preparation for the release of the Final EIS and Memorandum of Agreement. This will include distribution of the revised Memorandum of Agreement, including attached treatment plans, for consulting party review and comment. BOEM will seek additional input on resolution of adverse effects from consulting parties during forthcoming consulting party meetings.
Comments on Draft EIS Appendix N (Finding of Effect)	
N.5. Phased Identification. Page N-26: As noted in our letter, recommend revisions to this section and the MOA to better separate phasing and deferring of 106 being proposed.	Please refer to the response to comment 1273-0004. Reference to the new, separate Stipulation IV in the Memorandum of Agreement that addresses the process for phased identification has been added to Section N.5 of Appendix N.
Attachment A (MOA). Page 1: PA - Perhaps call this NJ-NY PA instead of just PA. I'm not sure if it's needed to include this PA as an attachment or perhaps just name the PA.	Page 1: BOEM will revise the Memorandum of Agreement to refer to the Programmatic Agreement as NJ-NY PA. Page 1: The Memorandum of Agreement will be revised to reference the Programmatic Agreement in lieu of attaching the full document.
Attachment A (MOA). Page 1: Regarding the statement "WHEREAS, in accordance with 36 CFR 800.3, BOEM invited ACHP to consult on the Project on March 30, 2021, and ACHP accepted on April 6, 2021", this sequence is inaccurate. On March 23, 2021, the ACHP provided its guidance on BOEM's use of 800.8(c) consistent with that letter it was on August 15, 2022, we indicated our formal participation, upon receiving the DEIS and AE finding. Recommend revising this clause and relocating it to later in the preamble.	Page 1: The WHEREAS clause regarding time sequence of correspondence has been corrected. The page 1 reference to ACHP now indicates "and ACHP responded with acknowledgement and guidance regarding NEPA substitution on March 23, 2021" and reference to ACHP indication of formal participation has been relocated to the bottom of page 2. Page 2 language clarifies: "upon receiving the Draft EIS, including Appendix N, *Finding of Adverse Effect*, ACHP notified BOEM that it will formally participate in this Section 106 consultation via letter sent on August 15, 2022."
Attachment A (MOA). Page 1. Regarding the statement "Both Section 106 reviews for the lease issuance and the approval of the site assessment plan were considered", replace with "which underwent Section 106 review".	Page 1: The language "Both Section 106 reviews for the lease issuance and the approval of the site assessment plan were considered..." was replaced with recommended language, "which underwent Section 106 review."

Attachment A (MOA). Page 2. Regarding the statement "be no visual adverse effect to these to these two NHLs because ocean views are not character-defining features of these historic properties", has NPS opined on this finding? I think it would be helpful to know.	Page 2: Regarding the finding of "no visual adverse effect" on the two NHLs (Lucy the Margate Elephant and Atlantic City Convention Hall), in response to comments from New Jersey SHPO and additional research presented in the revised historic resources visual effects assessment, BOEM has revised its findings in Appendix N and Section 3.10 to find both NHLs adversely affected by the Project. Regarding consultation with the National Park Service, BOEM has undertaken the following efforts to solicit input from the National Park Service: distribution of the complete historic resources visual effects assessment, complete cumulative visual effects assessment report, and a technical memorandum detailing the delineation of the APE for the Project on March 21, 2022; distribution of supplemental architectural intensive-level survey report on April 1, 2022; distribution of the Draft EIS to consulting parties for review and comment on June 24, 2022; distribution of the revised technical reports, revised draft finding of adverse effect, and revised draft Memorandum of Agreement to Consulting Parties on November 11, 2022; and invitation to provide input during Consultation Meeting #1 on March 8, 2022, Consultation Meeting #2 on May 4, 2022, Consultation Meeting #3 on November 30, 2022, Consultation Meeting #4 on February 22, 2023, and Consultation Meeting #5 during the second quarter of 2023. The National Park Service did not submit comments on the technical reports distributed in March; the National Park Service did participate in Consultation Meeting #1 but did not provide any additional input during the meeting. The National Park Service did participate in Consultation Meeting #2 and requested a link to the time-lapsed simulation shown during the presentation, which was provided. The National Park Service did not submit public comments on the Draft EIS. The National Park Service did provide comments on the revised technical reports in December 2022 and that input focused on consideration of cumulative effects on historic properties, impacts from nighttime lighting and associated visual simulations, approach to considering vegetation as a visual obstruction, and approach to considering parcels with no structures or no habitable structures. The National Park Service did participate in Consultation Meeting #3 and requested BOEM follow up to discuss the Oyster Creek route crossing at Island Beach Park and the park's status as a Land and Water Conservation Fund site, asked for an explanation of nighttime lighting impacts assessment approach, requested clarification on a visual

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	simulation image, and asked BOEM to share input about when central Atlantic leasing areas would be included in analysis of cumulative effects. The National Park Service participated in Consultation Meeting #4 and expressed several comments regarding nighttime lighting.
Attachment A (MOA). Page 2. Regarding the statement "WHEREAS, within the range of the Project alternatives…be adversely affected with the implementation of the undertaken", I would recommend that this Stipulation and the ones below be revised to more closely reflect our example clause that relates to the finding of adverse effect. I'm fine with it being several clauses due to the different APE's but the AE for the undertaking gets lost in the current language. WHEREAS, [Agency abbreviation] has determined that the undertaking may have an adverse effect on [insert name of historic property(ies)], which ["is" or "are"] ["listed in" or "eligible for listing in"] the National Register of Historic Places, and has consulted with the [insert name of State or Tribe] ["State" or "Tribal"] Historic Preservation Officer (["SHPO" or "THPO"]) pursuant to 36 CFR Part 800, the regulations implementing Section 106 of the National Historic Preservation Act (54 U.S.C. § 306108);	Page 2: Memorandum of Agreement clauses have been revised to more closely reflect the ACHP example clause that relates to the finding of adverse effect for the undertaking.
Attachment A (MOA). Page 2. Replace "avoid adverse effects" with "avoid adversely affecting". In previous consultation, the has been significant CP confusion concerning how BOEM describes the adverse effect from the undertaking being avoided for properties within the APE, which has lead to CPs thinking there might be more than one finding.	Page 2: "Avoid adverse effect..." has been replaced with recommended language "avoid adversely affecting."

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Attachment A (MOA). Page 3. Regarding the statement "[Month XX, 20XX], BOEM invited the USACE to sign this MOA as a concurring party, and the USACE accepted the invitation to sign this MOA as a concurring party": A non-lead federal agency is not required to sign an MOA for an undertaking to complete the Section 106 process. The lead agency signs the Section 106 agreement on behalf of the non-lead agencies to fulfill their collective responsibilities for the undertaking. However, non-lead federal agencies should sign the MOA if they have been assigned responsibility for certain actions in the implementation of that agreement. In this case, the non-lead agencies should sign the MOA as invited signatories. If the non-lead agencies would like to sign an MOA in which they have not been assigned any specific responsibilities, they may sign as a concurring party. If a non-lead agency does not sign an MOA, it does not prevent the agreement from being executed nor does it alter the fact that its responsibilities under Section 106 will be satisfied through the implementation of the agreement.	Page 3: Thank you for describing the variety of scenarios that provide for non-lead agencies to sign project-level Memorandum of Agreement documents. In this case USACE is a non-lead federal agency for this undertaking, but BOEM invited that agency to sign the Memorandum of Agreement as a concurring party because construction of the Project requires a Department of the Army permit from USACE for activities that result in the discharge of dredge or fill material into jurisdictional wetlands or other waters of the United States pursuant to Section 404 of the CWA, and activities occurring in or affecting navigable waters of the United States pursuant to Section 10 of the RHA. However, BOEM did not invite USACE to sign the Memorandum of Agreement as an invited signatory because that agency does not have responsibilities for actions in the implementation of the Memorandum of Agreement.
Attachment A (MOA). Page 3. Revise "is" to "as"?	Page 3: Use of "is" on page 3 has been revised to "as."
Attachment A (MOA). Page 4. Regarding the statement "any consulting party to sign this MOA or otherwise concur does not invalidate or affect the effective date of this MOA, and consulting parties who choose not to sign this MOA will continue to receive information if requested and have an opportunity to participate in consultation as specified in this MOA", this merely restates what the regulations and the ACHP's guidance indicates regarding signatories and concurring parties. It can stay if requested, but it seems unneeded.	Page 4: While this information restates what is required in Section 106 regulations and ACHP guidance, BOEM chose to retain the language in the Memorandum of Agreement for the benefit of concurring parties who are less frequently involved in the Section 106 process and may benefit from having this information included within the agreement for reference.
Attachment A (MOA). Page 4. Regarding "June 24, 2022 to August 8, 2022", update needed.	Page 4: Reference to June 24, 2022, has been updated to August 8, 2022.
Attachment A (MOA). Page 5. Stipulation A.1. This item seems to include the phasing and deferring of identification and assessment of adverse effects. The ACHP recommends clearly separating out the process for phased identification and assessment instead of folding it in the measures to mitigate stipulation. Recommend a separate stipulation earlier in the agreement focused on the phased component. As currently written it blends the resolution of know effects with the phasing process.	Page 5: BOEM has revised Memorandum of Agreement Stipulation I.A.1 to remove reference to phased identification. A new stipulation has been inserted as IV to address phased identification and assessment separate from measures to mitigate adverse effects. Please see related responses to comments 1273-0004 and 1273-0006.

Comment from Advisory Council on Historic Preservation	Response
Attachment A (MOA). Page 6. Regarding “if warranted”, what is a warranted trigger?	Page 6: III.A.1.ii states: “Revisit avoidance recommendation and adjust avoidance buffer, if warranted, based on Phase IB/Phase II results and allow BOEM to make final determination if the avoidance buffers will need to be adjusted.” This language has been revised to: “If Phase IB identification/Phase II NRHP evaluation and site boundary delineation result in a BOEM determination of ‘not eligible for listing in the NRHP,’ BOEM will consider and make final determination on if required avoidance buffers will be adjusted.”
Attachment A (MOA). Page 6. Stipulation A.1.iv -ACHP. There are several areas in the MOA focused on treatment plans or discovery plans that include ACHP participation. Given the capacity of ACHP staff as well and the specific expertise required, we request the ACHP be removed from the review and development of these documents and exclusively include the ACHP in places associated with disputes and disagreements.	Page 6: In response to ACHP concerns about capacity to review treatment plans, ACHP has been removed from the review and development of these plans and limited its involvement to disputes and disagreements.
Attachment A (MOA). Page 7. Stipulation B.1- 5. Typically, you spell out numbers less than 10.	Page 7: Number formatting on page 7 has been revised per ACHP’s recommendation.
Attachment A (MOA). Page 7. Stipulation B.1. Attachment 5 provides a schedule for completion, but I would recommend noting a deadline for these items here in conjunction with the Attachment.	Page 7: A deadline of “prior to construction” has been added to Stipulation B.1. in the Memorandum of Agreement. BOEM will consider requiring inclusion of a new section in Attachment 5, *Treatment Plan Above-ground Historic Properties That will be Visually Adversely Affected*, that summarizes requirements for Stipulation B.1.i, in addition to measures in Stipulation III.B., which area already detailed in Memorandum of Agreement Attachment 5.
Attachment A (MOA). Page 7. Stipulation B.1.i. Regarding “Historic American Building Survey (HABS) Level II documentation”, recommend BOEM codify as much as possible the terms of these treatment plans in the MOA.	Page 7: BOEM appreciates your recommendation and will consider providing additional details present in Memorandum of Agreement Attachment 5 related to HABS Level II documentation requirements in Stipulation III.B, where applicable.
Attachment A (MOA). Page 7. Stipulation B.1.i. HABs Level II standards. Has the NPS and CP weighed in on the selected level of HABS?	Page 7: The National Park Service and respective consulting parties have not provided input on preferred mitigation to resolve adverse effects on any of the 10 affected properties. The National Park Service did not provide comments on the Draft EIS. However, the draft Memorandum of Agreement was be redistributed in advance of Consultation Meeting #3 and consulting parties, including the National Park Service, had an additional opportunity to provide input at that time.

Comment from Advisory Council on Historic Preservation	Response
Attachment A (MOA). Page 9. Delete “ACHP [if ACHP chooses to participate]”.	Page 9: Reference to ACHP has been removed on page 9.
Attachment 1 – Programmatic Agreement. Recommend including this PA as an attachment only if necessary as referencing the document by name should be adequate.	Appendix N was revised to reference the Programmatic Agreement in lieu of attaching the full document.
Attachment 4 – Treatment Plan Ancient Submerged Landform Features. Page 20. The ACHP requests the HPTP and the MOA be revised to limit ACHP involvement to only when resolving disputes and disagreements under the MOA’s terms.	In response to ACHP concerns about capacity to review treatment plans in comment 1273-0007, ACHP has been removed from the review and development of these plans and limited its involvement to disputes and disagreements.

O.4.1.2. U.S. Environmental Protection Agency

Table O.4-2 Responses to Comments from U.S. Environmental Protection Agency (Letter No. 0609)

Comment from U.S. Environmental Protection Agency	Response
General Comments. EPA acknowledges changes made to clarify impact levels based on our comments on the administrative draft. In particular, we appreciate the resource-specific impact definitions added to the various sub-sections within Chapter 3. We recommend Section 3.3 be further revised to explicitly state the four-level classification scheme (negligible, minor, moderate, or major) and to clarify how duration of impacts are considered in this classification. Please clarify the distinction between minor and moderate impact level definitions for the Air Quality section. Currently Table 3-4-1 groups minor to moderate impacts together, however there are presumably distinctions between minor and moderate classifications that are not clear.	BOEM’s classification for levels of impact is addressed in Section 3.3. In Table 3.4.1-1 the distinction between “minor” and “moderate” is a qualitative evaluation based on predicted emission levels and durations and the size of the affected region. Minor: Measurable impacts that occur would be small and the affected resource is expected to recover completely without remedial or mitigating action. Moderate: The affected resource would recover completely when remedial or mitigating action is taken.
When evaluating project effects, we recommend using existing environmental conditions as the baseline for comparing impacts across all alternatives, including the no action alternative. This provides an important frame of reference for quantifying and/or characterizing magnitudes of effects and understanding each alternative’s impacts and potential benefits.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. A detailed description of BOEM’s methodology for assessing impacts is provided in Section 1.6 of the Final EIS.

Comment from U.S. Environmental Protection Agency	Response
Alternatives. Table 2-4 provides a comparison of impacts to each resource category using a few different scenarios: the no action alternative, the proposed action, the incremental difference of impacts from the proposed action and other ongoing and planned activities (including offshore wind activities) and for each of the different alternatives. A clear explanation of how the impacts in each scenario were analyzed to support the proposed action should be provided. Additionally, the DEIS characterizes most alternatives as causing similar impacts despite there being measurable differences in some of the alternatives (for example, Alternatives D and E which attempt to minimize impacts to habitat or resources). EPA believes that this may be an artifact of the broad and generalized metrics used to classify impacts. The DEIS should indicate how substantial a reduction in impacts would be necessary to result in any discernible difference in the impact determination given these broad evaluation metrics. Additionally, the DEIS would benefit from a clearer quantitative comparison of impacts across alternatives (when applicable) that would justify the selection of the proposed alternative.	Sections 1.6 and 3.1 of the Final EIS provide an explanation of the impact analysis approach, and additional clarification was added to Table 2-4 and Table S-2 to more clearly distinguish between impacts of each action alternative alone and cumulative impacts, consistent with Chapter 3 template changes. Resource-specific impact level definitions are presented in each resource section, and the impacts of each alternative align with the appropriate impact level, as supported by the analysis. Alternatives reduced impacts on many resources; however, they did not always result in a change to the resource’s impact level conclusion. The minimization of impacts is identified and quantified where possible in the Final EIS. For the No Action Alternative analysis in the Chapter 3 resource sections, the Final EIS was updated to present the analysis of the ongoing non-offshore wind and ongoing offshore wind activities under a separate subheading from the planned non-offshore wind and offshore wind activities. The Proposed Action and action alternatives were also updated to present the cumulative impact analysis under a separate subheading.
The current analysis of the No Action alternative is broken down into two parts within each of the Chapter 3 resource categories, a No Action scenario without other offshore wind projects and a No Action scenario that includes other offshore projects. The first of these analyses is valuable for the purpose of comparing impacts of each alternative. The second of these parts may be more valuable if moved to a separate cumulative impacts section. Creating a separate cumulative impacts section in the DEIS would allow the reader to review the cumulative impacts of the proposed action and nearby offshore wind projects more easily. This distinction could also be made in Tables 2.4.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. A detailed description of BOEM’s methodology for assessing impacts is provided in Section 1.6 of the Final EIS.

Comment from U.S. Environmental Protection Agency	Response
In S.4.1 it is unclear whether this No Action alternative includes other offshore wind projects; therefore, it is unclear in Table S-2 what the impact conclusion for the No Action alternative is based on.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. Text has been updated in Section S.4 of the Executive Summary to clarify what may be considered under the No Action Alternative. Table S-2 provides the impact for each resource. The No Action Alternative discussion for each resource area has also been updated. The impact conclusions can be found in each Chapter 3 section.
Air Quality. EPA understands that Ocean Wind, LLC is currently in the process of applying for an OCS permit. The DEIS states "emissions from the OCS source, as defined in the CAA, would be permitted as part of the OCS permit for which Ocean Wind has begun the application process. The Project must demonstrate compliance with the [National Ambient Air Quality Standards] NAAQS… The OCS air permitting process includes air dispersion modeling of emissions to demonstrate compliance with NAAQS" (p. 3.4-10). The preliminary modeling results within the OCS permit area are shown in Tables 3.4-4 and 3.4-6. EPA recommends these tables be modified to include information comparing the modelled concentrations to the NAAQS, state air quality standards, or other relevant reference measures, which would allow for a more quantitative assessment to determine if emissions would adversely impact the air quality resource.	As the commenter notes, Ocean Wind performed NAAQS and Air Quality–Related Values analyses as part of its OCS air quality permit application to USEPA. A summary of these analyses has been added to the Final EIS.
In addition, EPA recommends that BOEM conduct an analysis to determine whether emissions not covered by the OCS permit, particularly those emissions originating within the nonattainment area boundaries, will cause or contribute to a new violation of the NAAQS, increase the frequency or severity of any existing violation of the standards, or delay timely attainment of the standards. Alternatively, BOEM could ensure no adverse impact on the NAAQS from these emissions by demonstrating that they are contemporaneously offset.	Discussion of emissions not covered by the OCS permit has been added to the Final EIS. All emissions associated with the Project were included in the modeling for the OCS permit application to ensure that impacts would not be underestimated.

Comment from U.S. Environmental Protection Agency	Response
Page 3.4-10 of the DEIS states: “Long-range transport modeling is under review in conjunction with the OCS air permitting process and will be presented in the Final EIS.” This statement is in the context of the Class I area modeling that will be done in the Brigantine Wildlife Refuge. In this case, this area is only about 20 km away which is not considered “Long Range Transport” (> 50km). EPA recommends revising this to read “Modeling is under review to determine if emissions from the Project would cause or contribute to adverse impacts on the air-quality related values of a Class I area.”	The sentence has been deleted.
Some of the tables (3.4-3, and 3.4-4) present emissions estimates for Year 1 and Year 2 of construction. Please clarify why emissions for Year 2 are estimated to be substantially higher than Year 1.	Ocean Wind assumed all onshore construction occurs in Year 1 and all offshore construction occurs in Year 2 (COP Volume II, Section 2.1.3.2.1).
The DEIS states “BOEM anticipates that air quality impacts from construction and decommissioning of the Proposed Action would be minor.” (p 3.4-12). EPA understands that the summary is a conservative analysis as it assumes all emissions would directly affect the nearest county’s air, and further acknowledges that construction impacts are considered short-term. However, it is unclear how a determination of “minor” impacts can be made given the information portrayed in Table 3.4-4, which demonstrates the estimated construction emissions in relation to the total emission inventory of potentially affected counties. Please clarify how a determination of “minor” impacts can be made, when the emissions of criteria pollutants represent a substantial percentage of the potentially affected counties’ emission inventory (for example, in the case of NOx, the project construction emissions represent between 96.7-259.6% of the county emission inventories).	Although emissions totals can indicate general air quality conditions in a region, the impacts (pollutant concentrations) that result from the emissions depend on the source locations and characteristics, meteorology, topography, distances between sources and receptors, and other factors. Predicted concentrations are compared to the NAAQS. Final EIS Table 3.4-6 shows that all predicted maximum concentrations would be less than the NAAQS.
Additionally, the DEIS asserts “Given the generally low emissions of the sea vessels and equipment that would be used during proposed construction activities, any potential air quality impacts would likely be within a few miles of the source.” The assertion that vessels and equipment have “generally low emissions” is contradicted by the emissions estimates in the DEIS, which show peak NOx emissions from construction activities (primarily marine vessel emissions) exceeding the total annual emissions for 2017 of all other sources combined in Atlantic and Cape May counties.	The text has been revised in the Final EIS to address this comment and better characterize the emissions sources.

Comment from U.S. Environmental Protection Agency	Response
Qualitative statements such as “impacts due to construction are expected to be small” may be misleading. Even with the required permits impacts may not be small, these statements should be modified to better reflect the situation.	The characterization of impacts has been revised in the Final EIS based on the results of the NAAQS analysis performed for the OCS permit application.
Greenhouse Gas Emissions. Executive Order 13990 (E.O. 13990, 86 FR 7037; January 20, 2021) urges agencies to “consider all available tools and resources in assessing GHG emissions and climate change effects of their proposed actions, including as appropriate and relevant, the 2016 GHG Guidance”. EPA notes that the DEIS discloses greenhouse gas emissions (in CO2 equivalents) associated with construction and operation of the Project. EPA recommends that the data be presented both in terms of individual greenhouse gas (CO2, N2O, CH4), as well as the aggregated amount in terms of CO2 equivalents considering each pollutants global warming potential.	The individual GHGs have been added to the emissions tables.
EPA appreciates that the DEIS highlights the potential benefits associated with the Project with respect to greenhouse gas reductions. For example, the DEIS indicates that increases in renewable energy can lead to reduction in emissions from fossil-fuel powered plants and provides estimates of annual emissions avoided. EPA recommends that the DEIS incorporate an energy substitution analysis and clarify the assumptions made when calculating the emissions avoided, in particular, by specifying the changes to the resulting energy mix as energy resources are substituted for one another.	Ocean Wind used the BOEM Wind Tool to estimate avoided emissions. The avoided emissions estimate is based on the annual power generation of the Project and the associated grid emissions for each pollutant. The annual power generation was based on the Project capacity, the capacity factor, a transmission loss factor, and annual operating hours (assumed as 8,760 hours per year). The capacity is multiplied by the capacity factor and hours per year and then adjusted down by the transmission loss factor. The total annual power generated to the grid is then multiplied by the grid average annual emission factors for each pollutant from the USEPA eGRID data set to get annual emissions displacement per year for each pollutant.
Additionally, as the DEIS states that minor air quality benefits are projected, EPA recommends that BOEM expand upon this discussion to explain how the net greenhouse gas reductions would help meet relevant national and local climate action goals and commitments. As there will still be greenhouse gas emissions produced during construction and operations and maintenance, a chart comparing the magnitudes of the produced emissions and avoided emissions would also be helpful in assessing Project impacts and benefits.	Section 3.4.5 of the Draft EIS discusses the produced emissions (see Tables 3.4.3 through 3.4.5) and avoided emissions (in text) and provides the “payback period” during Project operation after which the avoided emissions (net of operational emissions) become greater than the construction emissions.

Comment from U.S. Environmental Protection Agency	Response
Climate Change. EPA recognizes the long-term potential benefits of the proposed large-scale offshore wind renewable energy project with respect to greenhouse gas reductions and climate change and acknowledges the importance of the Project for meeting New Jersey's renewable energy goals under Executive Orders 8 and 92. Furthermore, such projects are consistent with the goals outlined in Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*. To better convey potential climate benefits associated with the Project, EPA recommends that BOEM consider utilizing tools such as the Social Cost of Greenhouse Gases [Footnote 1: *See IWG SC-GHG, United States Government, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990 (Feb. 2021)*] which can demonstrate the net social benefits of greenhouse gas emission reductions across different alternatives.	Estimates of SC-GHG have been added to the Final EIS.
EPA recommends that BOEM consider the proposed action in the context of the future state of the environment in light of foreseeable climate change. Climate change can make ecosystems, resources, and communities more susceptible as well as lessen resilience to other environmental impacts apart from climate change. In some instances, this may exacerbate the environmental effects of the proposed action. While the DEIS does incorporate information about the impacts of climate change on various resource areas in Appendix F (Planned Activities Scenario), it does not fully consider the compounding impacts of climate-related vulnerabilities in the assessment of the proposed action.	Additional discussion on impacts of the Proposed Action in context of foreseeable climate change has been included in the Final EIS.
Additionally, EPA believes that the document would benefit from a more robust consideration of climate change risks to the proposed action in the description of the affected environment. This should include consideration of climate resiliency measures, particularly for infrastructure that may be vulnerable to the impacts associated with climate change (such as sea level rise, more frequent storms, etc.).	Additional discussion of how the design for onshore facilities accounts for erosion, more frequent high-intensity storm events, tidal surge, and sea level rise associated with climate change has been added to the Final EIS in Chapter 2, *Alternatives*. Additional discussion of climate change risks to the Proposed Action has been included in the Final EIS in Appendix I.
Water and Natural Resources. Pursuant to Section 320 of the Clean Water Act (CWA) (33 U.S.C. 1330; as amended by P.L. 100-4 et seq.), the Barnegat Bay-Little Egg Harbor was established as an estuary of national significance. The Barnegat Bay Partnership (BBP), which comprises federal, state, and local government agencies, academic institutions, nongovernmental organizations, and	The Draft EIS addresses IPFs that would affect Barnegat Bay. Ocean Wind would need to ensure that any action that would affect Barnegat Bay or tributaries to Barnegat Bay would not result in exceedances of water quality standards and would comply with any existing Total Maximum Daily Load requirements for any waters designated as impaired under CWA Section 303(d). All impacts on wetlands and

Comment from U.S. Environmental Protection Agency	Response
businesses working together to restore and protect the Bay, recently revised its Comprehensive Conservation and Management Plan (CCMP) for Barnegat Bay-Little Egg Harbor Estuary (January 2021). The CCMP identifies the following goals, all of which are meant to be considered/achieved in consideration of sea level rise, and includes objectives towards achievement of these goals: Water Quality – To protect and improve water quality throughout Barnegat Bay and its watershed by reducing the causes of water quality degradation to achieve swimmable, fishable, and drinkable water, and to support aquatic life. Water Supply – To ensure adequate water supplies and flow in the Barnegat Bay watershed for ecological and human communities now and in the future. Living Resources – To protect, restore, and enhance habitats in the Barnegat Bay and its watershed as well as ensure healthy and sustainable natural communities of plants and animals both now and in the future. Land Use – To improve and sustain collaborative regional approaches to responsible land use planning and open space preservation in the watershed that protect and improve soil function(s), water quality, water supply, and living resources. EPA requests that BOEM keep in mind the CCMP goals and provide enough analysis of impacts to assure that the activities proposed will not affect achievement of the CCMP goals, especially in light of climate change.	other waters of the United States that result in a loss of the resource would require compensatory mitigation per CWA Section 404. Terms and conditions of the Section 404 and RHA Section 10 permit would include various measures to avoid and minimize impacts on surface waters, including Barnegat Bay, including water quality.

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Wetland Impacts. EPA understands that Ocean Wind, LLC in parallel with the development of the DEIS is currently pursuing a CWA Section 404 permit and is conducting a wetland delineation to further inform a wetlands impact analysis. We look forward to reviewing this information, along with any proposed mitigation/restoration measures once it becomes made available. The DEIS indicates that Ocean Wind, LLC would use appropriate installation technology to minimize disturbance to the seabed and sensitive habitat. EPA recommends that the DEIS be revised to include specific details about the proposed installation technologies which would minimize impacts to wetlands. In the discussion of wetland impacts, the DEIS states “following construction, these wetland impact areas would be restored to pre-existing conditions, and herbaceous vegetation would become reestablished” (p. 3.22-9). EPA recommends that the project applicant commit to developing a Revegetation Maintenance & Monitoring Plan to ensure proper vegetation and habitat re-establishment. Section 3.22.8 of the DEIS states “No measures to mitigate impacts on wetlands have been proposed”. This contradicts what is stated in the text, for example on p. 3.22-11 where mitigation is referenced. According to the text, wetland mitigation would likely include a combination of onsite restoration of wetlands temporarily affected during construction and a wetland enhancement or mitigation banking credit purchase. EPA recommends that BOEM revise section 3.22.8 and Table H-1 in Appendix H (Mitigation and Monitoring) to reflect these mitigation measures.	Ocean Wind would be required to comply with the terms and conditions of the CWA Section 404 permit for restoring temporarily affected wetlands (e.g., onshore export cable placement), which would include the method of restoring wetland impacts. The statement regarding onsite restoration, enhancement, or mitigation banking credit purchase simply lists the options that Ocean Wind could implement to address wetland impacts. If BOEM decides to approve the Project and Ocean Wind 1 is constructed, the final issued Section 404 permit would include such restoration and mitigation details. BOEM has not proposed any specific mitigation measures for wetlands (as stated in Section 3.22.8), but Ocean Wind has proposed several measures that would avoid and reduce impacts on wetlands. Those measures (e.g., GEN-13) are cited throughout the Proposed Action analysis in EIS Section 3.22. If BOEM decides to approve the Project, BOEM may include additional measures that would be conditions of Project approval. All of these APMs are in EIS Appendix H. The statement regarding Ocean Wind using appropriate installation technologies to minimize impacts on seabed and sensitive habitats is an APM taken directly out of Ocean Wind’s COP (see COP Volume II Table 1.1-2, measure GEN-08). Ocean Wind provides no further details on this committed measure. The method/technology to install cables to minimize impacts would likely depend on final design and permitting requirements.

Comment from U.S. Environmental Protection Agency	Response
Land Use. EPA recommends the DEIS incorporate a table that indicates different land use types and impacts to the various land use types associated with each alternative. The table should quantify changes in land use and acreage impacted. A description of intended construction/development associated with construction ports should be incorporated in the description along with an explanation of separate permitting processes.	No changes in land use types are expected as a result of the Proposed Action or any alternative. Because Alternatives B, C, and D alter offshore aspects of the PDE, they would not result in different impacts on the various land use types when compared to the Proposed Action. However, additional information on land use types and acreage affected was added to the discussion of Alternative E in Section 3.14.7 to provide a meaningful comparison to the Proposed Action. The Proposed Action does not include port expansion activities. Information was added to Section 3.14.5 on page 3.14-9 to clarify that the port enhancement activities described are separate from the Proposed Action and would be evaluated as part of a separate permitting process.
Benthic. EPA appreciates commitments made by BOEM such as development of a benthic monitoring plan and the applicant-proposed measure to avoid anchoring on sensitive habitat. To better assess benthic impacts, EPA recommends revising Table 3.6.2 to compare impacts across all alternatives for each different habitat type. On p. 3.6-17: Comparison to pre-construction conditions should be included as part of the analysis of the benthic monitoring program. The total lengths of unburied cables are not disclosed in the DEIS. The DEIS should explain which phase of the project this information will be known and disclosed. On p. 3.6-23 the conclusion is made that cable emplacement would result in minor impacts while on page 3.6-24 it is stated that a main driver for a moderate impact rating includes emplacement of cables/structures. Please correct or discuss this discrepancy.	Text has been added to address the discrepancy in minor versus moderate impacts of cable emplacement. For example, “Overall impacts of cable emplacement on benthic habitats are anticipated to be negligible to moderate, depending on the location and the method of cable emplacement.” While removal of WTG positions is anticipated to result in a corresponding reduction in inter-array cable length and associated cable protection and cable installation and seafloor preparation impacts, the cable protection and cable installation and seafloor preparation area for the alternatives excluding WTG positions could not be calculated because the inter-array cable alignments associated with these alternatives have not been designed/engineered. However, acres of impacts of cables for each alternative are included in the Final EIS. Differences in impacts for Alternatives D and E compared to the Proposed Action have been added.
Recreation and Tourism. In Table L-2, for tourism/recreation, it is noted that there are expected to be neither irretrievable or irreversible impacts. Profit losses of businesses that rely on tourism could be considered irretrievable impacts, the DEIS should further discuss these impacts.	Impacts on businesses, including those that rely on tourism, as a result of the Proposed Action are described in Section 3.11, *Demographics, Employment, and Economics*. Profit losses of businesses that rely on tourism were added as a potential irretrievable impact in Table L-2.
Indian Nation Issues and Coordination. Executive Order 13175 Consultation and Coordination with Indian Tribal Governments (E.O. 13175, 65 FR 67249; November 6, 2000) was issued to establish	EIS Appendix N includes Section N.2.2.3, *NHPA Section 106 Consultations*. This section describes outreach to tribes, a government-to-government consultation meeting on June 17, 2021,

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regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, and to strengthen the U.S. government-to-government relationships with Indian tribes. EPA notes that the DEIS documents outreach to a number of federally recognized tribes with ancestral associations to lands within the Project area including the Eastern Shawnee Tribe of Oklahoma, Shawnee Tribe, Absentee-Shawnee Tribe of Indians of Oklahoma, Stockbridge-Munsee Community Band of Mohican Indians, Delaware Nation, Delaware Tribe of Indians, Shinnecock Indian Nation, Narragansett Indian Tribe, Rappahannock Tribe, Mashantucket Pequot Tribal Nation, and Wampanoag Tribe of Gay Head (Aquinnah). In addition to this information, we recommend the DEIS describe the process and outcomes of consultations with these tribal governments including major issues raised and how those issues were addressed. Additionally, EPA encourages continued outreach and involvement of tribes in evaluating terrestrial and marine archaeological resources, designing marine surveys, and interpreting results. We also recommend that tribes be invited to participate in the development of an unanticipated discovery plan (UDP) for offshore and onshore construction activities.	follow-up activities after the meeting, and Section 106 consulting party meetings, which included tribal participants. Detail has been added to describe issues raised and how those issues were addressed. Tribes that accepted BOEM's invitation to consult had an opportunity to provide input on identification of terrestrial and marine archaeological resources during Consultation Meeting #1 on March 8, 2022. BOEM shared with consulting parties the complete terrestrial archaeological resources report, complete marine archaeological resources report, complete historic resources visual effects assessment, and complete cumulative visual effects assessment report on March 21, 2022, and requested comments. In addition, the findings of these reports were discussed and BOEM sought input during Consultation Meeting #2 on May 4, 2022. BOEM sought input on its Finding of Adverse Effect during Consultation Meeting #3, which also offered tribes an opportunity to provide input on resolution of adverse effects as stipulated in the Memorandum of Agreement. Consistent with stipulations in the Memorandum of Agreement, BOEM will continue to seek involvement from the consulting tribes during implementation of treatment plans to resolve adverse effects on terrestrial and marine archaeological resources, including during fulfilment of mitigation measures that include designing marine surveys, and interpreting results. A Post-Review Discovery Plan for Terrestrial Resources and Post-Review Discovery Plan for Submerged Resources have been prepared for the Project and are included as attachments to the Memorandum of Agreement, which is attached to EIS Appendix N. These documents were included for public review with the Draft EIS. In addition, tribes that have accepted BOEM's invitation to be Section 106 consulting parties were invited to participate in Consultation Meeting #3, which discussed adverse effects on historic properties and sought input on resolution of adverse effects.
Environmental Justice and Impacted Communities. Please specify how emissions at offshore locations would have regional impacts with no disproportionate impacts on EJ populations. The DEIS states that overall air emissions associated with port activity near EJ populations would be minor, and that impacts at specific ports	Emissions at offshore locations would have regional impacts, with no disproportionate impacts on environmental justice populations, because (1) emissions generated during construction, O&M, and decommissioning of offshore infrastructure in the Lease Area would occur 15 miles offshore, (2) emissions would be mixed and dispersed

Comment from U.S. Environmental Protection Agency	Response
close to EJ populations cannot be evaluated because port usage has not been identified. EPA understands that specific ports of call have not yet been finalized, however this does not preclude BOEM from conducting a conservative analysis assuming maximum utilization of vessels for construction and operations and maintenance at each of the six potential ports of usage. Such an analysis is possible as there are readily available data sources that can estimate current vessel activity at U.S. ports [Footnote 2: See EPA's Ports Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1014J1S.pdf]. Given the information provided in Appendix N of the Construction and Operations Planin close proximity to ports who are exposed to air pollution and are at risk for developing asthma, heart disease and other health problems [Footnote 3: See EPA's National Port Strategy Assessment: Reducing Air Pollution and Greenhouse Gases at U.S. Ports. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100PGK9.pdf]. Communities with EJ concerns are often disproportionately burdened by environmental hazards and stressors, unhealthy land uses, psychosocial stressors, and historical traumas, all of which drive environmental health disparities.	into the atmosphere, (3) the prevailing wind direction (west to east, or westerlies) would generally not direct emissions back toward shore, and (4) the pollutant concentrations generated by the Proposed Action are predicted to be within the NAAQS at all locations. This clarification has been added to Section 3.12.5. Emission estimates included in COP Appendix N for the Atlantic City, New Jersey Carbon Monoxide Maintenance Area (NAM8) can be used to estimate emissions associated with utilization of the O&M facility in Atlantic City during Project construction and have been added to Section 3.12. While Ocean Wind has quantified estimated emissions by calendar year within the nonattainment area that includes Atlantic City, compliance with the NAAQS cannot be determined based on the emission inventory alone. Dispersion modeling would be required to characterize concentrations for comparison to the NAAQS. The Proposed Action's contributions to increased air emissions at the ports of Norfolk, Virginia, and Charleston, South Carolina, which are near environmental justice populations, are not quantitatively evaluated because the nonattainment/maintenance areas that include these ports are much larger and include multiple counties, which does not allow for meaningful conclusions regarding emissions at specific ports. Emissions at the Port of Paulsboro and Hope Creek are not analyzed because these ports are not in low-income or minority populations.
The DEIS should consider whether communities may already be experiencing existing pollution and social/health burdens. For example, EJ Screen analysis indicates that adjacent port communities near Paulsboro experience high levels of PM2.5, diesel particulate matter and are rated as high air toxics cancer and respiratory risk. EPA encourages BOEM to consider the cumulative impacts of these existing conditions that together with the proposed action may result in disproportionately adverse impacts on affected communities with EJ concerns. We recommend BOEM develop a stakeholder outreach/EJ public engagement plan for areas that may be impacted by the proposed action and provide an opportunity for affected communities to inform the project's mitigation measures. This outreach plan should detail information on planned engagement milestones and commitments to meetings with potentially impacted communities and community organizations.	Environmental justice populations are not present in most areas where onshore infrastructure would be located or at the ports expected to see the heaviest Project use (Port of Paulsboro and Hope Creek [New Jersey Wind Port]). BOEM has facilitated effective public outreach throughout the EIS process, including to low-income and minority populations, as demonstrated through broad participation in scoping meetings and public hearings and substantial public input received through comments submitted on regulations.gov or through verbal testimony at public meetings during scoping and the public review period for the Draft EIS. It is noted that no stakeholders representing environmental justice or disadvantaged communities requested targeted consultation and coordination to address Project impacts on disadvantaged communities during EIS scoping or the public comment period for the Draft EIS.

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We also encourage BOEM to determine if linguistically isolated populations reside in the geographic areas impacted by the proposed project and provide appropriate translation and interpretation services to ensure meaningful engagement. All outreach efforts should be documented in the EJ section of the DEIS.	
Analysis of Indirect and Cumulative Impacts. In accordance with the CEQ NEPA regulations, (Section 1508.1 (g)) effective as of May 2022) define effects or impacts to mean “changes to the human environment from the proposed action or alternatives that are reasonably foreseeable.” This definition includes indirect effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable and cumulative effects, which result from the incremental effects of the action when added to the effects of other past, present and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. As mentioned previously, EPA encourages the development of a separate section that considers cumulative impacts associated with the Project. The cumulative effects analysis would assess the impacts of each of the alternatives in combination with reasonably foreseeable future actions, which would include planned offshore wind projects. Throughout the DEIS, it is stated that the proposed action would not directly result in any port expansion, and that port improvements are not dependent on the proposed action. Consequently, impacts associated with port expansions and improvements are not considered in the DEIS. EPA believes that these activities are a reasonably foreseeable indirect effect of the proposed action, and therefore should be considered in the DEIS under NEPA. Omitting consideration of such actions results in an underestimation of the project’s impacts.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Clarification regarding BOEM’s methodology for assessing impacts has been provided in Section 1.6 of the Final EIS. Potential impacts of port expansion and improvements can be found in relevant Chapter 3 sections.

O.4.1.3. U.S. Department of the Interior, U.S. Fish and Wildlife Service

Table O.4-3 Responses to Comments from U.S. Fish and Wildlife Service (Letter No. 0922, 1177, 1265)

Comment from U.S. Fish and Wildlife Service	Response
FEDERALLY LISTED AND CANDIDATE SPECIES. The Biological Assessment (BA), submitted to the Service on May 27, 2022, and prepared by BOEM, correctly identified the appropriate federally listed and candidate species under the Service's jurisdiction that may be present in the proposed project's action area. They include the northern long-eared bat (Myotis septentrionalis, threatened [4d]), eastern black rail (Laterallus jamaicensis jamaicensis, threatened [4d]), piping plover (Charadrius melodus, threatened), rufa red knot (Calidris canutus rufa, threatened), roseate tern (Sterna dougallii dougallii, endangered), bog turtle (Glyptemys muhlenbergii, threatened), monarch butterfly (Danaus plexippus, candidate), American chaffseed (Schwalbea americana, endangered), Knieskern's beaked-rush (Rhynchospora knieskernii, threatened), seabeach amaranth (Amaranthus pumilus, threatened), sensitive joint-vetch (Aeschynomene virginica, threatened), and swamp pink (Helonias bullata, threatened). The Service provided a response to BOEM's BA on July 1, 2022, and ESA Section 7 consultation is ongoing. The Service requests that the Final Environmental Impact Statement (FEIS) is updated, as appropriate, to reflect our most recent and any future comments. The "presence of structures" portion within Section 3.7.5 of the DEIS currently states that "Due to the anticipated use of flashing red tower lights, restricted time period of exposure during migration, and small number of migrants that could cross the Wind Farm Area, BOEM and USFWS conclude that the Proposed Action would not likely adversely affect roseate terns, piping plovers, eastern black rail, and red knots. See the Ocean Wind 1 BA (BOEM 2022) for a complete discussion of the potential collision risk to ESA-listed species as a result of operation of the proposed Project". However, the Service has not concurred with this determination, and ESA Section 7 coordination with BOEM is currently ongoing. Please ensure that this Section and any other sections within the DEIS that may display incorrect information are revised.	Thank you for confirming that BOEM's BA for the Ocean Wind 1 Project correctly identifies the federally listed species that may be potentially present in the Project's action area. The inclusion of "and USFWS" in the sentence regarding the conclusion for ESA-listed species was an error. The sentence in question in the *Presence of Structures* section on page 3.7-18 has been revised by removing "and USFWS."

Comment from U.S. Fish and Wildlife Service	Response
Benthic Resources, Watercourses, Wetlands, and Permits. A public notice for a U.S. Army Corps of Engineers (Corps) permit application by Ocean Wind, LLC pursuant to Section 10 of the RHA and Section 404 of the CWA was recently released with plans illustrating the amount of impacts the proposed project would have to submerged aquatic vegetation (SAV), wetlands, and watercourses under the Corps jurisdiction. The Service is concerned about the impacts and loss of these valuable natural resources. The Service requests that BOEM ensures that the FEIS is consistent with the impacts displayed on the public notice (if they are not already), discusses mitigation for these impacts, and further explains what is being proposed to avoid or minimize impacts. For example, there is no mitigation explained for the permanent impacts to SAV and it is not clear why alternative installation methods, such as trenchless or horizontal directional drilling, were not considered to avoid SAV and the other aquatic resources within Barnegat Bay. It is also not clear what will be proposed to mitigate for permanent impacts to watercourses. The Service provided additional comments to the Corps on July 18, 2022, regarding the public notice and impacts on these resources.	SAV surveys completed for the HDD will be used to avoid SAV where practicable, e.g., Peck Bay, Oyster Creek. Ocean Wind has developed a SAV Monitoring Plan (June 2022) and SAV Preliminary Mitigation Plan (December 2022) that include pre- and post-construction monitoring of SAV along the inshore cable route and restoration for impacts that cannot be minimized or avoided. Alternative C includes avoidance of SAV beds via an alternate route through Oyster Creek (a dredged channel). Potential impacts on SAV were quantified for each alternative in the Final EIS and for each landfall; impacts on habitats for HDD and open trenching were also be quantified in the Final EIS, to determine potential impacts and mitigation needs.
Birds and the Migratory Bird Treaty Act. The Service continues to recommend incorporating or considering measures to help reduce the risks of bird collisions into the proposed project design. An example could be incorporating some of the creative thinking that was mentioned in our previous letters, referencing the Hodos (2003) and May et al. (2020) studies, which reported that the inclusion of black attachments on or painting portions of wind turbine blades black can be effective at reducing motion smear or blur and bird collisions. While BOEM has decided to not incorporate this specific recommendation into the design of the project, the Service encourages BOEM to review other studies or potential technologies that could be incorporated into the project design that may reduce collisions. Additionally, in relation to addressing possible motion smear or blur impacts in the DEIS, Section 3.7.3.2 explains that “Motion smear, a phenomenon where spinning turbine blades become deceptively transparent to the eye, can also factor into collision risk (Hodos 2003). However, offshore wind turbines are very large and spin much slower (7.8 rotations per minute) than onshore wind turbines.” As previously explained, the Hodos (2003) study explained “that as the blade diameter increases,	Since BOEM’s response to USFWS’s comments on the preliminary Draft EIS on motion smear/blur, BOEM has looked further into the referenced studies in the comment and FAA requirements for wind turbine paint. While BOEM acknowledges the May et al. (2020) study indicates a reduction in bird strikes with wind turbines with a black-painted blade, the results are preliminary, and eight turbines (half with black paint) is not a large sample size. In addition, relatively few bird carcasses were found both before and after painting the blades (a total of 42 dead birds at all eight turbines during the study period of 10 years). It is also not clear if the paint achieves the same results across different bird species, and its efficacy may be site specific. In addition, and more of a determining factor in the use of black paint on wind turbine blades in the United States, the FAA’s 2020 *Obstruction Marking and Lighting Circular* (70/7460-1M) includes a section (Section 13) on wind turbine paint requirements (for aviation safety) that states the darkest acceptable paint color is light gray, with preference of pure white. Black paint on wind turbines is not allowed under the FAA circular. As part of Ocean Wind’s Avian and Bat Post-Construction Monitoring Framework (see discussion in the next

Comment from U.S. Fish and Wildlife Service	Response
the minimum distance at which a visual deterrent will be visible increases." and that "paradoxically, the larger, slower turbines pose a greater hazard to birds in the region of the tip than do the smaller, faster turbines." As such, even though the larger turbines will spin slower, they may create a greater hazard for birds. The usage of the word "However" in the second sentence indicated above may give the impression that the larger, slower spinning turbines help alleviate the issue of motion smear. The Service recommends removing or rephasing that second sentence to avoid confusion while discussing this issue.	response below), BOEM would continue to evaluate technologies to reduce collisions if post-construction monitoring indicates action should be taken. BOEM has updated the text in Section 3.7.3.2 regarding larger turbines and slower rotations as they relate to motion smear.
Avian and Bat Post Construction Monitoring Framework. The DEIS provides multiple mentions of the avian and bat post-construction monitoring framework. Additionally, it is included in the construction and operations plan. Please note, that the Service has been working with BOEM regarding this framework during the ESA Section 7 consultation and will continue to do so. As noted in our July 1, 2022, response letter to BOEM's BA, previous Service comments on the avian and bat post-construction monitoring framework submitted to BOEM on April 11, 2022, were not addressed. Our key concern is that active monitoring efforts are proposed to continue for a maximum of 3 years, while the operational life of the proposed project is 35 years. Additionally, the Service is aware that offshore wind developers are interested in conservation measures that will provide a net positive in benefits for their projects. A monitoring framework that includes the lifetime of the project would help to ensure that this can be achieved. The Service anticipates continuing to address and work with BOEM on this issue during the ongoing ESA consultation.	Ocean Wind and BOEM recognize that active monitoring beyond 3 years may be necessary. The Avian and Bat Post-Construction Monitoring Framework states that, "Over the course of monitoring, Ocean Wind will work with BOEM, USFWS, and other relevant regulatory agencies, to determine the need for adjustments to monitoring approaches, consideration of new monitoring technologies, and/or additional periods of monitoring, based on an ongoing assessment of monitoring results." In addition, similar to previously approved COPs (e.g., South Fork, Vineyard Wind), BOEM anticipates that BOEM's COP approval conditions for avian and bat protection conditions will include an avian and bat monitoring plan for construction and operations. As part of the monitoring plan, adaptive management may be required (i.e., new mitigation measures and monitoring may be required by BOEM if impacts deviate substantially from the impact analysis in the EIS).
Section 3.7.8 of the DEIS explains that "If the reported post-construction bat monitoring results (generated as part of *Ocean Wind's Avian and Bat Post-Construction Monitoring Framework* [COP Appendix AB, Ocean Wind 2022) indicate bird impacts deviate substantially from the impact analysis included in this EIS, then Ocean Wind must make recommendations for new mitigation measures or monitoring methods (refer to Appendix H, Table H-2)." It appears that this Section should be edited to "if the reported post-construction avian and bat monitoring results…". As such, please ensure that this Section is edited in the FEIS.	BOEM has edited EIS Section 3.7.8 to replace "bat" with "bird."

Comment from U.S. Fish and Wildlife Service	Response
Edwin B. Forsythe National Wildlife Refuge and Air Quality. The project is in proximity to the Edwin B. Forsythe National Wildlife Refuge. Portions of the refuge, identified as the Brigantine National Wilderness Area, are designated as a Class 1 Wilderness Area. The Service is concerned about the potential air quality impacts to the wilderness area due to emissions and construction activities that will occur because of the proposed project. Class 1 Wilderness Areas are afforded, by Congress, Air Quality Related Value protections under the CAA and are also protected by the Wilderness Act. The Service is the Federal land manager of the Brigantine National Wilderness Area and, as such, is evaluating the project for air quality-related concerns. The Service will contact BOEM, as appropriate, if any additional information is required.	Ocean Wind performed an Air Quality-Related Values analysis as part of its OCS air quality permit application to USEPA. A summary of this analysis has been added to the Final EIS.
Adaptive Management. The Service's previous letters on the Preliminary DEIS included recommendations to include a commitment towards adaptive management, including regularly updating and adopting best management practices. As previously described, this is particularly important given the long-expected lifespan of the proposed wind farm, its potential to result in ongoing bird and bat collision and/or displacement over many years, and its role in the full build-out of offshore wind energy in the context of numerous other projects in various stages of planning/development along the OCS. New innovative technologies and solutions to protect the environment and species from the potential impacts of offshore wind are being developed while the industry continues its growth. They are being supported by offshore wind developers, scientists, and members of the public. The Service would like to ensure that all phases of the project are adaptive at applying new information as they progress. Many details would have to be worked out, but the Service is willing and would appreciate the opportunity to discuss and work with BOEM on this issue. As such, the Service continues to recommend an adaptive management section and commitment within the DEIS.	Table 2-2 of the Final EIS identifies the Avian and Bat Post-Construction Monitoring Framework, which would be implemented by Ocean Wind during operation. As stated in the framework, adaptive monitoring is an important principle of the monitoring framework. Over the course of monitoring, Ocean Wind will work with BOEM, USFWS, and other relevant regulatory agencies to determine the need for adjustments to monitoring approaches, consideration of new monitoring technologies, and additional periods of monitoring, based on an ongoing assessment of monitoring results.

Comment from U.S. Fish and Wildlife Service	Response
Supplemental Air Quality and AQRV Comments	
D.1. Incomplete or Unavailable Information Analysis for Resource Areas (D.1.1 Air Quality). This paragraph subjectively states that in BOEMs opinion that is that there is sufficient current information and that the overall impacts from the project will decrease the overall pollution in the area. However, as demonstrated in the emission estimates, especially during construction the amount of air emissions may be significant and potentially impact Air Quality Related Values (AQRVs) at Class I areas. It is requested that BOEM reevaluate this paragraph and provide a more detailed quantification of emissions and objectively describe the air quality and AQRV impacts.	Ocean Wind performed NAAQS and Air Quality-Related Values analyses as part of its OCS air quality permit application to USEPA. A summary of these analyses has been added to the Final EIS.
Suggested Language for the Paragraph from Ocean Wind 1 DEIS - Appendix G that discusses FLM responsibilities and AQRVs: The CAA defines Class I areas as certain national parks and wilderness areas where very little degradation of air quality from new sources or projects is allowed. Class I areas consist of national parks larger than 6,000 acres and wilderness areas larger than 5,000 acres that were in existence before August 1977. Class I areas are managed by the Federal Land Managers (FLM) (e.g. US Forest Service, National Park Service and the US Fish and Wildlife Service.) Projects subject to federal permits are required to notify the FLM responsible for designated Class I areas within 300 kilometers of the Project. One of the purposes of the federal Prevention of Significant Deterioration (PSD) permitting program under the CAA, is to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic or historic value. Air quality related values (AQRVs) are resources that are used to determine whether these resources may be adversely affected by a change in air quality. The resources may include visibility or specific scenic, cultural, physical, biological, ecological, or recreational resources. The Federal Land Managers AQRVs include visibility, vegetation, water quality, soils, and impacts to fish and wildlife. The potential harm from air pollution to these resources depends on how much, the type air emission exposure and the sensitivity of the resources. The FLM identifies appropriate AQRV for the Class I area and the impact to AQRVs is evaluated by the project proponent. Air quality–related values identified by USFWS for	Ocean Wind performed an Air Quality-Related Values analysis as part of its OCS air quality permit application to USEPA. A summary of this analysis has been added to the Final EIS.

Comment from U.S. Fish and Wildlife Service	Response
Brigantine Wilderness include aquatic resources, fauna/wildlife, soils, vegetation, and visibility. The project is in proximity to the Edwin B. Forsythe National Wildlife Refuge. Three distinct parts of the E.B. Forsythe Refuge have been identified as the Brigantine National Wilderness Area (WA), and are designated as Class 1 areas under the Clean Air Act (CAA). Brigantine Wilderness Area, approximately 25 miles north-northwest of the geographic center of the Project, is the only Class I area within 300 kilometers of the project. Class 1 Wilderness Areas are afforded, by Congress, Air Quality Related Value (AQRV) protections under the CAA and are afforded protections under the Wilderness Act. The Service is concerned about the potential air quality impacts to the wilderness area due to air emissions from construction activities that will occur because of the proposed project. Additional air quality protection may be warranted individually because of the project's proximity, or cumulatively because of the number of proposed future offshore wind energy leases and associated development affecting the area. The Service as the federal land manager (FLM) of the Brigantine National WA requests that the project evaluate and analyze the potential AQRV impacts, including visibility and deposition, to the Brigantine National Wilderness Area.	
Add this paragraph: The DEIS should include a description of the nearby air quality monitoring (IMPROVE, NADP, NJ DEP and EPA) and the long-term trends that these monitors are showing for each pollutant of concern. Current conditions and trends in Class I areas are for visibility are established via the IMPROVE (Interagency Monitoring of Protected Visual Environments) program and for deposition are established via the NADP (National Atmospheric Deposition Program). The Brigantine Wilderness air quality monitors are located at the Edwin B. Forsythe National Wildlife Refuge Visitor Center, approximately 4 miles west and 4 miles south-southwest of the 2 closest Brigantine Wilderness Area boundaries. Visibility and deposition at Brigantine Wilderness Class I areas has been _____ _____/ since (describe trends and provide reference).	Ocean Wind performed NAAQS and Air Quality-Related Values analyses as part of its OCS air quality permit application to USEPA. A summary of these analyses has been added to the Final EIS.
Make this a new paragraph: The CAA amendments directed USEPA to establish requirements to control air pollution from OCS oil and gas-related activities along the Pacific, Arctic, and Atlantic Coasts and along the U.S. Gulf Coast of Florida, east of 87° 30′ west longitude. . .	This comment does not request any change to the EIS.

Comment from U.S. Fish and Wildlife Service	Response
Correction: The FLM agencies evaluates project impacts as far away as 300 km from the Class I area.	
Other Suggested Additions: Include a paragraph about how the proposed actions' air emissions and contributions to climate change might impact these resources: ground-level ozone, atmospheric deposition of acids, (NADP Network) nutrients, toxics, vegetative impacts to onshore biological resources including vegetative quality, wetlands and other WOTUS, acidification of soils and waterbodies that could result in changes in community structure and biodiversity within these habitats. This paragraph should be a comprehensive look that accounts for the reasonable foreseeable future projects. Include a paragraph that addresses the potential impacts to wetlands and other WOTUS from the incremental contribution of climate change attributed to the action when combined with, past, present and other reasonable foreseeable projects.	Ocean Wind performed an Air Quality-Related Values analysis as part of its OCS air quality permit application to USEPA. A summary of this analysis has been added to the Final EIS.

O.4.1.4. National Oceanic and Atmospheric Administration, National Marine Fisheries Service

Table O.4-4 Responses to Comments from National Marine Fisheries Service (Letter No. 1287)

Comment from National Marine Fisheries Service	Response
Approach to the Alternatives Analysis: We appreciate that BOEM has made some modifications to the approach to the "No Action" Alternative, but we recommend further refinement in the approach to provide decision makers and the public with the clearest possible view of the potential impacts of the proposed action and alternative. In particular, we continue to recommend that BOEM evaluate a "No Action" scenario that does not include all future buildout throughout the analysis in the EIS. As presented in the Executive Summary and Chapter 2, the description of the No Action Alternative presumes that all other reasonably foreseeable impact- producing activities, including proposed but not yet approved offshore wind projects, have been built and these impacts are therefore included in the baseline against which other alternatives are evaluated. We are concerned that this approach leads to an incomplete description and analysis of impacts on NOAA trust resources from activities and trends in the baseline, as well as	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Clarification regarding BOEM's methodology for assessing impacts has been provided in Section 1.6 of the Final EIS. The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.

Comment from National Marine Fisheries Service	Response
from the proposed action and alternatives. This approach likely skews the impacts analysis in the DEIS in several ways: 1) By overstating the impacts of both the No Action Alternative and baseline effects; 2) by minimizing and diluting the direct and indirect effects of the proposed action and action alternatives when evaluated against the No Action Alternative and baseline; 3) by reducing the distinction in impacts among alternatives such that there is no material difference; and 4) by conflating the cumulative impacts analysis with impacts considered in the No Action Alternative	
The confusion and lack of clarity resulting from the alternative analysis approach in the DEIS are exemplified in its consideration of the effects of the proposed action on North Atlantic right whales (NARW), which may impact NMFS's ability to rely upon this analysis to support the determinations necessary to issue an ITA under the MMPA. We recommend the methodology be modified to define the No Action/baseline as the effects of existing constructed and permitted wind projects and ongoing non-wind activities and evaluate the effects of reasonably foreseeable future activities, such as future wind projects, in the cumulative impacts section of the FEIS, entirely independent from the No Action Alternative and baseline evaluation of the action alternatives. We provide additional comments on this critical issue in Attachment A.	The No Action Alternative evaluated in the EIS consists of the existing baseline and impacts of ongoing activities, including constructed and permitted offshore wind projects and ongoing non-wind activities. Reasonably foreseeable future planned activities were also evaluated.
Habitat Impact Minimization Alternatives: We recognize and appreciate that BOEM has considered alternatives to the proposed action that would minimize impacts to vulnerable marine habitats. NMFS considers both the Sand Ridge and Trough Avoidance alternative (Alternative D) and the Submerged Aquatic Vegetation (SAV) Avoidance alternative[s] (Alternative E) to be feasible alternatives, which would allow BOEM to meet its purpose and need while reducing impacts to sensitive habitats to the greatest extent practicable. However, we have concerns with how these alternatives are discussed, analyzed, and contextualized in the document. Comments herein and in Attachment A should be incorporated into the FEIS to provide decision makers and the public a clear understanding of how these alternatives could reduce adverse impacts of the Ocean Wind project on these important habitats.	BOEM has reviewed and addressed NMFS's comments regarding the analysis of Alternatives D and E in the Final EIS.

Comment from National Marine Fisheries Service	Response
Sand Ridge and Trough Avoidance (Alternative D): The DEIS does not include a comprehensive analysis of the Sand Ridge and Trough Avoidance alternative. This lack of detailed analysis makes it difficult for the reader to understand how impacts from this alternative differ from other alternatives under consideration. It is also not clear how BOEM would implement this alternative if selected. Like the PDEIS, the DEIS treats removal of any particular Wind Turbine Generator (WTG) as essentially equal across all alternatives, without properly recognizing the unique value of the sand ridge and trough habitat. In addition, the alternative does not consider impacts of inter-array cables and scour protection associated with those cables, as impacts appear to only be quantified for WTG locations with scour protection. The impacts from inter-array cables on the integrity of these habitats was one of the primary reasons the sand ridge and trough avoidance alternative was proposed, and should be evaluated under this alternative. We also recommend that additional details be provided in order to clarify how BOEM is considering this alternative. For example, the document discusses the potential removal of between 9 and 15 WTGs for this alternative, but it is unclear how the total number, or position, of WTGs would be prioritized for removal or ultimately selected. We recommend you coordinate with us to address these issues and further refine this alternative to ensure a clear understanding of the specifics of the alternative.	The Draft EIS provided a description of Alternative D in Chapter 2 and a detailed analysis of the impacts of Alternative D in comparison to the Proposed Action in Chapter 3. Although the removal of WTG positions is anticipated to result in a corresponding reduction in inter-array cable length and associated cable protection impacts, the resulting impacts are difficult to calculate because the inter-array cable alignments associated with Alternative D have not been designed. Section 3.6 of the Final EIS notes that impacts on benthic habitat would be further reduced due to the removal or reduction of required inter-array cables. The identification of individual WTGs for removal, should the number removed be fewer than 15, would be coordinated with NMFS.
SAV Avoidance (Alternative E): We have significant concerns with the scope and analysis of the SAV Avoidance Alternative, as it does not consider all practicable measures to avoid and minimize SAV impacts from cable routing and installation. The technical corrections provided by BOEM on August 3, 2022, indicate that this alternative does consider minimizing impacts to SAV habitat west of Island Beach State Park, as well as at the cable landing location; however, the impacts of cable route options are not clearly presented in the DEIS, making a straightforward comparison of routing options and associated impacts to SAV beds difficult. In addition, the discussion and analysis of alternate routine cable installation methods, which would avoid and minimize impacts to sensitive habitats in estuaries and embayments, lack detail.	Alternative E was developed to address concerns regarding impacts on SAV west of Island Beach State Park. Table 3.6-5 presents a comparison of the two cable route options for the area west of Island Beach State Park. Section 3.6.5 was updated to discuss an assessment of alternative cable installation methods.

Comment from National Marine Fisheries Service	Response
Specifically, the SAV Avoidance Alternative lacks any discussion or analysis of horizontal directional drilling (HDD), which could be used to further avoid and minimize impacts to SAV and other sensitive habitats, especially on the backside of Island Beach State Park. HDD is part of the proposed action (Barnegat Bay route through dense SAV beds); thus, it remains unclear why it is not being considered for the SAV Avoidance Alternative. In fact, due to the significant potential impacts to sensitive habitats, open trenching is rarely used in Barnegat Bay, and alternative methods, such as HDD, are routinely recommended and employed for similar actions. This is a significant omission that should be fully considered and analyzed in the FEIS.	Use of HDD for export cable installation west of Island Beach State Park was analyzed, and additional detail regarding the feasibility and impacts of this installation method was provided in Section 3.6.
Analytical Issues: We raised several concerns with the characterization and analysis of impacts to NOAA trust resources in our cooperating agency comments on the PDEIS. We recognize where BOEM included further resource descriptions and analysis in response to those comments; however, we have remaining concerns with the lack of information to support some impact determinations, as well as missing analyses on the scope of project impacts. Moreover, while the DEIS includes some additional discussion of resources, the document is not comprehensive and does not apply those findings to an examination of the proposed action and alternatives. As a result, conclusions stated in the document related to impact determinations lack supporting rationale.	As mentioned by NMFS, BOEM did respond to all comments received on the Preliminary Draft EIS. However, BOEM recognizes that NMFS has some remaining concerns and has responded to those specific concerns as raised by NMFS in EIS Sections 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*; 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*; 3.19, *Sea Turtles*; and 3.17, *Other Uses (Marine Minerals, Military Use, Aviation)*.
For example, as noted in our cooperating agency comments, the DEIS states that fishery management has a major impact on fishing operations, and suggests that fishery management actions will have a greater impact on fishery operations and revenue than the Ocean Wind project or other reasonably foreseeable future projects. Given that fishery management actions are taken to ensure the long-term optimal yield for the fishery, and no justification for the statement is provided, these conclusions appear without merit. This and other impact determination conclusions should be supported by information in the EIS.	The major impact rating is for some fisheries that would be adversely affected by regulated fishing effort. Text noting that species may be affected differently by fishery management measures has been added. In addition, the Final EIS has been updated to reorganize the No Action Alternative, cumulative impacts, and the Proposed Action. The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. Ongoing activities include permitted offshore wind projects. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Reasonably foreseeable future actions include the buildout of executed renewable energy lease areas. A detailed description of BOEM's methodology for assessing impacts is provided in Section 1.6 of the Final EIS.

Comment from National Marine Fisheries Service	Response
The approach used in the DEIS to present only average impact determinations in some locations (e.g., commercial fisheries), rather than articulating the anticipated range of impacts, also reduces transparency and makes it more difficult for our agency and the public to comprehend how conclusions were reached. We therefore request that a clear justification for impact determinations, consistent with definitions included in the DEIS, be included in the FEIS.	BOEM has included in the Ocean Wind 1 EIS clear justification for impact determinations consistent with definitions included in the EIS. In response to the specific comments provided by commenters, including NMFS, BOEM has addressed some instances where the justification was not clear.
In addition, there continue to be important analyses and conclusions that are absent from the DEIS. Specifically, in the Benthic Resources and Finfish, Invertebrates, and EFH sections, there is no analysis of impacts from unexploded ordnance (UXO) removal and/or detonation, nor is there any discussion of impacts from hydrodynamic changes on habitat, primary productivity or larval distribution due to the presence of in-water structures.	Discussion of potential impacts of UXO detonation (e.g., physical disturbance, increased sediment suspension and deposition, potential contaminant resuspension, physical impacts on finfish, disturbance to spawning/migration) has been added to Sections 3.6.5 and 3.13.5 of the Final EIS.
The DEIS also does not analyze impacts of the export cables construction and operation on federal and non-federally managed fisheries or overall impacts to shoreside support services and fishing communities. All anticipated changes to the marine environment and fishing communities from the Ocean Wind project and other projects need to be explicitly discussed and the potential impacts rigorously examined in the FEIS.	BOEM has determined that the qualitative analysis provided in Section 3.9.3.2 under the cable emplacement and maintenance IPF is appropriate for temporary cable route disturbance. Potential impacts on shoreside services are mentioned qualitatively in Sections 3.9.3.2 and Section 3.9.5 under the *presence of structures* IPF. BOEM acknowledges the importance of the commercial fishing industry, as well as the variety of ports and shoreside businesses related to and within this area. To that end, it has included extensive analysis of commercial fishing revenue exposure within the Ocean Wind 1 Lease Area, and presumably a reduced catch could have an impact on these related shoreside businesses. Use of the commercial fishing revenue exposure as a metric produces a conservative estimate of potential impacts on the industry. However, as the analysis indicates, a small fraction of the amount of fishing activity in New England and the Mid-Atlantic region is affected by the proposed development in the Lease Area, but, depending on the fishery in question, impacts on shoreside support services would be long term and negligible to moderate.

Comment from National Marine Fisheries Service	Response
Mitigation Measures: As we have highlighted in past comments, the evaluation of mitigation measures is a critical component of the analysis in any NEPA document. The FEIS should clearly analyze and describe the anticipated impacts of the proposed action, mitigation measures considered to be part of that action, the effectiveness of these measures, as well as the expected impacts if mitigation methods are applied; this structure is necessary to support the final impact determinations We recognize that additional text has been added to the DEIS since our review of the PDEIS; this provides some clarification between mitigation measures that are part of the proposed action and additional measures that could further reduce impacts. However, the DEIS still contains areas where BOEM is relying on measures to reduce impacts; yet it remains unclear which measures are considered in the impact determination. For example, in the section evaluating the impacts of pile driving noise on sea turtles, BOEM notes that the implementation of monitoring and clearance zones would prevent exposure of sea turtles to noise that could result in mortality or injury. However, given that pile driving is planned to occur at night, it is not clear if this conclusion is based on the applicant proposed measures (APM) or the APMs plus the additional mitigation measures related to night-time pile driving identified in section 3.19.9 of the DEIS. The FEIS should be explicit as to what additional mitigation measures beyond the APMs are anticipated to be required and which measures were relied on to reach the impact conclusions.	Ocean Wind's committed mitigation measures are analyzed as part of the Proposed Action and as such contribute to the impact level conclusion. BOEM evaluates proposed mitigation measures for each resource in Chapter 3 and describes whether implementation of the measure would result in reduced impacts.
In other sections of the DEIS, there are additional mitigation measures that should be considered, such as time of year restrictions and construction methods to reduce impacts, that are not contemplated at all in the document. These are significant omissions that should be remedied in the FEIS. This information is necessary to include as part of a full and complete project impact analysis, regardless of the location of where the mitigation measure would occur or which agency would have jurisdiction to enforce them.	In the Draft EIS, BOEM analyzed measures proposed during the public scoping comment period and proposed by cooperating agencies.
NOAA Scientific Surveys: As we have discussed previously, we have significant concerns related to the major impacts offshore wind will have on our NOAA scientific surveys. Despite comments provided in our PDEIS review, inaccurate and unsubstantiated claims remain in the document, such as the assertion that without offshore wind energy, the	The impact on scientific research and surveys as a result of ongoing and planned activities has been updated to major due to the potential impacts of ongoing and planned offshore wind activity, including Block Island Wind Farm, Coastal Virginia Offshore Wind pilot project, Vineyard Wind 1, and South Fork Wind Farm.

Comment from National Marine Fisheries Service	Response
effect of climate change on fisheries would have a "moderate" impact on NOAA surveys. The offshore wind development projects are the primary cause of immediate impacts on NOAA scientific surveys and research, not climate change. Furthermore, the analysis in the DEIS does not include any discussion or details on how these major impacts will be mitigated other than referencing the ongoing BOEM/NMFS survey mitigation efforts. Rather than providing further details, the DEIS suggests this information will be incorporated later in the FEIS. In order to minimize the major adverse impacts expected on scientific surveys, mitigation measures should be implemented before development moves forward, consistent with our joint survey mitigation efforts. As stated in the DEIS, we will continue to work with you to ensure these details can be included in the FEIS	BOEM has committed to working with NOAA to implement the Federal Survey Mitigation Strategy program (https://repository.library.noaa.gov/view/noaa/47925). As of February 2023, implementation is pending. As discussions between BOEM and NOAA on implementation of the program continue, specific details on appropriate mitigation measures will be added to the environmental analysis.
Section Number: S.4.1. Consistent with NMFS's comment related to its concern with the structure of the no action alternative, recommend the deletion of the text in S.4.1 stating "However, all other reasonably foreseeable future impact-producing activities will continue" as this language continues to confuse and conflate the cumulative impacts analysis with the effects of "no action" and thus skews the effects of action alternatives when compared to no action. NMFS does agree with the inclusion of "existing" IPFs but disagree with the inclusion of reasonably foreseeable future IPFs.	In EIS Section S.4.1 and Chapter 2, the sentence noted in this comment was deleted and replaced with a paragraph describing the analysis of reasonably foreseeable future impact-producing activities.
Section Number: S.5. In table S-2 under Marine mammals, this is a good demonstration that the structure of the alternatives analysis creates confusion and does not allow for a meaningful analysis of the alternatives as all the action alternatives are the same despite some alternatives including a good reduction in the number of turbines constructed (which would reduce both construction and operational impacts). In the impact analysis in Chapter 3, as well as the summary table presented in the Executive Summary, BOEM suggests minor impacts to NARWs would occur against current baseline situation, but major impacts to NARW would occur as a result of the No Action alternative when considering the baseline existing environmental trends and activities as well as planned non-offshore wind and offshore wind activities. As written, the impacts from the project in consideration of the baseline alone results in major impacts to NARWs but when combined with foreseeable actions, the impacts are reduced to moderate. These determinations are not supported in Chapter 3 but,	Note that table S-2 has incorrectly rated the impacts of the No Action Alternative as "minor." The table conclusions have been updated based on the analysis presented in Section 3.15 to reflect the rating for the No Action Alternative as "negligible to major." A note has also been added to the table to outline that the major effects are in relation to NARWs. In Section 3.15.6, the IPFs related to the action alternatives are discussed in relation to the species that may be affected by the alternatives. Through the analysis it was determined that the action alternatives are unlikely to result in a change to the impact determinations outlined for the Proposed Action. This is outlined in Section 3.15.6.1, which states, "BOEM anticipates that any incremental reduction in impacts would not change the resulting effects on marine mammals to the extent necessary to alter the impact level conclusions for any impact mechanism. The impacts resulting from Alternatives B-1, B-2, C-1, and D individually would be

Comment from National Marine Fisheries Service	Response
more importantly, these determinations challenge NMFS ability to make the required findings under the MMPA and adopt this EIS. We also note that teasing out these distinctions was extremely difficult and the differences in the determinations for each alternative are not supported. Finally, both here and in Chapter 3, it is not clear how the short (construction) and long-term impacts (operation) are influencing the overall single determination in this as well as the collective marine mammal group as a whole.	similar to those of the Proposed Action and would be **moderate** for mysticetes except for the NARW, which would range from **moderate** to **major**. BOEM anticipates that the impacts resulting from the Proposed Action would **minor** for odontocetes and pinnipeds and could include **minor beneficial** impacts.”
Section Number: 2.1.1. The following language should be added in Section 2.1.1, “Under the No Action Alternative, impacts to marine mammals incidental to construction activities would not occur. Therefore, NMFS would not issue the requested authorization under the MMPA to the applicant”. For adoption, it is important that NMFS’ No Action Alternative be incorporated into the EIS and the section that describes the No Action Alternative would be the most appropriate place to do this. This comment was made during NMFS’ cooperating agency review of the PDEIS but the language was not incorporated into the DEIS. This language should be incorporated into the FEIS.	Section 2.1.1 was revised to include the suggested language.
Section Number: 2.1, Table 2.1. Consistent with NMFS’s comment related to its concern with the structure of the no action alternative, we recommend deletion of the following text under the No Action Alternative Description “However, all other existing or other reasonably foreseeable future impact- producing activities would occur.”	In EIS Section S.4.1 and Chapter 2, the sentence noted in this comment was deleted and replaced with a paragraph describing the analysis of reasonably foreseeable future impact-producing activities.
Section Number: 3.3. As noted in a Global comment on Section 3.13 (Finfish, EFH, Invertebrates), NMFS has discussed with BOEM previously that we recommend the following categories be used to describe impact duration: short-term (less than 2 years); long-term (2 years to < life of the project); and permanent (life of the project). It is unclear why the Ocean Wind DEIS defines short term impacts as less than 3 years. We recommend this be modified to less than 2 years. We are also concerned that BOEM defines “long term” as lasting for the life of the project, and permanent effects are defined as those that extend beyond the life of the project. This should be modified to be consistent with the EFH duration definitions, as impacts that last the life of the project (30+ years) should be classified as a permanent impact.	BOEM disagrees with this comment and has not made this change. As explained in EIS Section 3.3, short term effects are effects that may extend up to 3 years, long-term effects are effects that may extend for more than 3 years and may extend for the life of the Project (35 years), and permanent effects are effects that extend beyond the life of the Project.
Section Number: 3.3. We have concerns about the use of terms to describe ‘incremental’ impacts of the action alternative in relation to the combined impacts from all ongoing and planned activities. The DEIS	EIS Section 3.3, *Definition of Impact Levels*, defines the terms “undetectable,” “noticeable,” and “appreciable.” These terms are used to describe the incremental impact of the action alternatives in

Comment from National Marine Fisheries Service	Response
introduces these new terms related to the contribution of the Proposed Action to cumulative effects. The definitions are new and it is unclear how they were developed, what they mean and how they were applied throughout the impacts analyses in Ch. 3.	relation to the combined impacts from all ongoing and planned activities, including both non-offshore wind and offshore wind activities.
Section Number: 3.6.3 and 3.6.5. There are limited citations from the peer-review literature for each of the impact producing factors evaluated. Please review the literature and provide relevant citations that support the analysis, rationale, and conclusions.	Additional literature review and citations have been added to Section 3.6 as noted in response to specific comments below.
Section Number: 3.6.3. Discussion of SAV and other important habitats should be included here. Additionally, this section may be the most appropriate place for SAV discussion in the context of climate change and carbon sequestration (blue carbon). Although the background information on the importance of SAV has been expanded, the current document lacks a robust discussion of SAV in the context of climate change and carbon sequestration-blue carbon. In addition to the role of SAV in providing habitat for aquatic species, it serves important ecosystem functions including primary production, carbon sequestration, and nutrient cycling in the coastal zone. The distribution and abundance of SAV has declined globally and in the northeast U.S. As you know, there have been documented dramatic declines in SAV throughout New Jersey and Barnegat Bay in particular. Although declines in water quality have been associated with SAV losses in New Jersey, direct losses through development, dredging, trenching, and other bottom disturbing activities further exacerbates the widespread impacts. We appreciate your recognition of SAV as an important, hard-to-replace resource, but recommend you also include robust background information on the importance of SAV to sequestering atmospheric carbon dioxide, providing an important service in addressing climate change. SAV occupy less than 0.2% of the area in the world's oceans, yet sequester approximately 10% of the annual organic carbon burial in the oceans (Duarte et al. 2005). The mean global long-term rate of carbon sequestration in seagrass sediments are an order of magnitude greater than terrestrial forests (Mcleod et al. 2011). This information should be integrated into your evaluation of any impacts to SAV, regardless of the alternative.	The information in the comment has been added to the text. However, it has been added to Section 3.6.1, which discusses the value of SAV rather than in Section 3.6.3, which addresses environmental consequences. Text addressing impacts of cable emplacement on seagrasses has been added to Section 3.6.3 and a more robust discussion of SAV in the context of climate change and carbon sequestrations has been added to Section 3.6.1 based on review of Duarte et al. 2005, Duarte and Krause-Jensen 2017, Howard et al. 2017, Mccreadie et al. 2019, Novak et al. 2020, Pendleton et al. 2012, Tokoro et al. 2014, Kennish et al. 2007, and Kennish et al. 2011.
Section Number: 3.6.3. In addition to warmer water, eelgrass is currently experiencing stresses and declines in distribution and abundance from invasive species such as green crabs (Neckles 2015)	The following has been added to Section 3.6.1, in addition to the text suggested in the comment: "The physical stress to organisms from climate change impacts can also increase the opportunity for

Comment from National Marine Fisheries Service	Response
and invasive tunicates (Wong and Vercaemer 2012; Carman et al. 2019). More intense rain events and coastal storms have been associated with climate change and are expected to increase in the future. Reduced salinities, stronger storms, and more turbid water are identified as stressors for eelgrass (Short et al. 2016). Therefore, minimizing additional direct and indirect impacts from dredging should be an important management policy for conserving eelgrass (Neckles et al. 2009).	disease. For example, eelgrass is threatened by seagrass wasting disease (in warmer ocean temperatures) (Graham et al. 2021)."
Section Number: 3.6.3 – 3.6.7. The adverse impacts of the presence of structures is inappropriately minimized/discounted, especially in the context of "range expansions" and the "stepping-stone effect," by comparing offshore wind development to existing artificial reefs. This is inappropriate as it does not account for size/scale/scope, distribution, etc. of offshore wind [farms] in addition to how they may interact with existing natural and artificial habitats (e.g., acting as bridges or corridors).	Recent studies have been reviewed and text added to Section 3.6.3.1 to clarify the effects of structures on benthic habitat and finfish. Text has been added to address the comment based on reviews of Bray et al. 2017, Wilding et al. 2017, Adams et al. 2014, Causon and Gill 2018, Krone et al. 2017, and Taormina et al. 2018.
Section Number: 3.6.5. The narrative on EMF indicates that the science is unsettled on this topic. However, the conclusion is that there would be no measurable impacts. Please provide a rationale for this conclusion.	Discussion informed by Hutchison et al. 2020, Harsanyi et al. 2022, and Albert et al. 2020 has been added to Section 3.6.5 to clarify that impacts on specific organisms are documented under specific conditions; however, the data are inadequate to predict the impacts of EMF.
Section Number: 3.6.5. This analysis of noise focuses on sound pressure. Noise can produce sound pressure, particle motion, and substrate vibration. All of these should be discussed separately.	Text has been added to Section 3.6.5 based on reviews of Popper et al. 2022, Carroll et al. 2016, and Roberts et al. 2016.
Section Number: 3.6.5. It is unclear where and how UXO detonations have been evaluated. The impacts of this activity should be included and integrated into this section, and impacts should be evaluated comprehensively.	Text has been added to Section 3.6.5 based on reviews of Hannay and Zykov 2022 and Middleton et al. 2022.
Section Number: 3.6.5. Presence of Structures: This section should incorporate discussion of new literature on wind wake effects and potential impacts on biological production and larval dispersal. For example: Christiansen et al. 2022 (doi: 10.3389/fmars.2022.818501); Dorrell et al. 2022 (doi: 10.3389/fmars.2022.830927); van Berkel et al. 2020 (https://doi.org/10.5670/oceanog.2020.410); Floeter et al. 2022 (doi: 10.3389/fmars.2022.884943); Chen et al. 2021 (https://s3.us-east-1.amazonaws.com/nefmc.org/Doc.14.a-UMASSD_WHOI_short_report_05_6_12_2021_revison.pdf)	Potential impacts on benthic resources from mixing has been added to Section 3.6.5 based on reviews of Tagliabue et al. 2021, Floeter et al. 2022, and Dorrell et al. 2022.

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Section Number: 3.6.5. Discharges: This discussion should include effects of anti-corrosive and anti-fouling compounds.	Discussion of impacts on benthic habitats due to anti-corrosive and anti-fouling compounds has been added to Section 3.6.5.
Section Number: 3.6.5. The background written here about ridge and trough complexes and the value they provide is more robust compared to the description included in the earlier version of the DEIS provided for our Cooperating Agency review of the DEIS. However, the impacts to this habitat (even in the evaluation of the ridge and trough avoidance alternative) appear to be inappropriately discounted and minimized. While quantitative information is now provided about the reduced benthic impacts of each alternative from removal of WTGs and associated scour protection, the qualitative assessment is still insufficient, as the document essentially still treats removing WTGs in any area of the lease area as being equal. We reject this approach and assumptions therein; this needs to be corrected and unique ridge and trough habitat and value it provides needs to be integrated into the analyses and conclusions.	Text has been added to Section 3.5 to describe the value of ridge and trough complexes based on review of Slacum et al. 2010, Byrnes et al. 2000, Brooks et al. 2006, and VIMS 2014. Text has been added to Section 3.6.7 to clarify that removing WTGs from the northeastern portion of the Project area would reduce impacts on ridge and trough habitats.
Section Number: 3.6.5. It remains unclear how the individual WTGs would be selected for removal in the Sand Ridge and Trough avoidance alternative. This should be done in coordination with NMFS.	If the sand ridge and trough avoidance alternative is selected, BOEM will coordinate with NMFS on removal of specific WTGs from the sand ridge and trough complex.
Section Number: 3.6.5. The tables of impacts (3.6-3 and -4) and narrative should include both total inter-array cable length/acreage and necessary cable scour protection in order to comprehensively compare impacts among alternatives. These should be displayed in the same way (with habitat categories) as they are in Table 3.6-2. The impacts of inter-array cables was a primary reason for development of the ridge and trough alternative.	While removal of WTG positions is anticipated to result in a corresponding reduction in inter-array cable length and associated cable protection and cable installation and seafloor preparation impacts, the cable protection and cable installation and seafloor preparation area for the alternatives excluding WTG positions could not be calculated because the inter-array cable alignments associated with these alternatives have not been designed/ engineered.
Section Number: 3.6.5. It is unclear why the current version of the DEIS concludes that the SAV Avoidance alternative, which reduces direct impacts to SAV by more than 14 acres would have negligible to moderate adverse impacts to benthic resources, in contrast to the proposed action that is expected to have minor impacts. The SAV Avoidance alternative, due to avoiding substantial SAV habitat, should be described as having less impacts in comparison to the proposed action.	The impact conclusion for Alternative E has been revised to conclude that Alternative E would have minor impacts on SAV with supporting rationale.
Section Number: 3.9. Please indicate how averages are calculated in the event that there is no available data for each port, area, FMP, etc.	A new data request was sent from BOEM to NMFS on October 13, 2022, and updated data were received on December 2, 2022. These

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in specific years. (e.g. if there is no data available for New Bedford in 2008 is a zero used in the average or is the observation dropped.)	data were updated in applicable tables. Averages were calculated based upon available data for each year across the 14-year period and a note has been added to indicate this methodology.
Section Number: 3.9. Please indicate which personal communications are NMFS GARFO data requests.	The NMFS GARFO personal communication reference has been removed and replaced with a new data reference in the Final EIS.
Section Number: 3.9. We appreciate the inclusion of the NOAA social indicators for gentrification pressure in the EJ section. However, an analysis of the socio-economic impacts to commercial fisheries from gentrification should be included in this section. Gentrification has increasingly been a significant pressure to commercial fisheries due to new industries (wind is a new industry), tourism (studies have shown that offshore wind increases tourism), and communities with higher dependence on recreational fishing also frequently have high levels of gentrification (section 3.18 states that there will be benefits to recreational fishing due to reef-effect). See our cooperating agency comments on example literature that should be used to evaluate impacts of gentrification from prior evidence, also repeated here: As found in the literature, established fishing communities are forced to adapt to new social, economic, and environmental conditions and as a result many fishing communities in the Northeast have been supplemented with technology-based industries and tourism, and are heavily impacted by coastal development, gentrification and the emergence of retirement communities (Claesson, Robertson and Hall-Arber, 2006). Increased tourism and recreational boating & fishing infrastructure as a result of gentrification has also resulted in space use conflicts both onshore and offshore between commercial and recreational fishing (Jepson and Colburn 2013, Thompson 2012, Hall Arber et al. 2001) that could be exacerbated by the proposed action and other projects. Offshore wind development can be another industry providing pressure to these communities, so recognizing those communities that are vulnerable is important. See NMFS Gentrification summaries: https://storymaps.arcgis.com/stories/56781eb366f1485e8ffd7c96b16f133f.	Discussion of gentrification is provided in Section 3.12, *Environmental Justice*. Within Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, a qualitative discussion of potential socioeconomic impacts on commercial fisheries has been developed and included in the presence of structures IPF, following discussion on fisheries revenue exposure. Additional text and citations referenced within this comment have been incorporated into the EIS section, as appropriate.
Section Number: 3.9. The inability/ability of fisheries to adapt and remain resilient should be included in BOEM's EIS analyses based on previous studies and evidence in fisheries. See research on commercial and recreational fishing industry's adaptive capacity in NY and NJ (Seara et al. 2012) and perceived resilience. As expressed by	Discussion of the ability of fishermen to adapt is included under the presence of structures IPF in Section 3.9.3.2. Additional text and citations referenced within this comment have been incorporated into the EIS section, as appropriate.

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BOEM during mitigation guidance public meetings, insight can be gained from prior changes in the system, such as fisheries disasters and hurricanes on how fisheries reacted. The following resources are helpful for social, economic and cultural impacts of northeast regional fisheries disasters: Scyphers SB, Picou JS, Grabowski JH. Chronic social disruption following a systemic fishery failure. Proc Natl Acad Sci U S A. 2019 Nov 12;116(46):22912-22914. doi: 10.1073/pnas.1913914116. Epub 2019 Oct 28. PMID: 31659050; PMCID: PMC6859345; The following study provided a national- scale view of fishery disasters and found fishery disasters to be a problem that has worsened over time, and has cascading socioeconomic impacts to society. Regional fishery disasters that have placed burden on fisheries should be considered in BOEM's determination of the ability for fisheries to adapt to changes from offshore wind: Bellquist L, Saccomanno V, Semmens BX, Gleason M, Wilson J. The rise in climate change-induced federal fishery disasters in the United States. PeerJ. 2021 Apr 22;9:e11186. doi: 10.7717/peerj.11186. PMID: 33981495; PMCID: PMC8071068.	
Section Number: 3.9. Please see research on the cultural dimensions of socioecological systems (Poe Norman and Levin 2013:https://conbio.onlinelibrary.wiley.com/doi/10.1111/conl.12068), which states that inadequate knowledge of cultural dimensions of ecosystems risks the inadequate accounting of negative impacts to communities and misses the opportune to build meaningful alternatives. As previously commented by NMFS and others, BOEM has not made an effort to acknowledge the importance of analyzing the socio-cultural effects in the EIS. Fisheries are part of social-ecological systems that take into account inter-relationships between ecological functions and human communities that depend on ecosystem services for their well-being. Similar to assessing the economic impacts based on historic catch and VMS data, discussion of and research on social wellbeing in the region should be discussed where available to consider the full impacts of the proposed action. Methodologies can be sought through Social Impact Assessment (SIA) documents-see Colburn and Clay Practitioners Handbook and resources included in the document https://spo.nmfs.noaa.gov/content/tech-memo/practitioners-handbook-fisheries-social-impact-assessment and other literature such as Hicks C. C., et al., Engage key social concepts	The development of alternatives for Ocean Wind 1 was done in a cooperative and transparent manner in coordination with cooperating agencies using the best science, data, and information available. Within Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, a qualitative discussion of potential socioeconomic impacts on commercial fisheries has been developed and included in the presence of structures IPF, following discussion on fisheries revenue exposure. In addition, EIS Sections 3.11 and 3.12 discuss elements of commercial fishing impacts and associated shore-side qualitative impacts. Additional text and citations referenced within this comment have been incorporated into the EIS section, as appropriate.

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for sustainability. Science 352, 38–40 (2016). In the Affected Environment description, please insert a discussion of and applicable references to social and well-being information of fishing industry participants. The brief discussions on cultural importance and identity can be supported by numerous studies on traditional values and historical significance of fishing areas in the region. Examples of available social research include: 1) Job satisfaction and well-being studies, including safety considerations, have been done in the region for decades -see Pollnac et al. (2014) and it's citations, Smith and Clay (2010), 2) Silva et al. 2021, Cutler et al. 2022 and Henry and Olson (2014) provides an overview of commercial fishing crew demographics and changes over time.	
Section Number: 3.9. Fisheries well-being topics relevant to offshore wind are listed below based on Van Holt et al. (2016) and Smith et al. 2020 and should be considered in BOEM's impact assessment with description of relevant research in the region. Where data is not available this should also be noted. Well-being objectives to consider include: Impacts to income and employment, infrastructure investment, equitable distribution of fisheries benefits, maintaining fishing opportunities for small-scale operators, promoting food security, and maintaining cultural importance of fishing to the community. Using available studies and data can allow BOEM to analyze the potential effects of offshore wind development to all alternatives proposed.	Social and cultural impact assessments are provided in Section 3.12, *Environmental Justice*. Within Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, a qualitative discussion of potential socioeconomic impacts on commercial fisheries has been developed and included in the presence of structures IPF, following discussion on fisheries revenue exposure. Additional text and citations referenced within this comment have been incorporated into the EIS section, as appropriate.
Section Number: 3.9. See NMFS comment from our Cooperating Agency review on transboundary nature of fishing fleets, which is still under review by BOEM and has not been incorporated into DEIS. NMFS submitted comment is summarized here: Discuss the transboundary nature of the fishing fleets in this section in terms of landing ports vs. primary/hailing port. Regional movement of fishing effort should be considered when evaluating the impacts from the project and future Offshore Wind activities. As more ocean space is used, this will increasingly impact travel time to landing ports historically utilized in other states. This could lead to shifts in landing ports (Papaioannou et al. 2021) and result in economic loss to ports & communities, especially small ports. In an intercept survey from Maine to North Carolina in 2018, researchers found that 20% (n=479) of the fishing industry participants reported different primary and landing ports from the intercept port, as well as differences between their primary	Discussion was incorporated into the presence of structures IPF in Section 3.9.3.2. Additional text and citations referenced within this comment have been incorporated into the EIS section, as appropriate.

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and landing port over the prior year. Almost all of the differences in this study were ports located in different states and the most common reported differences between primary (homeport) and landings ports were Cape May, NJ and New Bedford, MA and Newport News, VA, and Point Judith, RI and Point Pleasant, NJ. These findings give insight into the movement of vessels and the different ports they are operating and landing within (Cutler et al. 2022 and Silva et al. 2021, NOAA Technical MemoNMFS-NE-274). Studies have shown the decline of Northeast fishing communities given trends toward industry consolidation - both ownership and location (Brewer et al. 2011, Brinson and Thunberg 2016, Brewer et al. 2017). Papioannou et al. (2021) also account for “transient” vessels that land in a port not declared as landing or homeport.	
Section Number: 3.9.1. Explain how ports were identified for Table 3.9-4 and its purpose in this section, or remove it from this document. This table does not include ports that are primarily impacted by the project area. Table 3.9-10 includes ports affected by the project area and seems more relevant to this EIS. If this is supposed to show all landings from all ports in New England and Mid-Atlantic there are ports that are missing (e.g., Gloucester, MA, Belford, NY, North Kingstown, RI and Atlantic City, NJ). The table mischaracterizes “All New England/Mid-Atlantic Ports” in the last row, as there are a number of ports missing the way this table is described. Clarify what criteria was used in selecting these ports. Additionally, the citation listed under the table for NOAA Fisheries Office of Science and Technology 2019 does not list all ports with landings in the region. Where applicable please include ports from Appendix G 3.11 - Demographics, Employment, and Economics.	Table 3.9-4 was updated to specifically show both peak and average annual landings and revenue from the top 20 highest-revenue ports in the geographic analysis area.
Section Number: 3.9.1. Footnote 16 is incorrect and should be revised to reflect the use of the terms “VMS” and “non-VMS fisheries” such as in Figure 3.9-5. Similarly, footnote 19 is incorrect too. While some fisheries are not required to use VMS (those in parentheses), vessels issued other federal permits that require VMS also land these species. This could be refined to serve as a proxy definition for non-VMS fisheries because while “declared out of fishery” generally reflects fisheries that do not require the use of VMS, it actually only means declared out of a fishery managed by days-at-sea effort controls (i.e., scallops, Northeast multispecies, and monkfish).	Comment addressed. Footnotes 16 and 19 were modified using language provided in the comment.

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Section Number: 3.9.1. Figure 3.9-2 is a good way to illustrate inter-annual variability in fishing operations and clearly shows the spike in surfclam landings/revenue in 2010 and menhaden spikes in 2008, 2013, and 2017. Please consider depicting landings/revenue by primary affected fishery species (not FMP) and vessels/trips in a similar manner and discussing landings/revenue trends and min/max values to more accurately describe historical patterns and potential future fishery impacts. The use of averages in tabular data often obscures such patterns, although averages can be useful for other purposes.	A new data request was sent from BOEM to NMFS on October 13, 2022, and updated data were received on December 2, 2022. These data were updated in applicable tables. As part of this update, Figure 3.9-2 was updated to a bar chart covering the years 2008–2021. The noted inter-annual variability in fishing operations is still depicted for these data. Other data for landings/revenue by species, FMP, etc. remain in tabular format.
Section Number: 3.9.1. This section of the DEIS should include a more thorough evaluation of portside support services and community dependence on fishing. There is only one sentence indicating that commercial fishing contributes to the overall regional economy on the bottom of page 3.9-3, listing the general services such as vessel maintenance, processors, wholesalers/distributors, and retailers. This is insufficient and should be expanded to fully describe the affected environment for commercial and for-hire fishery operations to set the stage for evaluating impacts to fisheries and associated communities. Please provide data from the Fisheries Economics of the US data tool for the region https://www.fisheries.noaa.gov/data-tools/fisheries-economics-united-states# that describes the regional economic value of fisheries, including sales, value added, and number of employees by state. Also, the Fisheries of the US report referenced on page 3.11-6 contains useful information that could assist this discussion. See comments providing during the cooperating agency review. According to BOEM's Draft Mitigation Guidance, impacts to shoreside support could be compensated, but must be included in the EIS to be considered for compensation. NMFS continues to strongly recommend BOEM integrate data regarding shoreside support businesses and port communities into project EISs and has provided references to support that effort. We are available to further assist, as necessary.	Consistent with BOEM's Draft Fisheries Mitigation Guidance, BOEM has added a mitigation measure requiring the lessee to submit a shoreside seafood business analysis to further supplement funds available for settling claims of lost (unrecovered) economic activity as a result of offshore wind development to Appendix H, Table H-3, and has analyzed this measure in Section 3.9.9.
Section Number: 3.9.1. BOEM should be evaluating the impacts of alternatives based on prior research done by Hoagland et al. (2015). Please include the finding from Hoagland et al. (2015) regarding portions of the MA/RI lease areas and input-output modelling of displacement of fishermen out of New Bedford, MA and Point Judith, RI. This study found that "the direct output impact would involve a loss of $5.2 million, leading to $10.5 million in direct, indirect and induced	For an individual offshore wind project, there are too many variables and unknowns that would be necessary for conducting an analysis of this size and utilizing an input-output model (i.e., IMPLAN) to have an accurate representation by lease area of potential economic impacts. The EIS estimates the revenue exposure; however, the impacts on the fishing industry as a whole are discussed qualitatively. The Hoagland et al. (2015) article was evaluated and, although they

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impacts to the regional economy. The corresponding loss in employment in the economy was 152 jobs, with nearly three-quarters of these losses in the fishing industry." Analyses such as this are necessary for other regions and/or projects to estimate the impacts to the wider economy beyond ex-vessel exposure. Without this, impacts are not adequately captured and therefore mitigation measures will be insufficient. If studies/analyses like this cannot be done, BOEM should ensure a discussion in the analysis of alternatives within the FEIS that consider the methodology used here (and in other input-output analyses in the region) and use the best available science to evaluate possible impacts to wider economy and seafood industry.	reached conclusions on the direct, indirect, and induced impacts on the fishing industry, they created assumptions and applied methodology that may not be accurate or appropriate. For instance, they assumed 100 percent of commercial fishing activities would be precluded within this designated WEA. That is most likely not the case; while some commercial fishing vessels may chose to avoid fishing within the WEA, others may not. In addition, although there is a discussion of potential enhancements to recreational fishing and the establishment of fishery reserves, it is not quantified or included as part of the analysis.
Section Number: 3.9.1. Insert a discussion of the fisheries and ports affected along the proposed export cable corridors. Focusing exclusively on evaluating impacts from the project area and not the export cable does not provide all of the information necessary to make an informed decision regarding the full impacts of this proposed action. As we noted in comments for the South Fork Wind DEIS, fisheries that operate along the cable corridor could be very different than those operating within the project area. These fisheries are likely more state-managed fisheries, including the whelk/conch and menhaden fisheries. These fisheries are not well reflected in the federal fishing footprint data that is used almost exclusively in this DEIS - thus additional data sources such as those from states, the Atlantic States Marine Fisheries Commission, and the NOAA shoreside processor reports can and should be used to augment existing data sources and fully describe these fisheries and associated ports.	BOEM has determined that the qualitative analysis provided in Section 3.9.3.2 under the cable emplacement and maintenance IPF is appropriate for temporary cable route disturbance.
Section Number: 3.9.3.1. Insert a discussion that some species are unharmed or may actually benefit from climate change. For species affected by this project, Hare et al, 2016 note that Atlantic menhaden, squid, black sea bass, and butterfish are likely to benefit from warming waters, while summer flounder and spiny dogfish are likely to be unaffected (see Figure 5). Also note that fishery management actions are intended to achieve long-term sustainable fisheries populations which should have long-term benefits to fisheries and fishing communities.	Text has been added related to Hare et al. (2016) indicating certain species may benefit from climate change while others may be adversely affected. Text also has been added regarding the fishery management actions and intentions.
Section Number: 3.9.3.2. This section describes the No Action Alternative and should only discuss the potential impacts for wind projects that BOEM has already approved. Evaluating impacts from all	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated.

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planned projects listed in Appendix F incorrectly and inappropriately conflates the No Action alternative evaluation with the cumulative impact analysis. Such analyses should be kept separate and distinct to preserve the ability for the public and BOEM to accurately differentiate the impacts of each alternative considered in this action. Otherwise, BOEM risks minimizing the differences between alternatives and undermining the utility of the DEIS.	Ongoing activities include permitted offshore wind projects. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Reasonably foreseeable future actions include the buildout of executed renewable energy lease areas. A detailed description of BOEM's methodology for assessing impacts is provided in Section 1.6 of the Final EIS.
Section Number: 3.9.3.2. Under Noise, note that construction noise from construction activities can induce behavioral change across a broad geographic area up to 7.5 km from the source. Therefore, construction activities in adjacent projects could impact fish and fisheries beyond the boundaries of an individual project area. This should be identified as an impact so that buffers can be established in compensation estimates of exposure for fishermen filing claims for lost revenue if biological impacts occur.	The impact conclusion for noise has been revised to long term and moderate. Text has been added to discuss the broad range of noise impacts. Section 3.13.3.2 describes the impacts of sound pressure and particle motion on fish and invertebrates.
Section Number: 3.9.3.2. Under traffic, note that relocation and increased steaming time may also result in product spoilage for fisheries such as surfclams that must be processed shortly after harvest. This could result in increased adverse economic impacts to affected vessels in the form of lower product price or rejection of harvested product. This impact should be listed throughout this document relevant to impacts from increased transit times from other IPFs such as presence of structures on PDF page 180 (p 3.9-32) and elsewhere. Also, maintenance vessels during project operations could also increase vessel traffic and cause similar impacts. This should be noted here, as traffic is not limited to construction activities. Finally, the impacts should be classified as long term and major based on the definitions in Table 3.9- 19 because there is no reference to remedial action to lessen impacts and the potential increased traffic may occur indefinitely absent any details regarding plans for decommissioning project structures.	Text in Section 3.9 has been updated under the traffic IPF and elsewhere to identify and account for these additional potential impacts from relocating to different fishing grounds.
Section Number: 3.9.3.2. Thank you for inserting the additional references discussing fishing behavior and the potential for effort shifts that could impact communities that we suggested in our cooperating agency review. As noted in our comments, assuming fishermen will find alternate fishing grounds oversimplifies a complex issue (Holland and Sutton 2000). Please include the remaining literature provided, that discusses the increasing difficulty of fisheries to adapt due to	Additional text and citations referenced within this comment have been incorporated into the EIS section, as appropriate.

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management measures (Murray et al. 2010) and regional trends of more specialized vessels and catching fewer species (Seara 2014, Stoll et al. 2016, McClenachan et al. 2019).	
Section Number: 3.9.3.2. Under presence of structures, insert cumulative revenue exposure evaluations for all projects listed in Appendix F in the appropriate discussion of cumulative impacts instead of this section. Discussion of the no action alternative should only focus on the impacts of approved projects. We strongly encourage BOEM to request an evaluation of cumulative revenue exposure from NMFS for use in the cumulative impact analysis. Further, it is not accurate to say that available data cannot estimate impacts along the cable corridors. While we agree that the fishery footprint data are not of the preferred resolution to precisely evaluate impacts within small areas, such data can and have been used to estimate revenue exposure along the cable corridor for previous projects. Fishing footprint data, along with VMS data, are the best scientific information available and can and should be used to inform decisions relative to project and cumulative impacts. We strongly encourage BOEM to integrate such data into the NEPA documents for this and other actions.	Note that with the reorganization and separation of the No Action Alternative, cumulative impacts, and the Proposed Action, the new Section 3.9.3.2 is *Cumulative Impacts of the No Action Alternative* and summarizes the impacts of the No Action Alternative in combination with other non-offshore wind activities and planned offshore wind activities. The revenue exposure under the No Action Alternative is presented in Table 3.9-20. BOEM has determined that the qualitative analysis provided in Section 3.9.3.2 under the cable emplacement and maintenance IPF is appropriate for temporary cable route disturbance.
Section Number: 3.9.3.2. Please note that revenue exposure does not account for increased operational costs and does not fully represent potential impacts from project activities. Costs must be included and quantified throughout all sections whenever possible to present the most accurate estimate of project impacts, particularly considering the socioeconomic impacts discussion will form the basis of any potential fisheries compensation amounts used as mitigation.	By providing revenue exposure within the EIS analysis, not impacts, BOEM is already providing a very conservative estimate of potential revenue losses and potential impacts. Therefore, by providing this overestimation of revenue exposure, the analysis provides a buffer to cover other operating expenses.
Section Number: 3.9.3.2. Revise the impact conclusions from “moderate” to “moderate to major.” Vessels that derive a large percentage of their total revenue from wind energy areas would experience major impacts as defined in Table 3.9-19. Wind projects represent substantial disruptions and the entities could have indefinite measureable impacts with or without remedial action. Further, although most vessels derive a small percentage of the total revenue from any one wind lease area and would have moderate impacts there are some vessels, as noted in this discussion, those that rely on wind lease areas for over 50 percent of annual revenue and would experience major impacts. Therefore, it is more appropriate and accurate to state that impacts to commercial fishing vessels would be long term and	It is presumed that this revision is requested under the presence of structures IPF; the edit was made to note “long term and moderate to major.”

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moderate to major. It is also consistent with conclusions listed on page 185. Characterizing impacts as only moderate is similar to previous concerns we expressed regarding the "averaging" of impacts and dismisses impacts to vessels that are more reliant upon fishing within existing lease areas.	
Section Number: 3.9.3.2. Table 3.9-20 is poorly described and it's unclear how this data was used to determine these values. First, was an average taken? Average of the timeseries is not an accurate characterization. See prior comments about also using a maximum value in the time series and information provided in BOEM's draft mitigation guidance Appendix A. Secondly, how were projects that don't have clear construction timelines (those proposed from 2026-2030) addressed in this table? Please clarify what data and analyses determined the findings that "It is estimated that over that period, only 0.9 percent of the vessels that fished in one or more of the offshore wind lease areas generated more than 50 percent of their total fishing revenue for the year from one or more of the areas." The text is reporting percentages, but the table shows revenue values. What data was used to calculate that percentage? With increased clarity, this information should also be provided for individual species and ports. Lastly, see BOEM's draft mitigation guidance for dollar adjustment methodology recommendations and use those approaches in future analyses.	Explanatory text was updated for clarity and incorporated into this section that discusses the presentation of Table 3.9-20 and associated data.
Section Number: 3.9.3.2. Under cable emplacement and maintenance, note that seafloor preparation to install cables would likely require boulder and obstacle relocation. This could present indirect impacts on fishery operations by altering existing or creating new hangs for which fishing gear can get snagged, resulting in gear damage, gear loss, and safety issues if such boulders/obstacles are not accurately charted. This impact should be noted here and elsewhere in the DEIS, as relevant.	Text has been added to Section 3.9.3.2, similar to text present in Section 3.9.5.
Section Number: 3.9.3.3. Impact conclusions must be supported by supporting information. As noted in our cooperating agency comments, information justifying major impacts from fishery management actions is lacking. Similarly, the case for moderate impacts to party/charter vessels is not supported by previous text in this section. The FEIS must include more information to justify these conclusions relative to the definitions listed in Table 3.9-19. Also, this section should only discuss	Additional supporting information has been added to impact conclusion statements where applicable. The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. Ongoing activities include permitted offshore wind projects. The EIS also separately analyzes the continuation of all other existing and

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impacts from currently approved projects, not all potential projects. Again, this inappropriately confuses the evaluation of the no action alternative with the cumulative effects analysis. Further, the suggestion that undefined mitigation measures for as yet undeveloped projects could reduce impact levels should be removed from this paragraph.	reasonably foreseeable future activities. Reasonably foreseeable future actions include the buildout of executed renewable energy lease areas. A detailed description of BOEM's methodology for assessing impacts is provided in Section 1.6 of the Final EIS.
Section Number: 3.9.4. Although the DEIS notes that a bottom trawl survey would be conducted as part of its Fisheries Monitoring Plan, the project principle investigator recently indicated at the June 24, 2022, Responsible Offshore Science Alliance Advisory Council meeting that they would not conduct the intended trawl survey until the COP is signed and protected species coverage, acquired through the Biological Assessment, is completed for the project. This could compromise the ability of the Fisheries Monitoring Plan to collect sufficient baseline data to inform project-specific impacts. We encourage project proponents to collaborate with NMFS to initiate scientific surveys as quickly as possible to maximize the scientific information available to assess impacts of this project on marine resources.	Comment noted. No revision or incorporation into the EIS is required.
Section Number: 3.9.5. Under Noise, insert reference to Hastings and Popper 2005, which notes certain species can have behavioral responses up to 7.54 km miles from the noise source.	Comment addressed. Text has been added to the noise IPF under Section 3.9.5, including reference to the Ocean Wind 1 EFH Assessment, the table, and Hastings and Popper 2005.
Section Number: 3.9.5. Under Port Utilization, identify an impact level for associated vessel traffic and increased demand for shoreside support services (fuel, provisions, repair, etc.), particularly during construction and decommissioning operations. Based on the definitions in Table 3.9-19, these impacts would likely to be moderate to major, depending on the scale of port utilization of construction vessels, as the document concludes the proposed action would contribute a measurable ("noticeable increment") impact to the combined port utilization impacts on commercial fisheries and for-hire recreational fishing. It is unclear how a fishing liaison would affect impacts to shoreside support services.	Text has been added to the EIS noting that the New Jersey Wind Port and the Port of Paulsboro are specifically being improved for the purpose of supporting offshore wind farm development. This is to the overall benefit of the local economy and will help divert certain offshore wind construction and O&M activities (that could include vessel traffic) from existing ports and reduce the potential for space-use conflicts with the commercial fishing industry. Potential impacts on shoreside services are mentioned qualitatively in Sections 3.9.3.2 and Section 3.9.5 under the *presence of structures* IPF. BOEM acknowledges the importance of the commercial fishing industry, as well as the variety of ports and shoreside businesses related to and within this area. To that end, it has included extensive analysis of commercial fishing revenue exposure within the Ocean Wind 1 Lease Area, and presumably a reduced catch could have an impact on these related shoreside businesses. Use of the commercial fishing revenue exposure as a metric produces a conservative estimate of potential impacts on the

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	industry. However, as the analysis indicates, a small fraction of the amount of fishing activity in New England and the Mid-Atlantic region is affected by the proposed development in the Lease Area, but, depending on the fishery in question, impacts on shoreside support services would be long term and negligible to moderate.
Section Number: 3.9.5. Under Traffic, revise impacts to long term, moderate to major impacts, depending on the scale of disruptions to vessel traffic as a result of this project. Conclusions must be based on the definitions in Table 3.9-19. As noted, structures may be present indefinitely without details on any decommissioning activities and may cause traffic impacts indefinitely.	The impact conclusion already noted “long-term” impacts; however, the Project assumes full decommissioning as required by BOEM regulations, and therefore the impact conclusion was left at moderate.
Section Number: 3.9.5. Under Presence of Structures, please note in the top of PDF p192 (p3.9-44) that cumulative development of other regional wind projects, including the adjacent Atlantic Shores Projects and the New York Bight lease areas, could reduce the ability of commercial vessels from fishing in alternate locations, which could result in impacts that more closely reflect losses associated with fishing revenue exposure estimates in this section.	Text was added to the presence of structures IPF discussion noting that development of offshore wind in adjacent offshore wind lease areas could increase competition for alternative fishing locations.
Section Number: 3.9.5. Under Presence of Structures, insert an evaluation of revenue exposure along the export cable corridor. It is not accurate to say that available data cannot estimate impacts along the cable corridors. While we agree that the fishery footprint data are not of the preferred resolution to precisely evaluate impacts within small areas, such data can and have been used to estimate revenue exposure along the cable corridor for previous projects. Fishing footprint data, along with VMS data, are the best scientific information available and can and should be used to inform decisions relative to project and cumulative impacts.	BOEM has determined that the qualitative analysis provided in Section 3.9.3.2 under the cable emplacement and maintenance IPF is appropriate for temporary cable route disturbance. The text noted in the comment that there is “not enough resolution in the data to allow estimates” has been removed.
Section Number: 3.9.5. Under Presence of Structures, insert an estimate of fishery impacts for species not managed by NMFS that are affected by the proposed action, including the menhaden and whelk/conch fisheries. This section, along with the no-action alternative discussion, is lacking information on such impacts. As noted previously, federal logbook and dealer report data do not accurately characterize these fisheries due to existing reporting requirements. Any estimates of fishery landings and revenue in federal data likely substantially underestimate impacts to these fisheries. Therefore, additional sources such as state fishery data and the federal processed products report	Footnotes were included in Tables 3.9-1 through 3.9-12 to reflect that the analysis is based on fisheries receiving permits from the NMFS Greater Atlantic Regional Fisheries Office. Estimates of revenue exposure are based upon these data, as well. BOEM has determined that the qualitative analysis provided in Section 3.9.3.2 under the cable emplacement and maintenance IPF is appropriate for temporary cable route disturbance.

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should be integrated into the evaluation of impacts in the FEIS. These impacts must be included in this section to provide a complete evaluation of potential impacts from this project.	
Section Number: 3.9.5. Insert a discussion of the party/charter impacts within the project area from our report located at: https://www.greateratlantic.fisheries.noaa.gov/ro/fso/reports/WIND/WIND_AREA_REPORTS /party_charter_reports/ Ocean_Wind_1_ rec.html #Percentage_of_Angler_Trips_by_Permit. Updated data are available through 2020 upon request. This represents the most accurate and updated information available to describe party/charter impacts from this project and should be integrated into the FEIS to supplement the outdated 2012 data from Kirkpatrick et al. 2017. It is not accurate to say annual revenue exposure for party/charter vessels is not available. This text should be deleted.	A new data request was sent from BOEM to NMFS specific to Ocean Wind 1 on October 13, 2022. The tables in the Final EIS were updated with these data. In addition, a table note, where appropriate, was included to indicate how the averages were calculated.
Section Number: 3.9.5. Update Table 3.9-45 with data from a new data request to NMFS to reflect data through 2020 and additional analysis we've developed.	As there is no Table 3.9-45 in Section 3.9; BOEM assumes the comment pertains to Table 3.9-21 on page 3.9-45 of the Draft EIS. A new data request was sent from BOEM to NMFS specific to Ocean Wind 1 on October 13, 2022, and the tables in Section 3.9 of the Final EIS were updated with these data to the extent possible. In addition, a table note, where appropriate, was included to indicate how the averages were calculated.
Section Number: 3.9.5. Under Cable emplacement and maintenance, note that seabed preparation for cable installation may relocate boulders and other obstructions. Unless removed entirely from the ocean, boulder/obstruction relocation could result in indefinite impacts and could increase gear damage/loss if such relocations are not documented and notified to mariners. Therefore, revise the impact conclusions to moderate to major for consistency with Table 3.9-19.	Language was added to Section 3.9.5 acknowledging that relocation of boulders/obstructions to uncharted or unknown locations could result in damage to gear and equipment.
Section Number: 3.9.5. Costs must be included and quantified throughout all sections whenever possible to present the most accurate estimate of project impacts, particularly considering the socioeconomic impacts discussion will form the basis of any potential fisheries compensation amounts used as mitigation. Examples of such costs can be derived from Northeast Fisheries Observer Program data and NMFS Social Science Branch cost surveys, among other sources, and estimates could be included in the FEIS based on certain operational assumptions.	The EIS provides revenue exposure estimates as part of potential Project development. These were developed using NMFS data combined with proposed wind development areas. Additional analysis to quantify other costs, such as gear loss, equipment damage, increase in fuel costs, etc. that would result from offshore wind projects, have too many unknown factors to develop a reliable estimate of impacts on the commercial fishing industry. However, where possible, Sections 3.9.3 and 3.9.5 have been revised to identify when there may be an associated increase in costs

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	(e.g., under the presence of structures IPF to note that increased fuel costs would accompany increased travel time).
Section Number: 3.9.5.1. This section should consider the impacts of reasonably foreseeable actions, not just environmental trends. Insert an estimate of revenue exposure of federally permitted commercial and party/charter vessels expected from the proposed action and all reasonably foreseeable actions. This is necessary to evaluate the cumulative impacts of this action consistent with NEPA. While the impact category conclusions may not change, the public should be informed about the cumulative impacts to fishery operations and associated communities relative to annual fishery landings and revenues. Such data will demonstrate that fishery-specific impacts from this and other projects is well above the small project-specific impacts relative to regional landings/revenues highlighted in Tables 3.9-5 and 3.9-7.	Note that with the reorganization and separation of the No Action Alternative, cumulative impacts, and the Proposed Action, the new Section 3.9.5.1 is *Cumulative Impacts of the Proposed Action* and summarizes the impacts of the Proposed Action in combination with other ongoing and planned wind activities. The revenue exposure from offshore wind energy development under the No Action Alternative is included in Table 3.9-20 and discussed under the presence of structures IPF in Section 3.9.3.2, *Cumulative Impacts of the No Action Alternative*. With this separation of the impacts, the relative impact of a Project-specific impact on regional impacts will be clearer.
Section Number: 3.9.5.1. This concluding paragraph is confusing and inaccurate. It is not clear what BOEM means by suggesting the project impacts are “appreciable”. The paragraph goes on to make unsubstantiated statements related to fishery impacts. Justify or remove conclusions that regulated fishing effort and climate change would continue to be the most important factors affecting the sustainability of fisheries in the area. There is no discussion how fishing regulations affect fishery resources and minimal discussion of climate change on the fishery. For the federal surfclam fishery, the most affected species in the project area, fishery quotas have not changed since 2004. Further, quotas have not limited fishing operations since 2003 (see Table 1: https:// static1.squarespace.com / static/ 511cdc7fe4b00307a2628ac6 /t/ 627035119 cfe5d25371c4ba7 / 1651520790102 / e_2022_SC_ FishInf oDoc_ 2022-04-11.pdf). Similarly, the coastwide quota for menhaden has increased since it was first established in 2013 (see https://www.asmfc.org/ uploads/ file/ 5e5e84fb Atlantic Menhaden Assessments Overview_ Feb2020.pdf) and scallop quotas have generally increased 2011-2020 without being exceeded (see Table 18 here: https:// s3.amazonaws.com/ nefmc.org/ 210813- Amendment-21 -Final- Submission.pdf). Therefore, fishing regulations are not the most important factor facing the three primary fisheries affected within this project area. Further, this paragraph should list any mitigation measures that would support BOEM’s	Descriptors such as “undetectable,” “noticeable,” and “appreciable” are defined in Section 3.3 of the EIS and are used to describe the incremental impact of the action alternatives in relation to the combined impacts from all ongoing and planned activities, including both non-offshore wind and offshore wind activities. Note that with the reorganization and separation of the No Action Alternative, cumulative Impacts, and the Proposed Action, the new Section 3.9.5.1 is *Cumulative Impacts of the Proposed Action* and summarizes the impacts of the Proposed Action in combination with other ongoing and planned wind activities.

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conclusion that fishing regulations and climate change would continue to be the most important impacts to fishery operations, as no measures are listed here. Reference to Section 3.9.9 should be included at a minimum, along with a description of the measures BOEM expects will contribute to offsetting particular impacts.	
Section Number: 3.9.6.1. This section should consider the impacts of reasonably foreseeable actions, not just environmental trends. Given that impacts are “noticeable,” they can and should be quantified using the best scientific information available, including separate runs of the fishing footprint impact reports for each alternative.	This cumulative impact section includes other planned non-offshore wind activities and planned offshore wind activities, as well as environmental trends. Descriptors such as “undetectable,” “noticeable,” and “appreciable” are defined in Section 3.3 of the EIS and are used to describe the incremental impact of the action alternatives in relation to the combined impacts from all ongoing and planned activities, including both non-offshore wind and offshore wind activities. However, despite acknowledging that an overall impact may be noticeable, there may still be too many variables and unknowns to accurately quantify the impact. For the purposes of comparing alternatives, this incremental descriptor is sufficient.
Section Number: 3.9.6.1. This section should consider the impacts of reasonably foreseeable actions, not just environmental trends. Given that impacts are “noticeable,” they can and should be quantified using the best scientific information available, including separate runs of the fishing footprint impact reports for each alternative.	Duplicate comment; see response above.
Section Number: 3.9.7. In the second paragraph, please note that the impacts described within Section 3.9.5 only reflects federally permitted fisheries and do not fully reflect the maximum impacts to the menhaden and conch/whelk fisheries. Therefore, these fisheries may be similarly adversely affected by Alternative C-2 through compression of WTG spacing.	Text was added indicating that “This does not include potential impacts from the compression of WTG spacing on non-federally permitted species, such as menhaden and welk fisheries.”
Section Number: 3.9.7.1. This section should consider the impacts of reasonably foreseeable actions, not just environmental trends. Given that impacts are “noticeable,” they can and should be quantified using the best scientific information available, including separate runs of the fishing footprint impact reports for each alternative.	The cumulative impact section includes other planned non-offshore wind activities and planned offshore wind activities, as well as environmental trends. Descriptors such as “undetectable,” “noticeable,” and “appreciable” are defined in Section 3.3 of the EIS and are used to describe the incremental impact of the action alternatives in relation to the combined impacts from all ongoing and planned activities, including both non-offshore wind and offshore wind activities. However, despite acknowledging that an overall impact may be noticeable, there may

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	still be too many variables and unknowns to accurately quantify the impact. For the purposes of comparing alternatives, this incremental descriptor is sufficient.
Section Number: 3.9.8. Insert a map or reference to the figure depicting Alternative E as well as a discussion of which fisheries may benefit from reductions to SAV impacts from this alternative. That would help the reader understand and appreciate the implications of this alternative relative to affected resources. While the same types of impacts on commercial and for-hire fisheries from the proposed action may apply to Alternative E, Section 3.9.5 of this document does not contain any meaningful description of the types or amount of impacts that may result from the proposed export cable corridor. This section should include a more thorough evaluation of impacts along the cable corridor, including any state-managed fisheries and specific fish species that may be affected within Barnegat Bay.	A reference to Figure 2-12, which depicts Alternative E, has been added to the text. BOEM has determined that the qualitative analysis provided in Section 3.9.3.2 under the cable emplacement and maintenance IPF is appropriate for temporary cable route disturbance. The benefit of Alternative E, which is the reduction of SAV affected by an estimated 14.7 acres, is quantified in the EIS. However, the benefit that the reduction of SAV impacts would provide to fisheries would be negligible.
Section Number: 3.9.8. This section should consider the impacts of reasonably foreseeable actions, not just environmental trends. Given that impacts are “noticeable,” they can and should be quantified using the best scientific information available, including separate runs of the fishing footprint impact reports for each alternative. Specific to Alternative E, discussion should focus on what species might be affected by this alternative in the context of overall impacts to these species from other projects.	The cumulative impact section includes other planned non-offshore wind activities and planned offshore wind activities, as well as environmental trends. Descriptors such as “undetectable,” “noticeable,” and “appreciable” are defined in Section 3.3 of the EIS and are used to describe the incremental impact of the action alternatives in relation to the combined impacts from all ongoing and planned activities, including both non-offshore wind and offshore wind activities. However, despite acknowledging that an overall impact may be noticeable, there may still be too many variables and unknowns to accurately quantify the impact. For the purposes of comparing alternatives, this incremental descriptor is sufficient. BOEM has determined that the qualitative analysis provided in Section 3.9.3.2 under the cable emplacement and maintenance IPF is appropriate for temporary cable route disturbance. The benefit of Alternative E, which is the reduction of SAV affected by an estimated 14.7 acres, is quantified in the EIS. However, the benefit that the reduction of SAV impacts would provide to fisheries would be negligible.
Section Number: 3.9.9. Compensation for gear loss and damage should be applicable throughout decommissioning and possibly	Comment addressed. Text was revised to include through decommissioning and beyond if Project infrastructure is not fully removed.

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indefinitely if project infrastructure (scour protection and turbine structures) are not removed.	
Section Number: 3.9.9. Clarify whether funds set aside commensurate with those in Table 3.9-21 are for average or peak annual revenue exposed from the proposed project. As noted above, Table 3.9-21 does not include all fisheries that are affected by the proposed action and likely underestimates fishery exposure. Further, this table does not include any estimates of fishery impacts from the cable corridor, shoreside support service entities, or any increased costs that may be incurred by affected entities as a result of this project. Therefore, we are concerned that requiring any compensation funds based on the data in Table 3.9-21 will underestimate the funds needed to fulfill any valid compensation claim for lost fishing income and will not be sufficient to address all fishery impacts that may be observed. We disagree with your conclusion that such mitigation would reduce impacts to moderate for all entities and suggest impacts remain listed as major based on the definition in Table 3.9-19. We do not believe that income losses for all entities would be mitigated if funds are based on revenue exposure estimates in Table 3.9-21 for the reasons previously discussed. As noted above and in the document, some entities would experience substantial disruptions to existing fishing operations and may be impacted indefinitely unless all project infrastructure is removed, which is unlikely based on discussions in previous sections. Finally, it is unclear whether this measure would be adopted. Therefore, we expect some vessels could be impacted noticeably and indefinitely, even if compensation is required, as compensation may not continue beyond 5 years post-construction, while impacts may continue long after that date.	By providing revenue exposure within the EIS analysis, not impacts, BOEM is already providing a very conservative estimate of potential revenue losses and potential impacts. Therefore, by providing this overestimation of revenue exposure, the analysis provides a buffer to cover other operating expenses. BOEM has determined that the qualitative analysis provided in Section 3.9.3.2 under the cable emplacement and maintenance IPF is appropriate for temporary cable route disturbance.
Section Number: 3.9.9. Proposed Mitigation Measures should go beyond gear loss/damage and lost fishing income. Per above comment, fishery impacts also need to be addressed and mitigated. For example, fishing entities should be mitigated through compensation for increased travel costs if they choose to avoid navigating through Ocean Wind and adjacent projects to distant fishing grounds. These impacts are not considered through ex-vessel landing exposure analysis as vessels that transit through but don't have historical landings within are not represented. The EIS needs to provide an analysis of these travel cost impacts in order for compensation claims	By providing revenue exposure within the EIS analysis, not impacts, BOEM is already providing a very conservative estimate of potential revenue losses and potential impacts. Therefore, by providing this overestimation of revenue exposure, the analysis provides a buffer to cover other operating expenses, such as increased travel costs and other related impacts.

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to be made by the fishing industry to lessees according to BOEM's draft mitigation guidance. In order to ensure fishermen can make claims on anticipated impacts, BOEM must provide an analysis that includes costs, including travel, permit value loss, insurance premiums.	
Section Number: 3.11.5. The risk of collision focuses on vessel traffic but fails to include risks of collision with structures which should be added as a potential negative impact for each alternative (negatively correlated to the number of turbines).	The presence of structures IPF discussion in Section 3.11.5 (*Impacts of the Proposed Action on Demographics, Employment, and Economics*) of the EIS includes discussions of both vessel collisions and allisions. Allisions account for a vessel striking any stationary object, which may include offshore structures. The alternatives analysis in Section 3.16 (*Navigation and Vessel Traffic*) discusses that there may be slightly reduced impacts on navigation and vessel traffic due to WTG positioning compared to the Proposed Action, but impacts would be at the same level of major.
Section Number: 3.11. The potential for increased insurance costs (including but not limited to premiums, deductibles, and foregone revenues while waiting for repairs) due to collisions with other vessels and/or wind equipment and associated damages should also be included in this section. Conversation around compensation mitigation for these potentially incurred costs are especially important for vulnerable vessel owners who may no longer be able to operate creating negative knock on effects.	The EIS does not estimate potential increases in insurance costs due to collisions with other vessels or allisions with offshore wind structures because BOEM does not have a methodology for doing so. BOEM recently published draft guidance for a general compensation fund related to commercial and recreational fishing activities (https://www.boem.gov/renewable-energy/draft-fisheries-mitigation-guidance).
Section Number: 3.11. Please include current or projected locations as well as costs of related job training programs/facilities (when available) to ensure that the feasibility to support current and projected supply chain needs can be evaluated.	A recently released report from NREL (https://www.nrel.gov/docs/fy23osti/81798.pdf) states that the New Jersey Economic Development Authority is providing $4.5 million in funds to support the wind energy work force, specifically the New Jersey Wind Turbine Technician Training Challenge and New Jersey Offshore Wind Safety Training Challenge. Recent solicitations in New Jersey contained equity provisions that support the development of a local workforce by requiring developers to provide workforce training and support minority-owned businesses. This text has been added.
Section Number: 3.11.3.2. Please clarify in the text that the referenced BVG Associates Limited (2017) study found that the high-energy production scenario for 30GW of offshore wind by 2030 will make additional jobs more likely. The report indicates that this scenario does not lead to a higher proportion of baseline jobs because U.S. companies will still meet significant competition from more established suppliers and U.S. supply cannot be guaranteed. As a result coastal	A sentence stating that "the high-energy production scenario for 30 GW of offshore wind by 2030 will make additional jobs more likely" has been added to EIS Section 3.11.3.2. The discussion of this reference does not only account for East Coast jobs, but jobs across the U.S. that could be created from the offshore wind industry.

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communities will not necessarily see a net increase in jobs - which may not be a benefit to coastal communities that are largely dependent on the fishing industry. This information should be accurately reflected in the DEIS. Reference: https://tethys.pnnl.gov/ sites/ default/ files/ publications/ NYSERDA-Report-2017-OSW-Jobs.pdf.	
Section Number: 3.11.3.2. Please note in the text findings by Parkison and Kempton in 2022 that indicated "there is an East coast marshalling port shortage that will limit the future of the US OSW industry, impeding efficient and cost-effective OSW project deployment, delaying construction schedules, and constraining logistics. Marshaling ports are difficult to site due to their demanding specifications, and states have thus far depended mostly on re-working existing ports that are much smaller than recommended." Furthermore, according to a study by the D.O.E. on America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition in 2022, investments in specialized port infrastructure and Jones Act-compliant specialized maritime vessels required for offshore wind development are challenged by a lack of certainty in near-term offshore wind demand; uncertainty in demand is exacerbated by the lack of specialized vessels and port infrastructure. These findings contradict the following statement in the EIS which insinuates that the necessary level of investment for all existing and future activities at all stages of offshore wind development is assured: "While simultaneous construction or decommissioning (and, to a lesser degree, operation) activities for multiple offshore wind projects in the geographic analysis area could stress port capacity, it would also generate considerable economic activity and benefit the regional economy and infrastructure investment." We suggest the text be updated to note that without strong strategies to evaluate cumulative effects of offshore wind development to all surrounding ports and policy securing appropriate levels of investment, the lack of sufficient specialized port infrastructure and vessels could create significant bottlenecks at the major ports associated with Ocean Wind in addition to neighboring ports due to overcrowding.	As noted in the COP, Ocean Wind proposes to use two ports in New Jersey that are being improved specifically to support the offshore wind industry: Port of Paulsboro for foundation fabrication and Hope Creek, New Jersey for WTG pre-assembly. Given the substantial ongoing investment in these facilities as described in Appendix F, BOEM does not concur that the proposed Project is likely to create significant bottlenecks at major ports due to overcrowding.
Section Number: 3.11.3.2. Please insert an explanation for how "considerable benefits" were determined as potential impacts of port modifications. Please clarify the sources of information indicating planned modifications and expansions for each port mentioned in the port utilization section of this page, or remove the following statement:	Supporting reference has been added to substantiate "considerable benefits." Considerable benefits include the number of new jobs, economic growth and opportunity, and investment in clean energy.

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"While simultaneous construction or decommissioning (and, to a lesser degree, operation) activities for multiple offshore wind projects in the geographic analysis area could stress port capacity, it would also generate considerable economic activity and benefit the regional economy and infrastructure investment."	
Section Number: 3.11.3.2. Under 'Port Utilization', the DEIS should discuss situations where port facilities may experience competition between existing users and wind energy staging activities. The competition for dock space, and thus increase in dock space prices may create negative effects on some local communities.	As noted in the COP, Ocean Wind proposes to use two ports in New Jersey that are being improved specifically to support the offshore wind industry: Port of Paulsboro for foundation fabrication and Hope Creek, New Jersey for WTG pre-assembly. Given Ocean Wind's proposed use of ports specifically developed or improved to support the offshore wind industry, as described in Appendix F, BOEM does not concur that the proposed Project is likely to create significant competition with other users for dock space.
Section Number: 3.11.3.3. Under 'Presence of Structures,' please add text after citing the Hoagland study to elucidate the importance of the likely inequitable distribution of negative impacts on those living outside of coastal communities. Low-income workers found in commercial fishing and supporting industries are especially vulnerable to impacts mentioned in Hoagland et al. as they are more likely to live and contribute to local economies outside of coastal areas due to higher coastal costs of living.	EIS Section 3.11 includes mention of the Hoagland study under the presence of structures IPF, stating that "The study's authors found that impacts may be most pronounced in areas that are not close to the coastline (Hoagland et al. 2015), highlighting the potential for broad, regional socioeconomic impacts." The Hoagland et al. study's stated adjustment of welfare losses to account for "society's aversion to income inequality" and weighting of impacts to give low-income groups more influence on the net utility impacts is not a commonly applied methodology and may distort the findings, so these additional conclusions have not been incorporated.
Section Number: 3.12. Please include findings of Hoagland et al. (2015) which state that displacement of fishing vessels from Point Judith, RI and New Bedford, MA will impact a wider spatial area than would be expected, including communities inland. This study found communities in MA such as Boston, Fall River and Brockton, MA as well as Pawtucket, RI had highest level of impacts per household (see Figure 5 in article). "The figure reveals that five census tracts (colored in dark red) would bear the largest impacts, which, at ≥$140 year−1 would be an order of magnitude larger than those of the next group of impacted census tracts. These tracts (circled in Fig. 5) are located in Pawtucket (RI), Fall River (MA), Brockton (MA), between Boston South End and Fenway/Kenmore (MA), and between Mattapan and Roslindale (MA). Without providing analyses that will ensure all impacted communities are evaluated with the best available science, BOEM is not adequately making efforts to understand the impacts to	BOEM's methodology for associating offshore impacts on commercial fisheries and for-hire recreational fishing to onshore impacts on environmental justice populations involves the use of geospatial data to: (1) identify the location of low-income and minority populations in the geographic analysis area using mapped spatial data obtained from the U.S. Census Bureau or through EJSCREEN, along with state-identified populations if available, (2) assessing the intensity of commercial and recreational fishing engagement or reliance within the same geographic analysis area with mapped spatial data developed by NOAA, and (3) identifying geographic locations in the geographic analysis area where low-income and minority populations are present, that also have high levels of commercial or recreational fishing engagement or reliance, to identify specific environmental justice populations that could be vulnerable to offshore impacts on commercial and recreational fishing. In addition,

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underserved communities (most of the identified communities in this study have high levels of poverty and diversity). https://www.sciencedirect.com/ science/ article/ pii/ S0308597X15000871.	BOEM has identified public fishing sites close to Project infrastructure that could be temporarily disrupted during construction and potentially affect subsistence anglers. BOEM believes this methodology is a valid approach to associating offshore impacts to onshore environmental justice populations. The Hoagland et al. 2015 article analyzed a counterfactual scenario where offshore wind would completely displace commercial fishing and no economic impacts from the offshore wind development were considered. Despite these conservative assumptions about how impacts would be generated and attributed, the initial results found that welfare losses would be progressively distributed such that mid- to high-income categories would likely bear the most significant impacts, and therefore low-income populations would not experience disproportionately high and adverse effects. The authors “adjusted welfare losses for society’s aversion to income inequality,” weighting impacts to give low-income groups more influence on the net utility impacts, a methodology untested in EIS applications. Given these issues with the analysis, BOEM has elected not to include this citation in the EIS.
Section Number: 3.12. The Marine Recreational Information Program (MRIP) provides a list of publicly accessible fishing sites. Underserved communities often practice subsistence fishing in low income areas. We appreciate that BOEM included this information in the recreation and tourism section. However, impacts to subsistence fishing is listed in the DEIS as a potential unavoidable adverse impact of the Proposed Action and BOEM should make an effort in this section as well to identify those specific fishing sites that are within areas of environmental justice communities of concern, including a summary of these access sites within these communities. Consider noting which sites will be impacted and overlap with offshore wind infrastructure on land and cable placement during both construction and operation. See the Site Register here: https://www.st.nmfs.noaa.gov/msd/html/ siteRegister.jsp.	Reference to publicly accessible fishing sites near inshore cable routes, cable landfalls, onshore export cable routes, and the O&M facility on Atlantic City that are listed in the Marine Recreational Information Program database have been added to Section 3.12 of the Final EIS.
Section Number: 3.12. BOEM has clarified that the analysis only includes VA and SC because the Ocean Wind COP identified these ports. The COP identified these two ports because due to their proximity, VA and SC ports are anticipated to be used during construction. However, BOEM should provide a more comprehensive	BOEM’s methodology for identifying environmental justice populations involves the use of geospatial data to identify the location of low-income and minority populations in the geographic analysis area using mapped spatial data obtained from the U.S. Census Bureau or through EJSCREEN. The environmental justice geographic analysis area, Figure 3.12-1 in the EIS, identifies

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analysis of communities that could be impacted by offshore wind, which may go beyond port facility communities.	environmental justice populations that span beyond port facility communities. While the geographic analysis area does include the communities surrounding the identified ports, it also includes areas with onshore project infrastructure (interconnection points, O&M facility) or cable landings. In regard to Virginia and South Carolina, the identified environmental justice populations go beyond the immediate location of the ports and include a larger geographic area. Analysis of port utilization is carried forward for analysis of disproportionately high and adverse effects under the port utilization and air emissions IPFs.
Section Number: 3.13. As discussed with BOEM previously, we recommend the following categories be used to describe impact duration: short-term (less than 2 years); long-term (2 years to < life of the project); and permanent (life of the project). It is unclear why the Ocean Wind DEIS defines short term impacts as less than 3 years. We recommend this be modified to less than 2 years. We are also concerned that BOEM defines “long term” as lasting for the life of the project, and permanent effects are defined as those that extend beyond the life of the project. This should be modified to be consistent with the EFH duration definitions, as impacts that last the life of the project (30+ years) should be classified as a permanent impact.	The Ocean Wind 1 EIS defines short-term effects as effects that may extend up to 3 years. This duration corresponds to the anticipated duration of 2 to 3 years for construction and conceptual decommissioning activities. Long-term effects are defined as effects that may extend for more than 3 years, and may extend for the life of the Project (35 years). An example would be the loss of habitat where a foundation has been installed that would be decommissioned at the end of the Project. There would also be permanent conversions of habitat for the onshore substations that extend beyond the life of the Project, and the EFH definition of *permanent* would not capture this longer duration.
Section Number: 3.13. Citing the COP is inappropriate except for elements related to the action (e.g., project design, construction methodologies). Analyses of potential impacts should be independent of the COP and involve thorough reviews of the literature.	Additional literature review and citations have been added to Section 3.13 as noted in response to specific comments below.
Section Number: 3.13. Elements, alternatives, or methodologies that avoid and minimize impacts to resources should be described as such and not mischaracterized as “benefits” or “beneficial.”	One revision to an impact conclusion was made in Section 3.13.6 to restate that Alternative E would reduce impacts on fish and invertebrates. All other occurrences of “benefits” or “beneficial” are within the context of artificial reef effects.
Section Number: 3.13.1. While there is now mention of important prey species such as the two species of sand lance (Ammodytes americanus and A. dubius) and other forage fish in a list, there is no in-depth evaluation of potential impacts to sand lances and other important forage species. This should be corrected and thorough evaluations of potential impacts conducted.	A description of impacts on sand lance was added to Section 3.13.5 and a cross-reference will be added to the EFH Assessment where sand lance is discussed in detail.
Section Number: 3.13.1. Insert a discussion of the status of all species for which established EFH overlaps with the project area, particularly	A discussion of the status of all species with EFH in the Project area is detailed in the EFH Assessment (BOEM 2022a). Cross-reference

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for species important to fisheries that may be affected by this project. This helps establish baseline biomass levels as a means of evaluating impacts of this action.	to the EFH Assessment is made in Section 3.13.1. Additional information on species with EFH in the Project area by life stage is summarized in EIS Table I-6 of Appendix I, *Supplemental Information*.
Section Number: 3.13.1. In the third paragraph, please note that black sea bass is expanding its population size, but also its distribution northward as a result of warming waters that may offset noted additional pressures that could lead to population decline.	Sea bass was added to the list of species described similarly in a subsequent paragraph in the same section.
Section Number: 3.13.1. In the FEIS, rather than provide information on all ESA listed species (inclusive of whales and sea turtles), please provide a paragraph summarizing the distribution of ESA listed fish species that occur in the geographic analysis area.	The referenced paragraph on ESA-listed marine mammals and sea turtles was deleted and discussion added on the status of the Atlantic sturgeon, primarily from the Atlantic Sturgeon Status Review Team (2007).
Section Number: 3.13.1. While this section includes references to the BA (BOEM 2022b) and its analyses for Atlantic sturgeon, the FEIS should summarize the anticipated effects of the action on ESA-listed fish species. We note that the sea turtle section contains a summary of the findings in the BA (see 3.19.5) and recommend that a similar summary be provided for ESA listed fish with an emphasis on Atlantic sturgeon. If the BA will not be included as an appendix to the final document, we encourage BOEM to make the BA publicly available on the Ocean Wind webpage (not just on the ESA consultation page) so that the information can be easily referenced by the public.	Added as requested.
Section Number: 3.13.1. Table 3.13-1: With these definitions, it is difficult to identify a meaningful difference between “minor” and “moderate” effects to fish species. Both categories seem to indicate that there could be loss of individuals that would not have population level impacts with the only difference being that for minor, “most” impacts would be avoided (but there could still be loss of individuals). Additional clarity should be provided in the FEIS to ensure that there is a clear and meaningful difference between these categories.	Minor impacts would be mostly avoided and otherwise limited to temporary or short term; moderate impacts are unavoidable and may be short to long term or permanent.
Section Number: 3.13.1. At the bottom of the last full paragraph, please note that fishing regulations would result in positive impacts to marine resources through ensuring fishery removals are sustainable over the long term.	Text has been added to Section 3.13.3.1 to describe the relationship of fishing effort to regulations. Most fishing regulations would limit the removal of marine resources but would not necessarily eliminate the removal of or increase marine resources. Fishing regulations are not an IPF in this section, so positive and negative benefits are not analyzed here.

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Section Number: 3.13.3.1. Vessel strikes are missing from this analysis; vessel strikes are documented threats to at least some marine fish species, including Atlantic sturgeon and Giant manta rays.	Discussion of vessel strikes has been added to Sections 3.13.3. and 3.13.5 under the vessel traffic IPF.
Section Number: 3.13.2. Consideration of UXO detonations and vessel strikes are missing from this analysis. Both activities may result in adverse effects to at least some fish species.	Discussion of UXO and vessel strikes has been added to Section 3.13.3 and Section 3.13.5 under the noise and vessel traffic IPFs.
Section Number: 3.13.3.2. As noted earlier in this section, noise may disrupt spawning activity for species with social behavior or that communicate with sound during spawning seasons. This should be noted here for longfin squid and that impacts to multiple spawning seasons may have population level impacts for species such as longfin squid with short lifespans. Previous noise studies on longfin squid, including some mentioned in this document, did not evaluate the impacts of noise during spawning season.	Additional information related to impacts of noise on spawning behavior has been added to Section 3.13.3.2, based on Mooney et al. 2020 and Radford et al. 2014.
Section Number: 3.13.3.2. Please note in this section that changes to the Cold Pool size, distribution, and timing may negatively affect thermal habitats preferred by some species (e.g., Atlantic mackerel, Illex squid, etc.) and may affect the availability of some species to nearshore spawning habitats (longfin squid) and as a source of prey for other species.	Added as requested.
Section Number: 3.13.3.2. Remove mention of “reduction in favorable conditions” when the clear purpose of the statement/section is to describe long-term and permanent reductions in soft bottom habitat for various species. Recommend using appropriate terminology such as “reductions in habitat” or “reductions in spawning habitat” or “reductions in adult habitat.”	Revised as requested.
Section Number: 3.13.5. Consideration of UXO detonations and vessel strikes are missing from this analysis. Both activities may result in adverse effects to at least some fish species, including endangered Atlantic sturgeon.	Discussion of UXO and vessel strike has been added to Section 3.13.3 and Section 3.13.5 under the noise and vessel traffic IPFs.
Section Number: 3.13.5. Accidental releases: This discussion should include effects of anti-corrosive and anti-fouling compounds.	Added as requested.
Section Number: 3.13.5. The narrative on EMF indicates that the science is unsettled on this topic. However, the conclusion is that impacts will be negligible. Please provide a rationale for this conclusion.	Additional explanation of EMF impacts has been added based on Hutchinson et al. 2020 and Harsanyi et al. 2022.

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Section Number: 3.13.5. The conclusions regarding potential impacts of operational noise are dismissed/discounted with little justification. We disagree with this discounting and a thorough analysis of the potential impacts should be undertaken.	The discussion of noise impacts has been expanded in Section 3.13.5 to include results of studies documenting impacts of noise on individual fish species based on Southall et al. 2007, Popper et al. 2014, Popper and Hawkins 2018, and Popper et al. 2022.
Section Number: 3.13.5.1. The impact conclusion does not accurately reflect impact levels in Table 3.13-1, as habitat conversion may be permanent, but would not result in population level impacts to associated species. Recommend revising the EFH impact conclusions to moderate. Habitat conversion is expected to occur over the life of the project and beyond and would not recover naturally over time. In a similar manner, impacts on invertebrates should be classified as moderate or at least minor to moderate to reflect the range of impacts to various species. This impact determination would be consistent with the overall impact conclusions at the bottom of this page. For example, soft bottom habitats that support Atlantic surfclam, ocean quahog, sea scallop, and others will be permanently converted to steel pile (foundation) and rock riprap and would not support these species, thereby reducing colonization and reproductive potential/recruitment.	The impact conclusion was revised to moderate for EFH and to minor to moderate for invertebrates, as suggested.
Section Number: 3.13.6.1. Impact conclusions should differentiate between impacts associated with various activities, particularly for Alternative E. Although Alternative E may result in increased trenching, it would significantly reduce impacts to SAV. Given the previous section suggested minimal difference with cable-laying alternatives, the significant reduction in impacts to SAV suggest that Alternative E is much more effective at reducing overall impacts to important habitat than the proposed action. This should be noted in this section, as the marginal increased negative impacts of additional trenching are of less importance than the benefits of protecting important SAV. Additionally, trenchless cable installation methodologies should be fully considered for the SAV avoidance alternative.	Discussion has been added to Section 3.13.6 that describes the difference in the cable placement methods; impacts on SAV, particularly between the Proposed Action and Alternative E; and an analysis of short-term impacts (in acres for each cable route) of open-cut trenching and HDD for each of the estuarine cable routes. A table of areal extent of impacts has also been added to quantify the differences among export cable routes in Barnegat Bay by cable installation method.
Section Number: 3.13.6.1. There is an odd emphasis on the significance of trenching and other related impacts with little acknowledgement of the more than 14 acres of SAV that would be directly avoided via this alternative. While indirect impacts are difficult to estimate, given the occurrence and density of beds in the original cable location, those are also presumed to be reduced with Alternative E. Furthermore, it remains unclear why less invasive methods (e.g., HDD) could not be used to further avoid and minimize impacts to SAV.	In addition to text noted in the previous comment, information has been added to Section 3.13.6 that describes HDD and corresponding potential impacts of HDD to clarify differences in open cut and HDD cable methods and potential impacts on SAV.

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HDD and other methods should be included, potentially as avoidance and minimization measures. Specifically, the SAV Avoidance alternative should include, at a minimum, HDD at the backside of the barrier island with an exit pit west of the historic SAV beds (SAV habitat) and existing beds. HDD should also be discussed and analyzed as a measure to avoid SAV beds on the land-side landing location.	
Section Number: 3.13.6.1. The current discussion and analysis of the SAV Avoidance alternative (e.g., impact conclusion is “negligible to moderate” for benthic resources) appears to emphasize construction-related impacts to suggest this alternative has more impacts than the proposed action through SAV beds (e.g., impact conclusion minor for benthic resources), which included more than 14 acres of permanent impacts to SAV, a habitat that is extremely difficult to offset in-kind and for which there are extremely limited locations suitable for compensatory mitigation within Barnegat Bay. As mentioned here and in our letter, the document appears to discard the use of HDD in favor of methods that would result in greater impact (open trenching), but only for the new SAV Avoidance alternative. This approach relies on numerous assumptions that are not discussed, but do not appear to consider avoidance and minimization of impacts.	Discussion of avoidance, minimization, monitoring, and mitigation, including reference to the Ocean Wind SAV Monitoring Plan and SAV Preliminary Mitigation Plan, have been added to clarify anticipated impacts, including text from Section 3.6.8.1, e.g., “The anticipated impacts associated with Alternative E would be similar to those of the Proposed Action but impacts on SAV within Barnegat Bay would be greatly reduced.” However, overall impacts on benthic habitats reflect all IPFs and all habitats in the entire Lease Area and, considering all the IPFs together, the overall impacts on finfish, invertebrates, and EFH associated with the action alternatives when combined with the impacts from ongoing and planned activities including offshore wind would be negligible to moderate. References to Section 3.6.8 and the EFH Assessment are included in this section.
Section Number: 3.13.6.1. There is no evaluation or discussion of indirect impacts to SAV, especially those over the life of the project; please add this information to the document.	A discussion of indirect impacts on SAV has been added to Section 3.13.1.
Section Number: 3.13.6.1. Background information on SAV appropriately discusses that it is a difficult-to-replace resource and mitigation is rarely successful; however the conclusions do not align with this.	Additional discussion of long-term habitat loss that can result from cable installation through SAV beds has been added to Section 3.13.3 under the cable emplacement and maintenance IPF.
Section Number: 3.13.7. We appreciate the inclusion of mitigation measures, particularly time of year restrictions to reduce impacts to winter flounder and anadromous fish. However, a time-of-year restriction mitigation measure for SAV/SAV habitat is not mentioned or included, which is common for these types of projects in the Barnegat Bay and is recommended for this project. This time of year restriction extends from April 15 to October 15 of any year to avoid impacts to SAV (and the organisms that rely on this habitat) during the growing season.	Section 3.13.7 has been updated to include a table analyzing mitigation measures identified in Appendix H, Tables H-2 and H-3. EFH Conservation Recommendations issued by NMFS on February 23, 2023, include a time-of-year restriction to avoid construction activities from April 15 to October 15 of any year to avoid impacts on SAV. EFH Conservation Recommendations have been included in Appendix H, Table H-2 and analyzed in Section 3.13.7.

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Section Number: 3.13.7. Monitoring of SAV/inshore route, including areas adjacent to the route, needs to be more robust and occur for the life of the project, especially considering maintenance and other activities that may further impact nearby SAV.	Ocean Wind has developed a SAV Monitoring Plan (Inspire 2022) to document baseline delineations and conditions of SAV beds, assess potential impacts on these SAV beds as a result of construction and operation of the inshore export cable(s) associated with the Project, and track recovery of these SAV beds over time to inform potential mitigation strategies. A summary of the SAV Monitoring Plan has been added to Sections 3.13.5 and 3.6.4.
Section Number: 3.13.3.2. This section describes the No Action Alternative and should only discuss the potential impacts for wind projects are already permitted. Evaluating impacts from all potential wind projects listed in Appendix F incorrectly and inappropriately conflates the No Action alternative evaluation with the cumulative impact analysis. Such analyses should be kept separate and distinct to preserve the ability for the public and BOEM to accurately differentiate the impacts of each alternative considered in this action. Otherwise, BOEM risks minimizing the differences between alternatives and undermining the utility of the DEIS.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. A detailed description of BOEM's methodology for assessing impacts is provided in Section 1.6 of the Final EIS. The No Action Alternative analysis has been reorganized in each resource section in Chapter 3 of the Final EIS to provide separate subsections for ongoing and planned activities.
Section Number: 3.13.3.2. Speculative benefits of anchoring/anchor dragging to cobble-boulder habitat needs to be thoroughly and appropriately contextualized or removed from the document, as it emphasizes the benefits of that action while downplaying adverse impacts.	The statement regarding restructuring of patchy cobble boulder habitat under the anchoring IPF has been deleted.
Section Number: 3.13.5. Insert a discussion that noise may disrupt spawning activity for species with social behavior or that communicate with sound during spawning seasons. This should be noted here for longfin squid and that impacts to multiple spawning seasons may have population level impacts for species such as longfin squid with short lifespans.	Per the earlier response to comment on Section 3.13.3.2, additional information related to impacts of noise on spawning behavior (based on Mooney et al. 2020 and Radford et al. 2014) has been added to Section 3.13.3.2.
Section Number: 3.13.5. Per our previous comments: impact of vibrations, especially related to invertebrates (literature Roberts et al. 2015, Roberts and Elliott 2017, etc.) need to be more thoroughly discussed and potential impacts evaluated. We previously provided information on potential impacts and these need to be more fully integrated into the evaluation within the document.	The discussion of impacts of vibrations on invertebrates has been expanded in Section 3.13.5 based on updates to the Letter of Authorization (Ocean Wind 2022b).
Section Number: 3.13.5. This analysis of noise focuses on sound pressure. Noise can produce sound pressure, particle motion, and substrate vibration. All of these should be discussed separately.	Additional discussion of particle motion and vibration has been added to Section 3.13.5.

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Section Number: 3.13.5. Noise: Please include in discussion of impacts on communication, auditory mating cues, chorusing, masking, etc. These should be included in the analysis.	Text has been revised as requested, incorporating Mooney et al. 2020 and Radford et al. 2014.
Section Number: 3.13.5. It is unclear where and how UXO detonations have been evaluated, if they have been evaluated at all. The impacts of this activity should be integrated into this section and impacts evaluated comprehensively.	Discussion of impacts of UXO detonation has been added to Sections 3.13.1, 3.13.3, and 3.13.5.
Section Number: 3.13.5. Noise impacts, especially those from construction, are noted as being temporary or short-term in various locations that also discuss injury, mortality, and behavioral impacts to organisms. Sections related to noise currently omit important discussions of how the temporary activity of pile driving may result in short-term, long-term and permanent impacts to fish/invert populations and communities, specifically growth, fecundity, recruitment, and future production. This should be corrected and all impacts thoroughly discussed.	Impacts of noise on finfish are anticipated to be short term, temporary, and negligible to minor, and no population-level impacts are anticipated. Additional discussion of noise impacts has been added to Section 3.13.5 to describe peak and cumulative impacts of pile driving on finfish that were modeled by calculating the radius and intensity and type of sound from pile driving with respect to various groups of fish to evaluate the potential for injury and behavioral impacts. Results indicate injury from a single strike is limited to 70 meters from the pile and injury from prolonged cumulative exposure (over 24 hours) can extend as far as 9.35 kilometers from the pile; behavioral effects on fish could occur up to 7.54 kilometers from the pile source during the winter. Some level of behavioral reaction is expected but impacts on fish from pile-driving noise are considered temporary for the duration of the pile driving. No population-level effects are anticipated. Details of the modeling and results are provided in the EFH Assessment (BOEM 2022a).
Section Number: 3.13.5. Noise: The reader is referred to another section for a discussion on G&G impacts of noise. These impacts need to be clearly incorporated into the final conclusion of noise impacts.	Additional information on noise associated with G&G surveys has been added to Section 3.13.5. Adverse effects on benthic habitat and communities are expected to be reversible; no impacts on hard-bottom communities would be anticipated from G&G surveys. Surveys would include equipment operating at less than 180 kilohertz and consist of multibeam depth sounding, seafloor imaging, and shallow- and medium-penetration sub-bottom profiling within the Project area. BOEM's regulations and guidance under 30 CFR 585.626 and 585.627 require the lessee to submit detailed G&G data and analysis, among other data requirements, to establish engineering and other construction parameters.
Section Number: 3.13.5. Noise: Kuesel et al. 2021 examined two pile sizes (8 and 11m). Please indicate how this compares with the pile size in the Proposed Action.	As defined in Appendix E, the maximum design parameter for the monopile diameter at the seabed is 11 meters.

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Section Number: 3.13.5. While the background information provided about ridge and trough complexes and the value they provide is more robust, the impacts to this habitat (even in the evaluation of the ridge and trough avoidance alternative) appear to be inappropriately discounted and minimized. While quantitative information is provided about the reduced benthic impacts of each alternative from removal of WTGs and associated scour protection, the qualitative assessment is still insufficient, as the document essentially still treats removing WTGs in any alternative as being equal. We reject this approach and assumptions therein; this needs to be corrected. The presence of WTGs and scour protection would fundamentally alter the ridge and trough complexes.	Additional discussion of the value of ridge and trough habitat, and that WTGs would alter that habitat, has been added to Section 3.13.5 under the presence of structures IPF based on Byrnes et al. 2000, Slacum et al. 2010, and VIMS 2000. A discussion of Alternative D is presented in Section 3.6.7 and summarized in Section 3.13.5 with a reference to Section 3.6.7. Under Alternative D, impacts would be reduced from the Proposed Action by removal of up to 15 foundations and fewer miles of inter-array cable, resulting in an estimated 728 fewer acres of bottom impacts. Permanent impacts on complex habitat (NOAA habitat complexity category) would be reduced by 1.8 acres and soft-bottom habitat impacts would increase by 11.3 acres under Alternative D (refer to Table 3.6-4 in Section 3.6, *Benthic Resources*). Overall impacts associated with the presence of structures and conversion of habitat from existing bottom to scour protection would be reduced (both adverse and beneficial).
Section Number: 3.13.5. Presence of Structures: The section (and document as a whole) inappropriately concludes that there is a "moderate benefit" from the presence of structures, which is a value judgement made by the Author, as there is no scientific consensus, support, or evidence for this conclusion. We recommend this be changed to "negligible to minor" benefit throughout the document.	Various impacts on finfish resulting from the presence of new structures associated with the Proposed Action are described in detail in Section 3.13.3.2 and include beneficial impacts as a result of the artificial reef effect associated with WTGs, described in Section 3.13.5.
Section Number: 3.13.5. Presence of Structures: This section should incorporate discussion of new literature on wind wake effects and potential impacts on biological production and larval dispersal.	Discussion of wind wake effects has been added to Section 3.13.5 under the presence of structures IPF.
Section Number: 3.13.6.1. It is unclear how the land-side landing location (in Forked River/Waretown, NJ) SAV impacts are evaluated in Table 3.13-4, especially as two new route options have been added to the document and comprehensive field surveys have not been completed. Any analysis of land-side landing location, especially the two new options, will require current (2022 growing season and pre-construction) and comprehensive SAV surveys of all potential landing locations to further avoid and minimize impacts.	This information has been added to Section 3.13.5.1 and includes a table of impacts on SAV from both HDD and open-cut trenching. The SAV Monitoring and Mitigation Plans are also described in the same section and include pre-, during, and post-construction monitoring.
Section Number: 3.13.6.1. The analysis of the SAV avoidance alternative appears to be limited to considering impacts to the SAV habitat west of Island Beach State Park and does not consider impacts to the SAV bed at the land-side cable landing location. The impacts of	A comparison of SAV impacts for different landside cable connections has been added to Section 3.13.5.1 and includes a table of impacts on SAV from both HDD and open-cut trenching. The SAV

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all land-side landing location options are not clearly presented, making it impossible to draw a straightforward comparison of land-side routing options and associated impacts to SAV beds. The SAV avoidance alternative should limit the cable landing location options to only consider the route with the least impacts to SAV.	Monitoring and Mitigation Plans are also described in the same section and include pre-, during, and post-construction monitoring.
Section Number: 3.13.6.1. All SAV impacts, including direct, indirect, individual, cumulative, and synergistic need to be included in the analysis for both the backside of Island Beach State Park and all land-side landing locations.	The general comment was addressed through responses to specific comments above. SAV impacts are also analyzed in the EFH Assessment.
Section Number: 3.15. The document is inconsistent in identifying what the No Action alternative includes and the structure of the analysis in the action alternatives is equally confusing. Please restructure the document as advised in our letter accompanying these comments. Importantly, as written, it appears the project itself (without consideration of foreseeable actions) would result in a major impact to NARW since the No Action alternative only considering baseline results in only minor impacts to all marine mammals.	For the No Action Alternative analysis in the Chapter 3 resource sections, the Final EIS was updated to present the analysis of the ongoing non-offshore wind and ongoing offshore wind activities under a separate subheading from the planned non-offshore wind and offshore wind activities. Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. The Proposed Action and action alternative discussions were also updated to present the cumulative impact analysis under a separate subheading. Draft EIS Table S-2 incorrectly noted the No Action Alternative had a rating of “minor.” The table conclusions have been updated in the Final EIS based on the analysis presented in Section 3.15 and the rating for the No Action Alternative has been revised to “negligible to major.”
Section Number: 3.15.1. In their MMPA application, Ocean Wind has requested authorization to take 17 species (but 18 stocks), which contradicts the number presented in the DEIS (20 species). Please ensure that the DEIS accurately reflects the same species listed in the MMPA Authorization application.	Species and stock numbers have been revised to be consistent with those presented in the MMPA Authorization as requested.
Section Number: 3.15.1. See comment above. The species carried forward into BOEM’s analysis need to be listed or provided in a table with recent stock information that was used in BOEM’s analysis to ensure cohesion with the MMPA application. As only some of the species are mentioned in the paragraph above this one, it would provide clarity on which are being carried forward and which are not.	Species and stock numbers in the Draft EIS chapter and Appendix I have been revised to be consistent with those presented in the MMPA Authorization as requested.
Section Number: 3.15.1. The densities used for each marine mammal species should be presented below this section and show where the specific value came from (i.e., which data source). Note that the FEIS	The Draft EIS has been updated to reference the latest Letter of Authorization memo (Ocean Wind 2022b) dated August 2022.

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will need to be updated using the new Roberts densities which will be provided by Orsted soon to NMFS for the proposed rule.	Revised densities and take estimates are provided in the new Final EIS Attachment J-1 and Appendix J has been revised.
Section Number: 3.15.1. Given that the NARW migratory corridor Biologically Important Area (BIA) was described, BIAs for the relevant species in here need to be included as well. Specifically there are foraging BIAs located further north for some of these protected species. Although these areas are outside of the project area and to the north, it is relevant information to include.	Discussion of BIAs for fin, minke, humpback, sei, and NARW has been added.
Section Number: 3.15.1. Ocean Wind's MMPA application should not only be cited as a reference for several points that BOEM makes. Additional peer- reviewed scientific literature should be used in these spaces instead. Relevant and external literature for each species exists and should be incorporated into BOEM's analysis. Furthermore, Protected Species Observer reports from past site characterization surveys exist that could supplement this section.	Ocean Wind 2022b, which is the Letter of Authorization, is only cited once. The protected species observer reports collected in support of the site characterization surveys are outlined in the COP, which is referenced in the EIS.
Section Number: 3.15.5. The FEIS should summarize the anticipated effects of the action on ESA-listed marine mammals. We note that the sea turtle section contains a summary of the findings in the BA (see 3.19.5) and recommend that a similar summary be provided for ESA listed marine mammals. If the BA will not be included as an appendix to the final document, we encourage BOEM to make the BA publicly available on the Ocean Wind webpage (not just on the ESA consultation page) so that the information can be easily referenced by the public.	The BA is incorporated in its entirety by reference, as described in Chapter 1 of the Final EIS. The BA is available on BOEM's website: https://www.boem.gov/renewable-energy/state-activities/nmfs-esa-consultations.
Section Number: 3.15.1. The FEIS must be updated using the new Roberts density data as NMFS will do so in the rule: https://seamap.env.duke.edu/models/Duke/EC/. Not doing so would not be using the best available science.	The Draft EIS has been updated to reference the latest Letter of Authorization memo (Ocean Wind 2022b) dated August 2022. Revised densities and take estimates are provided in the new Final EIS Attachment J-1 and Appendix J has been revised.
Section Number: 3.15.1. In their LOA application, Ocean Wind has indicated they would not detonate more than 1 UXO per day; therefore, this threshold is not relevant. BOEM should ensure the proposed action in the EIS aligns with that described in the LOA application for this activity (i.e., BOEM shouldn't consider authorizing detonating more than 1 UXO per day).	The EIS only considers one UXO/24 hours and a total of 10 UXOs for the duration of the Project as outlined in the Letter of Authorization. The thresholds used in the Letter of Authorization are outlined in Tables 3.15-2, 3.15-3, 3.15-4, and 3.15-5. The reference to multiple blasting events in Section 3.15.1 under *Non-auditory Injury Criteria for Explosives (Unexploded Ordnance)* has been removed.
Section Number: 3.15.2. Delete this table as it is only applicable to assessing take from military readiness activities. NMFS has posted all our thresholds for projects like offshore wind in a summary document at	Table 3.15-2 is representative of the thresholds presented in https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance (NMFS 2018). Which

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https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine- mammal-acoustic-technical-guidance.	table is being referenced is unclear. The underwater blasting thresholds presented in Tables 3.15-2, 3.15-3, 3.15-4, and 3.15-5 are relevant, as these are the thresholds used in the Letter of Authorization to assess the potential zones of influence for UXO detonations.
Section Number: 3.15-2.1. Significant criteria should be added to this section 3.3. Significant criteria should be added to this section.	Section 3.15.2.1, *Impact Level Definitions for Marine Mammals*, provides definitions of potential impact levels for adverse effects.
Section Number: 3.15-2.1. The purpose of this table is unclear and unnecessarily complicates the analysis as most of these are ingrained into the definitions in Table 3.15.-6. Moreover, the analyses for each alternative does not always identify these categories so there is inconsistency in the writing.	The table was removed.
Section Number: 3.15.3.1. We are not clear on what tidal energy projects would be occurring in this area. Please identify planned tidal energy projects.	Further information on specific tidal energy projects can be found in Appendix F.
Section Number: 3.15.3.2. It will be important that the EIS does not allude to an interpretation that all these noise sources would produce impacts rising to the level that NMFS would consider it take under the MMPA. While it is not necessary to define this specifically in the NEPA document, the EIS should not define it such that a take, as defined under the MMPA, can be inferred. Sources included in this discussion currently include sources like dredging and cable laying.	Language that implies that noise sources may lead to take was removed from the Final EIS; however, please note that no discussion on take was presented in the assessment of cable laying and dredging.
Section Number: 3.15.3.2. NMFS would like to work directly with BOEM to revise this section to better reflect the statute.	BOEM will follow up with NMFS to address this comment.
Section Number: 3.15.3.2. Because this section addresses other wind development activities, this should include vibratory driving of foundation piles as several other developers are proposing to use vibratory hammers to install foundations, not just for the cable tie-in area work. Some are also proposing drilling to break up obstacles which is also not reflected in the document Please include vibratory driving foundations and drilling at foundations as activities that could occur from other wind projects and the associated analysis.	Vibratory pile installation has been added to the No Action Alternative scenario under the installation of WTG foundations. It is also discussed under the installation and removal of sheet piles for cofferdams or other structures.
Section Number: 3.15.3.2. NMFS does not consider it likely that dredging would result in TTS. Source levels alone are not the sole predictor of TTS. The DEIS does not consider the duration component, receiver behavior, and weighting functions that are critical to a TTS analysis. The EIS should incorporate a complete analysis of the	Similar to the response above, language that implies that noise sources may lead to take was removed from the Final EIS. Text has been revised regarding the potential for TTS from dredging activities.

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potential for TTS from the dredging activity proposed by Ocean Wind. If BOEM continues to conclude there is a real potential for a marine mammal to experience TTS from dredging after consideration of the full context of exposure, NMFS and BOEM should meet to discuss such analysis.	
Section Number: 3.15.3.2. Although "behavior-level effects" are not analogous to take under the MMPA, it should be clear that this is the case. For example, dredging, vessel transit, and cable laying are not expected to cause harassment of marine mammals rising to the level of take under the MMPA and are not thought to cause TTS. The writing should be clear about which sources are likely to have these impacts.	Language that implies that noise sources may lead to take was removed from the Final EIS.
Section Number: 3.15.3.2. There are several statements here that are not supported and are not aligned with previous discussions. For example, the statement that UXO detonations may cause "non-auditory mortality" is not aligned with NMFS impact assessments assuming effective mitigation. We are also not clear on what "non-auditory" mortality means or if it even exists and we request that BOEM provide a definition and extra context. Also, it is not clear why some impacts (e.g,, PTS) are omitted from statements like "all noise sources have potential to cause behavior-level effects and some may also cause TTS." BOEM needs to provide a definition of behavior-level, as we are not sure what that means.	Text has been revised to closer align with what is presented in the BA and definitions of non-auditory mortality and injury and behavior-level effects is included in the Final EIS.
Section Number: 3.15.3.2. There is no justification for the assumption that traffic generated from the proposed action is going to be an appropriate proxy for all other projects. There should be some justification for this assumption or BOEM should find additional information to estimate vessel traffic generated by other projects. This proposed action is not equivalent to the size and scope of other projects given the variation in number of turbines and other factors between projects.	Various levels of estimation of vessel numbers have been incorporated for Vineyard Wind, Atlantic Shores, Sunrise Wind, and Empire Wind. However, if no COP exists, there is not an adequate way to estimate a proxy for vessel traffic generated by other projects. Additionally, the number of turbines proposed for other projects may not yet be known, so a scale could not necessarily be run with proxy numbers. The planned activities scenario does not include vessel traffic of all projects on the East Coast. There is a lower level of certainty around the details of the cumulative analysis. Lastly, available COPs do not always provide the same level of detail on simultaneous vessels for construction or operation.
Section Number: 3.15.3.2. The meaning of "impacts from climate change from other offshore wind activities" is unclear. Please clarify. Also please clarify how impacts from climate change from other wind	The referenced text in Final EIS Section 3.15.3.2 has been revised to clarify the conclusions with respect to impacts from planned offshore wind activities.

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activities would be adverse, as described here (moderate for all marine mammals except NARWs, major for NARWs).	
Section Number: 3.15.5. Ocean Wind has committed to achieving a minimum of 10 dB broadband noise reduction during impact pile-driving operations. As the noise mitigation system selected has not been specified, the document should include an overview of the possible noise abatement systems and information to support that is reasonable to expect that the 10 dB attenuation can be achieved.	This section has been revised to include the possible noise abatement systems and information to support that it is reasonable to expect that the 10 dB attenuation can be achieved.
Section Number: 3.15.5. As written, it appears the Proposed Action Alternative is now also conflating cumulative effects with the impacts of the proposed action against the baseline. It is unclear what this statement means. Because the No Action non-wind activities says major impacts, and No Action wind activities says moderate impacts, it is unclear how the moderate finding here fits in with those two different analyses.	For the No Action Alternative analysis in the Chapter 3 resource sections, the Final EIS was updated to present the analysis of the ongoing non-offshore wind and ongoing offshore wind activities under a separate subheading from the planned non-offshore wind and offshore wind activities. Section 3.1 of the Final EIS explains the approach to predicting impacts related to the No Action Alternative. The Proposed Action and action alternative discussions were also updated to present the cumulative impact analysis under a separate subheading.
Section Number: 3.15.5. BOEM should consider inclusion of the Dorell 2022 paper cited below: Dorrell R.M., Lloyd C.J., Lincoln B.J., Rippeth T.P., Taylor J.R., Caulfield C.C.P., Sharples J, Polton JA, Scannell BD, Greaves DM, Hall RA and Simpson JH (2022) Anthropogenic Mixing in Seasonally Stratified Shelf Seas by Offshore Wind Farm Infrastructure. Frontiers in Marine Science. 9:830927. doi: 10.3389/fmars.2022.83092. The determination of minor impacts is not supported.	Results were incorporated into the Final EIS.
Section Number: 3.16.1. The geographic analysis area is too small and should be expanded to include adjacent lease areas (Garden State, Skipjack, and the NY Bight lease areas) that later discussion on page 3.16-2 acknowledges could increase vessel traffic and navigation impacts within the narrow geographic analysis area. This expansion will substantially change resulting impact descriptions regarding the number of turbines and vessels during project construction and operations, but would ensure the analysis area accurately encompasses all activities that affect navigation for this project.	The EIS navigation and vessel traffic geographic analysis area is of sufficient size to capture current vessel traffic patterns, density, and vessel numbers required for a holistic analysis of Project impacts. The geographic analysis area encompasses the vessel traffic entering and departing Delaware Bay and the Barnegat to Ambrose north-to-south TSS as well as the heavily traveled coastwise traffic area to the west of the Project Lease Area and the waters to the east of the Project Lease Area where deep-draft traffic is shown to transit according to AIS data. As noted in Section 3.16, vessel traffic associated with existing offshore wind lease areas outside of the geographic analysis area is still likely to contribute to increased vessel traffic within the navigable waterways and approaches to New Jersey ports within the geographic analysis area. BOEM confirms

Comment from National Marine Fisheries Service	Response
	that the geographic analysis area is sufficiently broad to describe the full extent of Project impacts, including cumulative impacts.
Section Number: 3.17.1. Please add North Atlantic Right Whale Aerial Surveys and Large Coastal Shark Bottom Long-line Survey to the list of surveys that overlap proposed offshore wind development on pg. 3.17-4. Additionally, the text in the first sentence of the last paragraph should be changed to say “would overlap with offshore wind lease areas in the Mid-Atlantic and Southern New England region”.	Suggested text edits were incorporated into the Final EIS.
Section Number: 3.17.5.1. Please change the Scientific Research and Surveys bullet on pg. 3.17-15 to read as “[Bold: Major] adverse impacts on scientific research and surveys, particularly for NOAA surveys supporting” The description of “generally be major” is inconsistent to other conclusion language and confusing.	Suggested text edits were incorporated into the Final EIS.
Section Number: 3.17.3.3. There is no information to support the conclusion that climate change and fishing will reduce impacts to scientific research and surveys cited earlier in this section from major to moderate. Current scientific research and surveys are already affected by climate change and fishing, but that does not preclude their operation. The impacts associated with non-offshore wind activities on NMFS surveys should not be determined by BOEM; these impacts should be described and evaluated by NMFS. In contrast, an offshore wind farm would preclude existing survey and research operations. The conclusions of “moderate” impacts from non-offshore wind activities is not supported by the analysis provided in Attachment 1 in Appendix F on pg. F-90. BOEM responses to NMFS comments from the cooperating agency review of PDEIS state this was included because it matches South Fork FEIS conclusions. This is not a sufficient reason to repeat this statement as it is unsupported in the South Fork analysis as well and should be corrected going forward based on the information NMFS has provided on this impact.	The impact on scientific research and surveys as a result of ongoing activities has been updated to major due to the impacts of ongoing offshore wind activity including Block Island Wind Farm, Coastal Virginia Offshore Wind pilot project, Vineyard Wind 1, and South Fork Wind Farm.
Section Number: 3.17.1. Scientific Research and Surveys is not sufficiently described. In addition the statement that “sampling methodologies could be needed to maintain surveys conducted in or near the project” should be corrected to “will be needed”. Saying “could be” needed contradicts the analysis of impacts within the DEIS and the work described for BOEM-NMFS mitigation strategy effort.	Suggested text edits were incorporated into the Final EIS.

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Section Number: 3.18. Please update the data from FEUS report to 2019 which was released this spring. Link here: https://www.fisheries.noaa.gov/resource/document/fisheries-economics-united-states-report-2019#: ~:text=Fisheries %20Economics%20of%20the% 20United%20States%20(FEUS)%20 is%20an%20annual ,fisheries%20and%20 marine%2Drelated %20businesses.	Data were updated in the Final EIS to reflect the updated 2019 Fisheries Economics of the United States report.
Section Number: 3.18. We appreciate BOEM addressing our comment to include the list of NOAA MRIP fishing sites, which could be impacted during export cable and infrastructure development and impact recreational and subsistence shoreside fishing.	Comment noted.
Section Number: 3.18. An analysis of private recreational angler exposure should be included based on methodologies of Kirkpatrick et al. 2017 with updated data that is publicly available through MRIP. See section 3.1.4.2 and 3.1.4.2 for methodologies. https://espis.boem.gov/final%20reports/5580.pdf	Additional information on private recreational angler exposure has been added to the Final EIS. An analysis of for-hire recreational fishery exposure is included in Section 3.9.
Section Number: 3.18. Consider incorporating the following studies into this analysis: Haughton et al., 2003; Giuffre et al., 2004.	Information from the Haughton et al. 2003 study was incorporated into analysis in Section 3.18.3.2.
Section Number: 3.18. Please consider including information related to the https://www.sciencedirect.com/science/article/pii/ S0928765518302902#sec0060 study. This research indicated limited, seasonal economic benefits associated with increased tourism, specifically from private angling. The study found that the construction of the Block Island Wind Farm caused a significant increase in various tourism metrics in Block Island during peak tourism months of July and August, but importantly found it had no effect on other months.	Information from the study referenced in the comment was incorporated into analysis in Section 3.18.3.2.
Section Number: 3.18. Please note that noise from construction can lead to the disbursement of fish in and around construction sites, which, in turn, can lead to spatial competition depending on migrating patterns and negative impacts on recreational trips. This section of the EIS should discuss how impacts of construction may effect catchability and thus impact recreational trips in and around the project area.	Additional analysis was included in Section 3.18.5 on page 3.18-20 to address potential decreased catchability due to construction-related activities.
Section Number: 3.19.1. The description of abundance and distribution of sea turtles is focused on the coastal waters of New Jersey; this approach excludes other areas that may be transited by project vessels and is inconsistent with the geographic analysis area (figure 3.19-1). This section should contain relevant information on the distribution,	The geographic analysis area defines the scope of the NEPA analysis and should not focus only on “the area where individuals may be affected by the Proposed Action.” It encompasses two LMEs: the Northeast U.S. OCS and Southeast U.S. OCS LMEs. Due to the size of the geographic analysis area, for analysis purposes in this

Comment from National Marine Fisheries Service	Response
abundance, and habitat use of sea turtles throughout the area where individuals may be affected by the proposed action.	EIS, the focus is on sea turtles that would likely occur in the proposed Project area and be affected by Project activities. The existing text therefore provides an overview of sea turtles along the eastern coast of the United States. BOEM has reviewed the existing text and made edits to provide additional information about sea turtle occurrences in the Project area, such as observations from HRG surveys. However, reliable, up-to-date abundance information for the entire area affected by boat transits is not available and BOEM has revised the text to generally describe the distribution patterns of sea turtles in more detail.
Section Number: 3.19.1. Table 3.19-1 outlines that the likelihood of Green sea turtle occurrence in the Project Area is unlikely and that Green sea turtles are uncommon in New Jersey. Please see our PDEIS comments on this issue.	The text in Table 3.19-1 has been edited to state that green sea turtles are anticipated to be “likely” rather than “uncommon” in the Project area, as recommended by the Preliminary Draft EIS comments. However, for consistency with the BA and published species occurrence data, BOEM has kept the frequency of occurrence in New Jersey as “uncommon.”
Section Number: 3.19.1. References should be reviewed throughout this section to ensure they are up to date; it is not reasonable to rely on a summary of sea turtle information in an ESA from 2012. More recent, appropriate summaries of sea turtle status are available in recovery plans and 5- year reviews prepared by NMFS and USFWS.	The 2012 BOEM Programmatic EIS is referenced because it summarizes the potential impacts on sea turtles and is not provided as a source regarding sea turtle status. The existing text was reviewed and revised where necessary to provide appropriate summaries of the status of sea turtles. All recent recovery plans and 5-year reviews have been cited in the discussion of each species.
Section Number: 3.19.3.2. The discussion of lighting should be expanded to consider the continuous lighting that is anticipated for work areas during construction and decommissioning.	Text has been added to describe that it is not anticipated that construction lighting would affect sea turtles and supporting literature has been referenced (e.g., Salmon and Wyneken 1990).
Section Number: 3.19.3.2. Information should be added to the consideration of effects of operational noise to support the conclusion that operational noise will not exceed thresholds of concern.	Text has been added to provide more detail about the anticipated operational noise and its potential effects on sea turtles from the operation of ongoing and planned offshore wind projects.
Section Number: 3.19.3.2. The anticipated population level impacts to sea turtles from vessel strikes is inconsistent with the definition of “minor” provided in table 3.19-3.	The existing text has been reviewed and is consistent with the definition of “minor” in Table 3.19-3, which reads that “Impacts on sea turtles would be detectable and measurable, but of low intensity, highly localized, and temporary or short term in duration. Impacts may include injury or loss of individuals, but these impacts would not result in population-level effects.” For reference, the existing text has been revised to describe more clearly that vessel strikes due to ongoing and planned offshore wind projects have the potential to result in injury to or mortality of individual sea turtles; however, it

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	describes that population-level impacts are unlikely given the low densities of each species, occurring only seasonally, and the relatively small increase in vessel traffic.
Section Number: 3.19.3.2. The consideration of impacts of structures should be expanded to address potential impacts to habitats and prey and should incorporate additional literature/references to support conclusions.	Text has been added to the affected environment section to describe the diets of each sea turtle species and explain the reef effect and how the available information suggests that it could increase the prey base for leatherback, loggerhead, and Kemp's ridley sea turtles.
Section Number: 3.19.5. Additional analysis is needed to support the conclusions regarding impacts to sea turtles from the loss of eelgrass habitat from dredging operations within Barnegat Bay, with a focus on consequences to foraging sea turtles.	Text has been added and the existing text has been revised to detail the acreage of SAV that would be potentially affected in Barnegat Bay, including impacts from dredging activities, and how those impacts could affect sea turtles and, in particular, the green sea turtle.
Section Number: 3.19.5. Please add information to support the conclusion that it is reasonable to expect that a 10 dB reduction in pile driving noise can be achieved.	The three noise mitigation system technologies considered for the Project include: (1) big bubble curtain, (2) hydro-sound damper, and (3) AdBm Technologies' Helmholtz resonator. More details about these systems can be found in Section 2.8 of the Project Protected Species Mitigation and Monitoring Plan. Data supporting the 10 dB reduction are presented in Bellman (2021), "Expert opinion report regarding underwater noise emissions during UXO-clearance activity and possible options for noise mitigation," provided to NMFS and BOEM in February 2022 as supporting documentation for the Ocean Wind 1 incidental take authorization application.
Section Number: 3.19.5. It is unclear if the conclusions related to pile driving noise are dependent on the additional mitigation measures identified by BOEM for nighttime pile driving operations. This should be clarified in the FEIS.	Text has been added to clarify that no new piles could be initiated after dark if BOEM and NMFS do not approve the nighttime monitoring plan and the technology proposed. In addition, Ocean Wind is proposing that if during nighttime pile driving a protected species observer is unable to monitor the visual clearance or shutdown zones with available night vision devices (due to light pollution from the platform), nighttime pile driving will not commence or will be halted (as safe to do so).
Section Number: 3.19.5. Consideration of the effects of turbine operational noise should be put in the context of the WTGs proposed for this project and the soundscape/ambient noise conditions in the lease area.	Text has been added in Section 3.19.3.2 to detail the anticipated operational noise and add a reference to the subsequent text for the Proposed Action in Section 3.19.5 under the turbine operational noise IPF. Also, the mitigation measure for an operational sound field verification plan has been added to the list of Applicant-proposed mitigation measures in Section 3.19.9 (*Proposed Mitigation Measures*). A reference to that proposed plan has been added to the

Comment from National Marine Fisheries Service	Response
	concluding statement about the impacts on sea turtles under *Summary of Noise Impacts* in Section 3.19.5.
Section Number: 3.19.5. We agree that it is unlikely that all vessel strikes with sea turtles can be avoided. Additional information should be provided on the frequency and severity of vessel strikes anticipated and which species are expected to experience serious injury or mortality. This information is necessary to support the determination that effects will be "minor" and to support the conclusion that there will be no population level effects.	Text has been added about the potential for sea turtle vessel collision, mostly taken from existing text in the BA, which provided a more robust analysis of the issue.
Section Number: 3.19.5. The DEIS contains limited analysis and discussion with respect to nighttime monitoring measures for sea turtles during periods of increased vessel traffic. Information on the anticipated effectiveness of the proposed measures for detecting and avoiding sea turtles at night or in other low visibility conditions should be provided.	Nighttime monitoring is proposed during impact pile driving. In addition to passive acoustic monitoring, Ocean Wind is proposing to use other visual monitoring techniques during nighttime installation or during periods of daytime low visibility, including thermal or infrared cameras, night vision devices, and infrared spotlight. The efficacy of these other monitoring devices is relatively unknown. Therefore, BOEM included a proposed mitigation for Ocean Wind to develop an alternative monitoring plan for NMFS and BOEM review and approval 6 months prior to initiating impact pile-driving activities. The purpose of the plan is to demonstrate that Ocean Wind can meet the visual monitoring criteria for the Level A harassment zone(s)/mitigation and monitoring zones plus an agreed-upon buffer with the technologies Ocean Wind is proposing to use for monitoring during nighttime impact pile driving (Measure No. 22 in Table H-2, BOEM-proposed Mitigation and Monitoring Measures in the NMFS BA as Amended). Text has been added to the Final EIS about the effectiveness of thermal imaging for sea turtle monitoring, including its limitations, as demonstrated by the protected species observer monitoring for the Project's HRG surveys.
Section Number: 3.19.5. The conclusion that effects of gear utilization (fisheries survey) will be "negligible" is not consistent with the impact definitions in Table 3.19-3 as capture, injury, and mortality are possible. There is no information presented to support this conclusion and details should be added on the anticipated gear types and the consequences to sea turtles that are anticipated (e.g., capture, injury, mortality).	Text has been added describing that the trawl surveys for fisheries monitoring would mostly avoid impacts due to the limited time of each tow, and provided a reference to the BA for further details about this impact. The impact level determination was revised from "negligible" to "minor."
Section Number: 3.19.5. There is limited consideration being taken for the specific dredge type/equipment proposed within Barnegat Bay. This is problematic because sea turtles may be present in the Bay and are	Text has been added acknowledging that sea turtles would be more vulnerable to suction dredging in inshore places like Barnegat Bay and detailing the short duration and small area affected.

Comment from National Marine Fisheries Service	Response
prone to entrainment by hopper dredges. Please provide further clarification on the gear selection and any mitigation measures being taken.	
Section Number: 3.19.6. Please see other comments regarding the consideration of alternatives. The FEIS should reflect which IPFs would be reduced from a 10-20% reduction in project size, and in particular should explain if any of these alternatives would reduce the amount of anticipated habitat loss or alteration and/or the potential for injury or mortality from pile driving, fisheries surveys, UXO detonation, or vessel strike.	The IPFs that would be reduced are described in sufficient detail. In cases where the amount of anticipated impact is not quantified, the text has been revised to state that that there would be a proportional reduction of 10 to 20 percent.
Appendix H – Mitigation and Monitoring. There is no mention of SAV time-of-year restriction in the Barnegat Bay, which extends from April 15 to October 15 of any given year for sedimentation and turbidity generating activities like trenching and plowing. This needs to be corrected and included as a mitigation measure and analyzed in the DEIS. This TOY is routine for all projects that occur in Barnegat Bay and should be included for this project.	See response to comment 1287-0118.
Appendix H – Mitigation and Monitoring. Specific to activities in the Barnegat Bay: open trenching/plowing is an invasive method of cable installation with potential significant adverse impacts. Federal and state agencies, including NMFS, routinely recommend this type of activity not be undertaken in Barnegat Bay and methods such as horizontal directional drilling (HDD) are used to avoid and minimize impacts, especially to habitats such as SAV. This mitigation measure should be addressed in detail in the document and included in the SAV Avoidance alternative.	Ocean Wind includes open cut and trenchless technology (i.e., HDD) within the PDE of the Ocean Wind 1 Project. Ocean Wind has undertaken additional evaluation of the HDD option for the Oyster Creek landfall and has found a high risk of inadvertent return with HDD technology. Therefore, BOEM has not proposed a measure requiring use of HDD for construction of the Oyster Creek landfall in Barnegat Bay.
Appendix H – Mitigation and Monitoring. For all construction activities, please crosscheck all the applicant's proposed measures, with particular attention to zone sizes, with that in the LOA application.	APMs related to shutdowns for impact pile driving, ramp-up (soft start) for HRG surveys, and pre-start clearance for UXO detonations have been updated in Appendix H, Table H-1. Additional review and revisions are pending.

GARFO = Greater Atlantic Regional Fisheries Office

O.4.2 Cooperating State Agencies

O.4.2.1. New Jersey Department of Environmental Protection

Table O.4-5 Responses to Comments from New Jersey Department of Environmental Protection (Letter No. 1203)

Comment	Response
Land Resource Protection. The draft DEIS discusses a series of alternatives, including a "no action" alternative, to the construction, operation, maintenance, and decommissioning of Ocean Wind 1's intended 1,100 megawatts offshore wind farm proposed to be sited 15 miles southeast of Atlantic City. NJDEP strongly encourages BOEM to select a proposal and/or alternative which results in the least impact to regulated areas and/or environmentally sensitive areas and which is consistent with all applicable land use regulations, including but not limited to the Coastal Zone Management Rules at N.J.A.C. 7:7, the Flood Hazard Area Control Act Rules at N.J.A.C. 7:13, and the Freshwater Wetlands Protection Act Rules at N.J.A.C. 7:7A. A detailed review of the impacts from the proposed project will be conducted during NJDEP's review of the required state permit applications and the pending Federal Consistency Certification for Ocean Wind 1's Construction and Operations Plan (COP). The NJDEP's resource agencies will comment during the review of both the state permit applications and consistency certification as their expertise is critical to the evaluation of the proposed project's environmental impacts and in determination of the project's compliance and consistency with the state's land use regulations and the Coastal Zone Management Plan's enforceable policies.	Comment noted.
Historic Preservation. On May 31, 2002, the Historic Preservation Office (HPO) provided comments to BOEM regarding the identification of historic properties under Section 106 of the National Historic Preservation Act (see attached correspondence, (HPO-E2022-239). Additionally, the HPO has not provided feedback to BOEM regarding the assessment of effects or proposed mitigation measures; however, we expect to do so once the identification of historic resources is complete. As a result, the HPO cannot concur with the findings of the DEIS regarding the project's potential impacts on cultural resources at this time.	Ocean Wind has revised these reports in response to consulting party comments on the initial versions of these reports. These revisions were incorporated into the Final EIS and inform the identification and evaluation of historic properties and BOEM's assessment of these properties within the Project's APE. We look forward to your further comments regarding BOEM's assessment of effects and proposed resolution measures to adverse effects including mitigation measures.

Comment	Response
Fish and Wildlife. NJDEP applauds BOEM with effective avoidance mitigation in siting this lease and agrees with the overall assessment that existing fishing effort in the Ocean Wind 1 project area is relatively low. However, NJDEP notes that the DEIS seems to minimize project-specific impacts because the No Action Alternative assumes full development of other leases (and the description of impacts of offshore wind on fisheries was mostly in Section 3.9.3.2, the No Action Alternative). Additionally, NJDEP recommends including a discussion of the menhaden fishery and landings from the lease area. The National Marine Fisheries Service (NMFS) Socioeconomic Impacts of Atlantic Offshore Wind Development website ranks menhaden 1st in total landings and 3rd in total revenue. Also, the effects and potential impacts of pile-driving noise on fish populations is not well understood and more information is needed before impacts can be considered negligible, particularly considering the scale of development on the Outer Continental Shelf. Recreational and commercial fishing may be affected during construction.	The No Action Alternative and cumulative impacts have been reorganized. The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. Ongoing activities include permitted offshore wind projects. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Reasonably foreseeable future actions include the buildout of executed renewable energy lease areas. A detailed description of BOEM's methodology for assessing impacts is provided in Section 1.6 of the Final EIS. As noted in footnote 4 in Section 3.9.1, the "No Federal FMP" category contains a variety of species that are managed under an FMP but are not federally regulated, such as the smooth and chain dogfish (*Mustelus canis* and *Scyliorhinus retifer*, respectively), whelk (Buccinidae), and menhaden. Therefore, the menhaden fishery is included in this analysis, but grouped under the "No Federal FMP" category. Additional discussion has been included acknowledging the importance of the menhaden fishery for commercial fisheries operating in and around New Jersey.
Fisheries Mitigation. NJDEP supports the proposed fisheries mitigation measures outlined in the DEIS, and we encourage BOEM to consider that compensation for economic losses will require extensive, fishery-by-fishery analysis including consultation with fisheries economists and industry. NJDEP further encourages a robust, transparent, and manageable process for engagement with the fishing industry on compensation. The commercial fishing industry should be involved at all stages of compensation, beginning early in the process. The industry can provide unique insight into planning effective engagement, valuation, and distribution that includes secondary industries that will also have economic losses. Additionally, the Responsible Offshore Development Alliance (RODA) December 2021 Report, *Impact Fees for Commercial Fishing from Offshore Wind Development: Considerations for National Framework* should be leveraged by BOEM to the greatest extent possible as the compensation guidance is developed. Also, recreational fisheries have expressed concern about potential economic losses and should be engaged in compensation development. Additionally, the DEIS should	Comment noted. Consistent with BOEM's Draft Fisheries Mitigation Guidance, BOEM has added a mitigation measure requiring the lessee to submit a shoreside seafood business analysis to further supplement funds available for settling claims of lost (unrecovered) economic activity as a result of offshore wind development to Appendix H, Table H-3, and has analyzed this measure in Section 3.9.9. For Ocean Wind, the mitigation fund would be based on the total revenue exposure for fisheries based out of ports listed in the Final EIS.

Comment	Response
include a detailed description of secondary economic impacts that could result from reduced landings. Landings revenue is a starting point in evaluating loss, however, economic impacts to processors, fuel suppliers, and distributors, must also be considered.	
Navigation Safety. The DEIS Alternative C is favorable in terms of navigational safety because it creates a buffer zone between Ocean Wind and Atlantic Shores. In 2020, the NJDEP facilitated stakeholder meetings regarding transit through the two lease areas, and there was a clear and consistent request for undeveloped space between the leases. The industry has consistently expressed concerns regarding safe transit through the array and fishing within the array. In addition, Alternative C is consistent with the new lease stipulation in the NY Bight that requires a setback between projects that don't have consistent turbine alignments.	Alternative C-2 is incorporated into the proposed action in the Final EIS.
Protected Species. Timing restrictions for sturgeon should be included in the DEIS, and Endangered Species Act-listed fish should be included in the *Injured/Protected Species* reporting section. Moreover, all injuries to ESA-fish (sturgeon) should be reported. Freshwater Fisheries. In section 3.8.1, *Description of the Affected Environment and Environmental Consequences of the No Action Alternative for Coastal Habitat and Fauna*, under "Coastal Fauna Special-Status Species, the last paragraph discusses other state special concern species that could potentially occur in the geographic analysis areas and should include "Diamond-backed Terrapin". In section 3.8.3, *Impacts of the Proposed Action on Coastal Habitat and Fauna, under "Land disturbance"*, in the second paragraph, "Ocean Wind proposes to restore disturbance areas in the Onshore Project area to pre-existing contours (maintaining natural surface drainage patterns) and allow vegetation to become reestablished once construction activities are completed, to the extent practicable" (APM GEN-13; see Table 1.1-2 of the COP Volume II, Section 1.1; Ocean Wind 2021). NJDEP notes that only native vegetation should be allowed to become re-established.	Impacts on ESA-listed fish (i.e., Atlantic sturgeon) are addressed in Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*. BOEM has proposed a time-of-year restriction for Atlantic sturgeon for UXO detonations (see Table H-2 and the Project BA [BOEM 2022b]): "Ocean Wind would extend the APM seasonal restriction of UXO detonations (January to April) to include months of increased Atlantic sturgeon presence in the offshore wind area. No UXOs can be detonated from November to April in the offshore areas greater than three nautical miles offshore. UXO surveys are expected in Fall 2022 which will define the exact location and size of UXO." Reporting requirements for Atlantic sturgeon are incorporated into the NMFS ESA reporting requirements (see Table H-2). Other ESA-listed species are addressed in appropriate sections in the EIS. The diamond-backed terrapin is included in the paragraph referenced. Freshwater (spawning) is addressed in Section 3.8, *Coastal Habitat and Fauna*, where timing is critical to the species. With respect to the request to revise APM GEN-13, this is an Applicant-proposed mitigation measure, so BOEM cannot change the language. However, BOEM has proposed a new mitigation measure that states that GEN-13 will be modified to clarify that native vegetation will be reestablished.
Migratory Shorebirds. Upon review of the DEIS, NJDEP requests additional details on the Ocean City landfall in order to evaluate	The comment does not specify the additional details requested regarding the landfall at Ocean City and Island Beach State Park.

Comment	Response
potential impacts to state and federally listed species; as well as additional information on the trenchless technology (HDD) to be used in proximity to nesting birds on Island Beach State Park. Additionally, timing restrictions for breeding birds should be adhered to for onshore construction noise, including installation of the cable via trenchless technology (HDD). Further, NJDEP encourages Ocean Wind to consider the use of meteorological radar to detect bird movement and migration through the wind farm on wave buoys set to be deployed. Migration forecast maps can be found here: https://birdcast.info/migration-tools/migration-forecast-maps/, however, limitations of forecast maps may include radar's ability to detect offshore movements as most radar stations are onshore. Therefore, consideration could be given to placing radar stations on structures, like wave buoys, within the lease area to improve accuracy and develop guidelines for triggering lighting alterations when peak migratory movements are detected.	However, all beach habitats, including beach habitats for state and federally listed species, will be avoided at landings and at Island Beach State Park through the use of trenchless technology (HDD). Indicative HDD layouts, configurations, cross sections, and operating rigs can be found in COP figures 6.2.1-3, 6.2.2-1, 6.2.2-2, 6.2.2-3, and 6.2.2-4. In addition, as stated in the BA, the Project would avoid intrusion into any beach or dune habitat from March 1 to August 31, unless otherwise authorized by USFWS and NJDEP. Similarly, the project would avoid conducting activities within 500 feet of any beach or dune habitat from March 15 to August 31, unless otherwise authorized by USFWS and NJDEP. Regarding the consideration of meteorological radar and lighting alterations, lighting on offshore wind structures is required for aviation and vessel movement safety. Ocean Wind proposes to use ADLS, which would dramatically reduce the amount of time obstruction lights are on, significantly reducing the potential impacts on birds. It is estimated that lights would be activated for only 10.9 hours over a 1-year period. In addition, Ocean Wind has proposed an Avian and Bat Post-Constructing Monitoring Framework (COP Appendix AB and BA Appendix B) that outlines an approach to post-construction monitoring that supports advancement of the understanding of bird and bat interactions with offshore wind farms. The scope of monitoring is designed to meet federal requirements (30 CFR 585.626(b)(15) and 585.622(b)) and is scaled to the size and risk profile of the Project with a focus on species of conservation concern. Furthermore, BOEM anticipates the bird and bat mitigation/adaptive management for Ocean Wind to be similar to the Vineyard Wind COP approval conditions for birds and bats (found at https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/VW1-COP-Project-Easement-Approval-Letter_0.pdf). The Avian and Bat Protection Conditions (Condition Section 5.2.3) includes an avian and bat monitoring plan for construction and operations. As part of the monitoring plan, new mitigation measures and monitoring may be imposed by BOEM if impacts deviate substantially from the impact analysis in the EIS.
State and Federal Surveys in Project Area. The list of notification recipients for surveys within the project area should include agencies responsible for research survey activities, such as NOAA, VIMS	NOAA-NMFS and NJDEP are cooperating agencies for the Ocean Wind 1 EIS. Impacts on scientific research and surveys are discussed in Section 3.17 of the Final EIS. NJDEP's Ocean Trawl Survey could

Comment	Response
(NEAMAP survey), and NJDEP. Further, mitigation for research surveys should include NJDEP's Ocean Trawl Survey. This 30+ year old survey supplies data for stock assessment for many of the species managed by ASMFC and regional management councils such as the New England Fishery Management Council and the Mid-Atlantic Fishery Management Council. The loss of survey sampling areas will have a direct impact on the precision and accuracy of future stock assessments.	be affected during construction and operations of the Proposed Action; however, research activities may continue within the proposed Project area, as permissible by survey operators. Mitigation for research surveys discussed in the Draft EIS was associated with the Federal Survey Mitigation Strategy in the Northeast U.S. Region, which is specific to NOAA Fisheries surveys. Because a mitigation measure specifically for NJDEP's Ocean Trawl Survey was not identified in this comment, it could not be analyzed in the Final EIS.
Submerged Aquatic Vegetation (SAV). SAV functions as a blue carbon sink and is a highly productive estuarine habitat for ecologically, commercially, and recreationally important species. Physical damage, removal, increased turbidity, scarring, and bed fragmentation should be minimized. Therefore, DEIS Alternative E is recommended to reduce impacts to submerged aquatic vegetation. This Alternative reroutes the transmission cable as it enters Barnegat Bay from Island Beach State Park through a relic channel, which is a relatively short diversion that avoids denser areas of SAV on the inside shoreline of the island. Avoiding SAV in cable siting will substantially reduce the need for SAV compensatory mitigation, which is costly, time-consuming, and difficult to successfully achieve. Any SAV loss or damage should be documented carefully in a pre- and post-construction survey. Island Beach State Park (IBSP). The DEIS states the target depth of the cable at Island Beach State Park is 4 feet, but it is not clear if this refers to the area where the cable will be direct-buried, or the area that will be installed via horizontal directional drill (HDD) under the beach and dunes. NJDEP notes that during storms, IBSP may lose 6 feet or more in depth at the beach berm. If the cable is at a depth of 4 feet, the cable would become exposed. Exposed cable across the beach would impede vehicle access for park staff and mobile fishing permit holders. Additionally, there are years where the beach berm will not build back up to its pre-storm elevation, which may mean exposed cables during the busy summer season. The depth of the cable on the beachfront berm should be deeper to avoid impacts to travel and tourism as well as normal park operations and post storm work on the beach. Additionally, Ocean Wind will be responsible for maintaining exposed cables post-storm within IBSP, and within the IBSP swimming areas (275 yards into the water). Ocean Wind will also be	The Final EIS has been updated to describe Ocean Wind's SAV Monitoring Plan, which was developed in coordination and discussions with NJDEP to document baseline conditions, assess impacts on SAV beds as a result of construction and operation of the inshore export cables, and track recovery of SAV beds over time. The Final EIS was also updated to describe the export cable installation at Island State Beach Park in more detail. At Island Beach State Park the cable would be installed using HDD under Swimming Beach 2 (both the beach and dunes), as shown on Figure 2-1, at a depth of 30 feet or more. Onshore, the cable would be buried approximately 4 feet deep. As the cable enters Barnegat Bay, it would be installed via trenching. Living shoreline is not proposed by Ocean Wind and therefore is not analyzed in the Final EIS. As described in Section 2.1.2.4, BOEM's regulations at 30 CFR 585 and commercial Renewable Energy Lease OCS-A 0498 require that Ocean Wind remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the seafloor of all obstructions created by the proposed Project. APM GEN-13 in Appendix H, Table H-1 states that disturbed onshore areas would be restored to pre-existing conditions. Section 3.8, Coastal Habitat and Fauna, has been revised to analyze a measure for revegetation of disturbed areas with species native to New Jersey barrier islands and not allowing the use of fertilizer or lime.

Comment	Response
responsible for maintaining the cable line that will be located on the bayside of IBSP. Regarding this section of cable, DEP notes that the DEIS does not make specific reference to the living shoreline proposed by Ocean Wind for the purpose of protecting the cable. This should be addressed in the Final EIS. Although Ocean Wind plans to remove all above ground structures upon project decommissioning, the cable, including all underground components, will need to be removed from IBSP, including the swimming area and in Barnegat Bay; and any areas of disturbance will need to be restored to the pre-project conditions at IBSP. Finally, NJDEP recommends that areas of temporary disturbance be re-seeded or replanted with species native to New Jersey barrier islands, and efforts to reduce soil erosion and sediment control should not include application of fertilizer or lime.	
Coastal Engineering. The DEIS notes that no exclusion zones will be implemented, except the potential for a safety zone exercised by the United States Coast Guard during construction. NJDEP requests that BOEM and Ocean Wind confirm that there will be no restrictions near/around cables related to marine navigation, anchoring, fishing, or dredging operations. Additionally, the current proposal avoids borrow areas/sand resource areas but there are proposed cable landings that may impact beach replenishment projects, and therefore require coordination & communication with the U.S. Army Corps of Engineers, the Non-federal Sponsor, and local owner (municipal and/or private). NJDEP also recommends that vibration monitoring/structure monitoring be implemented for the onshore construction activities including but not limited to infrastructure, bridges, businesses, homes, and drainage structure.	Information was added to the Final EIS on planned and proposed beach replenishment projects within the area and additional coordination that would be necessary with USACE, the non-federal sponsor, and the local owners. Per APM GEN-18, there will be no permanent exclusion zones within the Lease Area during Project operations. However, standard industry practice is that anchoring within a wind farm should only be undertaken by project-related vessels or in emergency situations, as it is a potentially hazardous activity. To control this risk, Project cables will be buried or protected on the seabed and marked on charts, and their location will be monitored to detect any movement. Section 3.14, *Land Use and Coastal Infrastructure*, has been revised to analyze a proposed measure for vibration monitoring/structure monitoring, and Appendix H for the Final EIS has been revised to include this measure.
Water Allocation and Well Permitting. The plan calls for the installation of transmission lines from the offshore export cables to the onshore distribution system. The onshore cables and substation construction would require either trenching or directional drilling. These projects may require some form of construction related dewatering authorization from the Bureau of Water Allocation and Well Permitting and are identified in Appendix A, Table A-1 of the DEIS. As indicated in Appendix A, Table A-1 a Temporary Dewatering Permit for each site, which requires the submittal of a hydrogeological report to determine potential impacts from the dewatering activities. These	If BOEM approves the Project and Ocean Wind decides to construct the Project, Ocean Wind would be required to obtain all applicable federal and New Jersey state permits for the protection of water quality. Table 2.2-1 of the COP lists the anticipated federal, state, and local authorizations that would likely be required for the Project. Ocean Wind would be required to implement the terms and conditions of each permit.

Comment	Response
permits typically take between 6-9 months to review and may include a public hearing. Surface Water & Pretreatment Permitting. Based on the information provided in the DEIS, a NJPDES Discharge to Surface Water General Permit will be needed for a surface water discharge from construction related dewatering. If the discharge will be uncontaminated groundwater generated during construction activities, the appropriate NJPDES Discharge to Surface Water General Permit is the B7 - Short Term De Minimis General Permit (http://www.nj.gov/dep/dwq/gp-b7.htm). As per the B7 application checklist, analytical lab data of all the parameters specified in Attachment 1 must be submitted and the results must demonstrate that they are below the effluent standards. If the discharge will be treated groundwater from remediations and dewaterings, the appropriate NJPDES Discharge to Surface Water General Permit is the BGR – General Groundwater Remediation Clean-up Permit (http://www.nj.gov/dep/dwq/gp_bgr.htm). As per the BGR permit application, a summary of the contaminants of concern must be submitted where the data was collected no more than 12 months prior to the submittal of the application. In addition, a Treatment Works Approval (TWA) may be needed for the construction of the treatment system.	
Air Quality - Evaluation and Planning. Section 3.4.1 Description of the Affected Environment for Air Quality. In addition to Ocean, Atlantic, and Cape May counties, the counties of Cumberland, Gloucester and Salem are also in the southern New Jersey nonattainment area (Philadelphia-Wilmington-Atlantic City, PA-NJ- MD-DE) for ozone where activities are taking place for this project. This area is currently classified as marginal nonattainment for both the 2015 8-hour ozone National Ambient Air Quality Standard (NAAQS), and the 2008 8-hour ozone NAAQS. Also, the area designations for carbon monoxide (CO) are incorrect. The counties of Cape May, Cumberland, Gloucester, and Salem are in attainment of CO. The second ten- year maintenance plan for CO for Atlantic and Ocean counties ended on December 31, 2017, therefore General Conformity no longer applies (40 CFR Section 93.102(b)(4)). Therefore, Section 3.4.1 of the Final EIS should be updated to be consistent with the current nonattainment and maintenance area status for New Jersey that are applicable to this project. In addition, a General Conformity Applicability Analysis	The descriptions of county attainment status were updated in the Final EIS. The activities for which BOEM has authority are outside of any nonattainment or maintenance area and therefore not subject to the requirement to show conformity.

Comment	Response
and possibly a Conformity Determination may be required by any federal department or agency that has authority for any portions of the emissions from activities taking place in the nonattainment areas in accordance with the USEPA's Federal General Conformity regulation (40 CFR, part 93, Subpart B, Determining Conformity of General Federal Actions to State or Federal Implementation Plans). Clarification of compliance with the General conformity regulations should be included in the final EIS. Further, a General Conformity Applicability Analysis and possibly a Conformity Determination may be required pursuant to the USEPA Federal General Conformity regulation for any portions of the emissions from activities taking place in the nonattainment areas (40 CFR, part 93, Subpart B, Determining Conformity of General Federal Actions to State or Federal Implementation Plans). Clarification of compliance with the General conformity regulations should be included in the final EIS. Section 2.1.3.1 Affected Environment.	
NJDEP notes that the DEIS should mention that Gloucester County is in the maintenance area for the 2006 PM2.5 NAAQS, and also that EPA has revoked the 1979 1-hour ozone standard. Therefore, Section 2.1.3.1 of the final EIS should be updated to be consistent with the current nonattainment and maintenance area status for New Jersey that are applicable to this project.	The descriptions of county attainment status have been updated in the Final EIS.

O.4.2.2. New York State Department of State

Table O.4-6 Responses to Comments from New York State Department of State (Letter No. 1207)

Comment	Response
The Department's public comments which are supportive of appropriate offshore wind development in the New York Bight are intended to place a finer point on the State's interests in the Project's development and ensure that the needs of affected New York stakeholders including the shipping and commercial fishing industries and recreational fisheries are met as these initial formative offshore wind projects are developed. As the largest port complex on the East Coast the NY/NJ Harbor is an economic driver for New York State and the region. New York benefits from the strong maritime ties with the Delaware Bay most directly by important tug-tow coastwise routes along New Jersey that overlap with the Project area and eastward. New York's robust commercial fishing industry is of economic significance to the State. The New York Bight contains important fishing grounds for commercial vessels landing in New York as well as long- established routes to access productive grounds far-afield and onshore processing facilities. To this end New York seeks to ensure that navigational safety is prioritized and that use conflicts between mariners and offshore wind are minimized to the extent possible. Additionally we seek to ensure that impacts to important offshore habitats of the New York Bight are addressed through avoidance and minimization measures wherever possible.	The EIS currently analyzes and evaluates the elements within this comment in both Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, and Section 3.16, *Navigation and Vessel Traffic*. BOEM acknowledges the importance of both commercial and recreational fishing, as well as the variety of ports, shoreside businesses, and commercial shipping lanes that are important in this area. To that end, it has included extensive analysis on commercial fishing revenue exposure within the Ocean Wind 1 Lease Area. Space-use conflicts are acknowledged within the EIS, both in the Wind Farm Area and related to port utilization. The EIS presents a variety of information, including the number of trips and vessels by port (Table 3.9-9) and revenue by port (Table 3.9-10), both specific to federally permitted vessels in the Ocean Wind 1 Lease Area. These tables indicated, among other things, that Atlantic City, New Jersey is the highest utilized port for federally permitted vessels operating in the Lease Area. It should also be noted that the New Jersey Wind Port and the Port of Paulsboro are specifically being improved for the purpose of supporting offshore wind farm development. This is to the overall benefit of the local economy and will help divert certain offshore wind construction and O&M activities from existing ports and reduce the potential for space-use conflicts with the commercial fishing industry. For additional discussion of navigation and vessel traffic impacts, please refer to Section 3.16.

Comment	Response
Cable burial depth (target of 4-6ft): DOS continues to urge greater transparency and additional details on the Cable Burial Risk Assessment (CBRA) process and the anticipated need for deeper burial depths to minimize risks to commercial vessels operating and transiting within the Project area. Refer to the Kitty Hawk Offshore Wind Project Construction and Operations Plan (COP) Appendix J as a template for how to provide a qualitative CBRA during the COP phase. [Footnote 2*: Available at https://www.boem.gov/renewable-energy/state-activities/kitty-hawk-wind-construction-and-operation-plan-commercial- lease*] Further refinement to this target burial depth may be needed given BOEM's recommendation for a minimum six (6) foot cable burial depth identified in the Draft Fisheries Mitigation Guidance. [Footnote 3: *https://www.regulations.gov/docket/BOEM-2022-0033, posted June 23, 2022, which states, "[a]ll static cables should be buried to a minimum depth of 6 feet below the seabed where technically feasible."]*	Section 2.1.2.2.3 of the Final EIS provides details regarding factors considered for target burial depth and notes that further coordination with agencies would occur as part of the development of the CBRA. BOEM's Guidelines for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR Part 585 recommend a minimum burial depth of 6 feet below the seabed where technically feasible. Thermal conductivity is a technical feasibility factor when determining target burial depth.

Comment	Response
Sensitive Benthic Habitats (Alternatives D and E): DOS supports BOEM's analysis of DEIS Alternatives to avoid impacts to sensitive benthic habitats like sand ridge and trough and submerged aquatic vegetation (SAV) habitat. Thoroughly evaluating the immediate and long-term impacts to habitat disturbance and, in some cases, habitat conversion is essential to ensuring these critical habitats can continue to provide structure for important commercial and recreational Mid-Atlantic species such as loligo squid and summer flounder. Notably, SAV known to occur in intercoastal bays also provides an important sanctuary for juvenile species. Sand wave clearance (Section 3.6): The DEIS does not appear to fully address the duration of impacts resulting from clearing 100% of sand waves along the cable corridor routes nor the potential for continued maintenance during operations to prevent cables from becoming overburied. [Footnote 4: *COP Volume 1, pg. 104*]. The DEIS states "sand ridges and troughs are areas of biological significance for migration and spawning of mid-Atlantic fish species, many of which are recreationally targeted in those specific areas." [emphasis added] [Footnote 5: *DEIS pg. 2-24*] Research indicates sand waves can take 10 or more years to reform following disturbance. [Footnote 6: *References: Campmans et al. (2021) Modeling tidal sand wave recovery after dredging: effect of different types of dredging strategies. Coastal Engineering 165: 103862. Hulscher et al. (2000) Regeneration of dredged sand waves in Marine Sandwave Dynamics, Lille, France. Hayes and Nairn (2004) Natural Maintenance of Sand Ridges and Linear Shoals on the U.S. Gulf and Atlantic Continental Shelves and the Potential Impacts of Dredging. Journal of Coastal Research 20 (1): 138–148.*] Longer recovery time results in sustained impairment to the habitat and potential impacts to invertebrate communities and fisheries. Furthermore, the DEIS should analyze the anticipated need for sand wave clearing during maintenance activities to prevent cables from overburying and identify whether the resulting impacts may be longer-term and not as transient as initially contemplated.	Text has been added in Section 3.6.5 to address potential impacts on sand waves. Sand waves are also distinguished from sand ridges in Section 3.6. Sand waves are mobile with respect to wave energy and in the New York Bight, the prevailing wave energy pushes sand west along the south shore of Long Island and north along the New Jersey shore, forming sand waves. Reference to NYSERDA 2019 has been added to the Final EIS. In contrast, sand ridges are geologic formations, i.e., sand and gravel ridges in offshore areas that are the eroded and reworked remnants of barrier islands that formed during the early Holocene. Sand ridges are included in the analysis of Alternative D. Sand waves and clearance are included under all the alternatives because their clearance may be required to install cables at a sufficient depth that they would not be uncovered as a result of sand wave mobility (as noted by the commentor). In Section 3.6.5, the following text has been added to expand the analysis of potential impacts due to sand wave clearance: "Cable emplacement and maintenance activities may flatten depressions and small sand waves, temporarily reducing benthic habitat suitability for species such as red and silver hake within the cable footprint. Prey organisms that use these habitats would also be displaced, potentially affecting habitat suitability for fish species. Trenching may leave behind temporary depressions. The extent of these natural features is difficult to quantify, as they are continually reshaped by natural sediment transport processes. Natural recovery from anthropogenic disturbance is likely to occur within several months of the disturbance, depending on timing relative to winter storm events." As already stated in Draft EIS Section 3.6.5, "Despite unavoidable mortality, damage, or displacement of invertebrate organisms, the area affected by the construction footprint for cable emplacement would be just 4 percent of the Wind Farm Area and the area affected within the export cable routes would similarly represent a small fraction of available benthic habitat."

Comment	Response
Fisheries economic exposure (Section 3.9): A quantitative analysis of fisheries economic exposure along the export cable corridors should be provided. Both Vineyard Wind and South Fork Wind included quantitative exposure analyses of the wind farm area and cable corridors, which set the appropriate precedent of analyzing the entire project area. The same should be done for this and future offshore wind reviews. BOEM's commendable release of draft fisheries mitigation guidance articulates the importance of developing accurate revenue exposure estimates in order to evaluate the potential for income losses to fishing industries and the need for compensation. Omitting the cable corridors from this analysis would undervalue the revenue exposure estimate.	BOEM has determined that the qualitative analysis provided in Section 3.9.3.2 under the cable emplacement and maintenance IPF is appropriate for temporary cable route disturbance.
Transit and fishing industries (Sections 3.9 and/or 3.16): DOS recommends updating the analyses of Offshore Wind Activities and the Proposed Action to include potential fishing vessel route detours and whether direct and indirect impacts could occur to fishermen, fishing ports, seafood processing facilities, and other shoreside support industries, like those in Atlantic City and Cape May, New Jersey. While the Coast Guard determined that formal routing measures for fishing vessels are not required through this region, [Footnote 8: *U.S. Coast Guard. 2021. USCG-2020-0172 Port Access Route Study: Seacoast of New Jersey including offshore approaches to the Delaware Bay.*] it is important to evaluate impacts to the fishing industry and port approaches in the EIS so these can be considered when determining appropriate avoidance, minimization, and mitigation measures. The DEIS acknowledges that many factors depend on project- specific information that is unknown at this time; [Footnote 9: *DEIS pg. 3.9-32 (and elsewhere)*] however, a suite of reasonable assumptions could be made based on the currently proposed projects in the New Jersey and New York Wind Energy Areas and BOEM's own efforts to develop a Programmatic EIS for the New York Bight lease areas. [Footnote 10: *87 FR 42495 [July 15, 2022]*] Existing transit patterns are well documented in the New York Bight. [Footnote 11: *NYSERDA, NYSDEC, and RODA. 2020. New York Bight Transit Lanes Surveys, Workshop, and Outreach Summary. Available at: https://www.nyftwg.com/wp-content/uploads/2020/06/NY-Bight-Transit-Lanes-Workshop-and-Outreach-Summary_-Final- Draft.pdf*] A key driver of transit patterns for New York State fishermen stems from New York ports not having adequate docking and unloading facilities, seafood processing capacity,	Space-use conflicts are acknowledged within the EIS, both in the Wind Farm Area and related to port utilization; however, as the comment indicates, there are many variables and factors that dictate where fishing vessels may off-land their catch. To address this, the EIS presents a variety of information, including the number of trips and vessels by port (Table 3.9-9) and revenue by port (Table 3.9-10), both specific to federally permitted vessels in the Ocean Wind 1 Lease Area. These tables indicated, among other things, that Atlantic City, New Jersey is the highest utilized port for vessels operating in the Lease Area. In addition, text has been added to the EIS noting that the New Jersey Wind Port and the Port of Paulsboro are specifically being improved for the purpose of supporting offshore wind farm development. This is to the overall benefit of the local economy and will help divert certain offshore wind construction and O&M activities from existing ports and reduce the potential for space-use conflicts with the commercial fishing industry.

Comment	Response
or land-based transportation networks to efficiently get the seafood to market. For example, seafood logistics and distribution systems, including last mile delivery, is often challenging due to workforce shortages and supply chain bottlenecks (e.g., access to refrigerated trucks). [Footnote 12: *NYS Department of Agriculture and Markets. 2019. Senate Bill S7300, Seafood Roundtable Meetings Written Report. Dated September 30, 2019. Available at:* https://agriculture.ny.gov/ *system/files/documents/2019/12/2019seafoodreport.pdf*.] This has resulted in New York fishermen choosing to land in other states, like surfclam fishermen landing in New Jersey because New York does not have an appropriate processing facility. Where a fisherman chooses to land their catch also depends on market price, proximity to fishing grounds, permit requirements, among other factors. Because of these existing challenges, BOEM's EIS should consider whether Offshore Wind Activities and the Proposed Action could make it more challenging or costly for New York fishermen and others to land their catch in New Jersey and whether this impacts the shoreside industries.	
Radar Interference (Section 3.9): Update Section 3.9 to more accurately characterize the anticipated radar interference, as was done in Section 3.16, Navigation and Vessel Traffic. The commercial fishing impacts analysis in the DEIS states, "[s]ome fishing vessels operating in or near offshore wind facilities may experience radar clutter and shadowing." [Footnote 13: *DEIS, pg. 3.9-31*] DOS recommends this be rephrased to more closely align with the assessment in Section 3.16 which states that, "O&M of the Proposed Action would likely affect marine vessel radar performance near or within the Wind Farm Area." [Footnote 14: *DEIS, pg. 3.16-15*]. Mariner Communication and Outreach Plan (Appendix H): Develop and implement a Mariner Communication and Outreach Plan that covers all project phases from pre-construction to decommissioning. There is a proposed fisheries outreach plan (See ID CFHFISH-02), and this should be expanded to include coordination with other mariners, including the commercial shipping industry and other recreational users who would also benefit from this coordination and may not be captured in the currently proposed fisheries plan. The Oyster Creek route specifically presents an increased risk to ocean users because two parallel cables would be constructed and maintained to occupy a heavily trafficked route with relatively shallow burial depths, and with multiple cable sections that	Text within Section 3.9.5 for the presence of structures IPF has been updated with additional text from Section 3.16 related to radar interference for large and small vessels. In addition, reference to Ocean Wind's Fisheries Communication and Outreach Plan (COP Volume III, Appendix O; Ocean Wind 2023) has been added to this section of the EIS noting that it will provide a mechanism for communication and coordination with the commercial fishing industry. However, this communication and outreach plan is specific to the fishing industry and, although elements may overlap with the commercial shipping and other mariners, this plan has a defined scope and purpose. Also, as noted in Section 3.16, *Navigation and Vessel Traffic*, there are additional mitigation measures and equipment being implemented for other resources. In addition, APM GEN-14 includes the development and implementation of a communication plan to inform USCG, DOD headquarters, harbor masters, the public, local businesses, and commercial and recreational fishers, among others, of construction and maintenance activities and vessel movements, as coordinated by the Ocean Wind Marine and Helicopter Coordination Center, which could potentially cover most of the information noted within

Comment	Response
would not achieve even target depth because of existing asset crossings (telecommunications cables). Additionally, if periodic cable exposures occur, New York and New Jersey's shipping industries could be directly affected by the increased risk of interactions, maintenance and remedial burial activities, and vessel congestion and delays during maintenance. DOS recommends the following as components of an effective mariner communication plan to ensure existing uses are accommodated to the maximum extent possible: a. Pre-COP consultation with potentially affected stakeholders on initial routing and results of the draft Navigation Safety Risk Assessment; b. During Project design, coordinating in-water construction activities to avoid and minimize disruptions; c. At least 90 days prior to commencing in-water construction activities in any construction season, consultation with stakeholders on an approximate schedule of activities and existing uses within the Project area. Make good faith efforts to accommodate those existing uses. The results of these good faith consultations can be summarized in a report and submitted to the federal agency(ies) prior to the start of each construction season; d. Following COP approval, notice of proposed changes which have the potential to impact fishing or maritime resources or activities; e. Notices to commence construction activities, conduct maintenance activities, and commence decommissioning; f. Status reports during construction with specific information on construction activities and locations for upcoming activities in the next 1-2 weeks; g. Post-construction notice of: (i) all cable protection measure locations (including protection type and charted location); (ii) any areas where the identified burial depth is less than target burial depth; and (iii) other obstructions to navigation created by the Project; and h. Post all notices described above to the Project website with information on how to opt-in for alerts.	the comment. The Marine and Helicopter Coordination Center is a fully staffed operations center (24/7 staffing) that would coordinate construction vessel traffic and operations and manage communications with vessels on site. It was established in 2019 and manages all direct and immediate on-scene communications (e.g., radio, satellite phone, instant messaging, email) with project vessels and other mariners. Once a wind farm is operational, control is passed from the Marine and Helicopter Coordination Center to the respective operations center. Ørsted is still in the planning phase for developing the operations center; however, the center will be open and operational before the commissioning of Ocean Wind 1. Ocean Wind is also developing a Navigational Safety and Training program, where eligible commercial, charter, and for-hire fishing vessels operating in and around Ocean Wind 1 would be reimbursed for new radar equipment and training to help in mitigating navigation and radar concerns. Reference to this program has been added to Section 3.9.4, and it has been incorporated into the analysis as applicable.

Comment	Response
Incident reporting (Appendix H): DOS looks forward to further coordination with BOEM, the Bureau of Safety and Environmental Enforcement (BSEE), the U.S. Army Corps of Engineers, and other interested parties on how to best address reporting of fishing gear and/or anchor strike incidents that fall below or are simply not captured by the regulatory thresholds outlined in 30 CFR §§ 585.832 and 585.833. The purpose is to increase awareness of the frequency and circumstances surrounding these incidents and assess whether any actions are needed to address them. DOS supports a process whereby standardized, routine reports are filed that identify incidents. Ideally, the reports would be annual during construction and decommissioning, then have an adjusted timeframe (e.g., every 5 years) during operations.	BOEM will continue to coordinate with NYSDOS on establishing processes for reporting fishing gear and anchor strike incidents that fall below regulatory thresholds.

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O.5. Responses to Lessee Comments on the Draft EIS

Table O.5-1 Responses to Comments from Ocean Wind LLC (Letter No. 1190)

Comment	Response
Benefits of Offshore Wind; The burgeoning offshore wind industry in the United States is poised to benefit consumers, the economy, and the environment in at least five key areas, including: Delivering significant economic benefits to the United States and the State of New Jersey. To construct, operate, and service offshore wind farms along the east coast, improvements to port and harbor infrastructure will also be undertaken. To support development, construction, and operation of offshore wind projects, as well as related infrastructure improvements, it is estimated that the offshore wind industry could create up to 83,000 new, well-paying jobs by 2030. [Footnote 1: American Clean Power. U.S. Offshore Wind Power Economic Impact Assessment, March 2020. [Embedded Hyperlink Text (https://supportoffshorewind.org/wp-content/uploads/sites/6/2020/03/AWEA_Offshore-Wind-Economic-ImpactsV3.pdf)]], Diversifying the nation's overall energy strategy and helping to balance the domestic portfolio with the added benefit of displacing or supplementing generation from non-renewable sources, thereby supporting energy security and independence in the United States while displacing generators that contribute to climate change. Use of renewable energy technologies will reduce demand for domestic and imported fossil fuels while using clean, renewable domestic energy sources. Helping the United States meet its renewable energy goal of 30 gigawatts ("GW") from offshore wind by 2030, facilitated by state offshore wind procurement targets. [Footnote 2: American Clean Power. Offshore wind power facts. [Embedded Hyperlink Text (https://cleanpower.org/facts/offshore-wind/)]] Development of the Project will support the priorities established by the Biden Administration to deploy 30 GW of offshore wind by 2030 and accelerate clean energy siting and permitting in an environmentally sustainable manner. [Footnote 3: Currently, the Purpose and Need in the DEIS references one Executive Order. This Executive Order, issued in 2021, determined a need to "increase renewable energy production … in those waters,	Comment noted.

Comment	Response
with the goal of doubling offshore wind by 2030 while ensuring robust protection for our lands, waters, and biodiversity and creating good jobs" and "to accelerate the deployment of clean energy and transmission projects in an environmentally stable manner" (Executive Order 14008, Tackling the Climate Crisis at Home and Abroad).The FEIS should also reference Executive Order 13990 (Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis) "to accurately determine the social benefits of reducing greenhouse gas emissions when conducting cost-benefit analyses of regulatory and other actions."] Helping New Jersey meet its offshore wind goal of 7.5 GW by 2035, [Footnote 4: Department of Environmental Protection. About offshore Wind. [Embedded Hyperlink Text (https://www.nj.gov/dep/offshorewind/about.html)]] as well as the state's goal of a 100 percent clean energy economy by 2050, [Footnote 5: New Jersey Economic Development Authority. Offshore Wind. [Embedded Hyperlink Text (https://www.njeda.com/offshorewind/),] and Developing energy projects in an environmentally responsible manner that will ultimately deliver greenhouse gas reductions. While relatively new to the United States, the offshore wind industry has been developing in Europe for more than 25 years and has become an important part of the global economic and energy portfolio. [Footnote 6: In 1991, Ørsted built the world's first offshore wind farm in Denmark. Twenty-five years later, Ørsted built America's first offshore wind farm. To date, Ørsted has constructed 5.6 gigawatts (GW) of offshore wind capacity, nearly 30 percent of globally installed offshore wind capacity, with another 4.3 GW under construction. In addition to the Block Island Wind Farm already operating in Rhode Island, the states of New York, New Jersey, Virginia, Maryland, and Connecticut have each entrusted Ørsted to deliver their first offshore wind farms.] Europe's experience with offshore wind demonstrates that collaboration with public officials and other stakeholders can ensure that offshore wind facilities grow the economy while being constructed and operated compatibly with the fishing industry and successfully accommodating vessel navigation and other important marine uses. The United States is well-positioned to experience growth that allows for co-existence of multiple uses of the Outer Continental Shelf ("OCS"). BOEM's role will be instrumental in fostering the responsible	

Comment	Response
development of renewable energy resources on the OCS while maintaining environmental safeguards, conservation of natural resources, and compatibility with other uses of the OCS.	
Benefits of the Project; Ocean Wind strongly agrees that offshore wind will provide the long-term benefits identified throughout the DEIS and believes the benefits of the Project should be evaluated and considered as prominently as the evaluation of impacts. Ocean Wind suggests that BOEM expand the discussion of these positive findings in the FEIS to emphasize and balance those benefits in comparison to the impacts. Several benefits are described in detail below. The Project will bring significant economic and environmental benefits to the communities along the New Jersey shore, the State of New Jersey, and other states that will be part of the offshore wind installation and operation supply chain. The Project will generate enough clean energy to power more than 500,000 New Jersey homes annually. Through displacement of conventional generation, the Project is expected to displace over 100 million tons of carbon emissions over its operational life, the equivalent of removing 21.6 million cars from the road, leading to overall cleaner air and water directly because of the Project. The Project will also contribute to local climate initiatives and community investments, such as the Ocean Wind Pro-NJ Grantor Trust (“Trust”). The $15 million trust offers small, women-owned and minority-owned business support to re-tool their business to participate in the offshore wind industry. The Trust also provides funding for infrastructure resiliency improvements in Atlantic, Ocean, and Cape May counties. Ocean Wind was also pleased to give back to the New Jersey community through the Ørsted Cares program by providing financial assistance to electric customers in Atlantic, Cape May, and Ocean counties facing financial crisis, as well as participating in a 12-week training course for high school students in Atlantic City. In addition to supporting the clean energy goals of New Jersey, the Project will create new high-paying jobs and provide economic and infrastructure improvements to New Jersey and surrounding states. Specifically, the Project will result in the creation of thousands of direct construction jobs, major investments in infrastructure, including port facilities and the first U.S.-based monopile manufacturing facility, increased property tax revenue associated with onshore substation development, and increased income associated with local construction	Economic benefits of the Project are described in Section 3.11.

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employment. The Project will also create long-term operations and maintenance jobs based out of an operations and maintenance facility to be developed in Atlantic City, which will serve as a hub facility for the Project and other offshore wind projects.	
Ocean Wind is also investing nearly $13 million to implement fisheries monitoring surveys in collaboration with Rutgers, the State University of New Jersey, Delaware University, and Monmouth University. This work will support local universities while also advancing our understanding of the marine environment through the collection of valuable data on important commercial and recreational species. Additionally, Ocean Wind is supporting the development of a first-of-its-kind program which will enable Stockton University to train individuals to be Protected Species Observers (PSOs) thus preparing students to participate in the offshore wind industry.	Ocean Wind's programs and commitment to minimize impacts on commercial fisheries and for-hire recreational fishing through the development of a Fisheries Communication and Outreach Plan as well as a Fisheries Monitoring Plan are both noted within Section 3.9.4.
Finally, artificial reefs created through the placement of the wind turbine generator ("WTG") foundations will create hard substrate habitats for a more diverse community of finfish and invertebrates in the offshore Lease Area. These artificial reefs are expected to result in increased opportunities for recreational anglers in the region. Number of trips is expected to increase for private recreational anglers as well as charter and party vessels. Additional revenues are expected for charter and party vessels as a result of the Project.	Creation of artificial reefs with the construction and installation of foundations for the WTGs and OSS has been acknowledged and included in Section 3.9, including the beneficial impact associated with for-hire recreational fishing.
It is important to note that, in addition to the BOEM-led National Environmental Policy Act ("NEPA") process, The Project is also being reviewed through a robust state permitting process before the New Jersey Department of Environmental Protection ("NJDEP") and its various offices including: Division of Land Resource Protection, Division of Water Allocation and Well Permitting, Division of Water Quality, Bureau of Tidelands Management, Green Acres Program, Division of Parks and Forestry Natural Heritage Program, and the Historic Preservation Office.	Comment noted.
1. Comments, 1.1 Alternatives; Ocean Wind appreciates the NEPA alternative screening criteria that BOEM highlighted in the DEIS and that BOEM subsequently further elaborated upon in published guidance. [Footnote 7: BOEM, Process for Identifying Alternatives for Environmental Reviews of Offshore Wind Construction and Operations Plans pursuant to the National Environmental Policy Act (June 22, 2022), [Embedded Hyperlink Text	Comment noted.

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(https://www.boem.gov/sites/default/files/documents/renewable-energy/BOEM%20COP%20EIS%20Alternatives-2022-06-22.pdf)]] In particular, the guidance emphasizes that in developing the Purpose and Need for the EIS, the lead agency should consider "the goals of affected states, including state laws that establish renewable energy goals and mandates, where applicable." [Footnote 8: Id. at 3.] The guidance also highlighted the appropriateness of considering the project developer's goals, including "awarded contracts for offtake and/or the MW nameplate capacity for the proposed project; the proposed area within the lease." [Footnote 9: Id. at 3.] As a result, in weighing whether a proposed alternative is reasonable, and warrants further consideration, the agency must consider whether the alternative would result in the development of a project that would not allow the developer to satisfy contractual offtake obligations. As discussed below, Ocean Wind provides additional detail for how several of the proposed alternatives are not technically or economically feasible and thus are not reasonable alternatives.	
1.1.1 Alternatives B and D; Alternatives B and D as proposed by BOEM in the DEIS involve a reduction in the number of turbines. The Project would like to clarify that a reduction in turbines will prevent the Project from delivering the 1,100- megawatt ("MW") target generation, and as such, Alternatives B and D do not meet the stated Purpose and Need of the Project.	BOEM's purpose as stated in Section 1.2 to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP is needed to fulfill BOEM's duties under the lease. Although a reduction in expected annual energy production would affect Ocean Wind's Project goals, reduced energy generation would not prevent the Project from meeting BOEM's purpose and need. BOEM sought feedback from BPU regarding the potential implications of the alternatives analyzed in detail in relation to the 1,100-MW nameplate capacity and annual OREC allowance to fulfill Ocean Wind's contractual obligations with BPU in accordance with its application of 40 CFR 1508.1(z) ("Reasonable alternatives means a reasonable range of alternatives that are technically and economically feasible..."). In its analysis BOEM found that a Project with fewer than 98 turbines could potentially meet these obligations.
The New Jersey Board of Public Utilities ("BPU") June 21, 2019 Order ("OREC Order") referenced by BOEM in Section 1.2 "Purpose and Need for the Proposed Action" of the DEIS does not merely specify the annual production capacity expected by the state—it also gives Ocean Wind an "Annual OREC Allowance" of 4,851,489 Megawatt-hours ("MWh") per year, and identifies in which years that electricity is to be delivered. The OREC Order envisions the Project coming online in three phases: May,	Comment noted.

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September, and December 2024 (or no later than six months after each date). While BPU may, in its discretion, adjust the commercial operation dates, the BPU anticipates the Project to be completed by late 2024 or early 2025 to begin delivering on New Jersey's clean energy goals. On September 19, 2019, Ocean Wind selected GE Renewable Energy as the preferred turbine supplier for the Project. The BPU issued an order approving that selection on November 13, 2019. GE Renewable Energy provided the world's first commercial deployment of GE's Haliade-X 12 MW offshore wind turbine, which were the world's most powerful turbines at the time of the BPU's approval. In May 2020, Ocean Wind submitted a petition to the BPU seeking authorization to increase the number of turbine positions from the number that the BPU had assumed when approving use of the Haliade-X turbine that such an increase would be necessary for the Project's actual generation to be able consistently to on the basis achieve the Annual OREC Allowance in the OREC Order. On July 15, 2020, the BPU issued an order granting Ocean Wind's petition to increase the number of turbines, finding that such an increase order to be in a better position to achieve the Project's Annual OREC Allowance was reasonable in light of the goals of New Jersey's offshore wind solicitation, and that "achieving the Annual OREC Allowance [would] enable the residents of New Jersey to realize the maximum clean energy benefits expected from the Project." [Footnote 10: BPU, Order Authorizing Ocean Wind's Petition for an Increase in Turbines , Docket No. QO18121289 (July 15, 2020), available at [Embedded Hyperlink Text (https://nj.gov/bpu/bpu/pdf/boardorders/2020/20200715/8A%20-%20ORDER%20OSW%20Petition.pdf)]]. The BPU acknowledged that increasing the number of turbine positions would also increase the Project's nameplate capacity, but that the increased nameplate capacity was reasonable in order to achieve the benefits associated with consistent achievement of the Annual OREC Allowance. [Footnote 11: Id.] It also noted that the number of turbine positions was "still well below the number proposed in Ocean Wind's December 2018 Application," thanks to the use of the Haliade-X turbine. [Footnote 12: Id.].	
Alternatives B and D, however, include scenarios in which fewer than 98 turbines are proposed. BOEM states that removing nine or fewer turbines from the design would still result in "meeting the proposed 1,100-MW nameplate capacity," [Footnote 13: DEIS at 2-27] but this	Project goals, including Ocean Wind's annual OREC allowance, are described in Section 1.2. Given that Project nameplate capacity (i.e., 1,100 MW) may not account for capacity factor, further explanation was provided in the footnote on page 2-3 regarding how BOEM

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overlooks the fact that, in order for the Project to achieve the goals set for it by the State of New Jersey, it must be capable of actually generating enough MWH of electricity to achieve its Annual OREC Allowance on a consistent basis, and may not simply rely on having a nameplate capacity of 1,100 MW. In other words, BOEM has modified the proposed number of turbines proposed by Ocean Wind in its Construction and Operations Plan ("COP") without consideration of the relationship between the number of turbines, the energy generated, and the collective energy output of the system. While BOEM notes that it is continuing to assess the energy production impacts associated with exclusion of WTG positions, the DEIS continues to evaluate alternatives which would not enable the Project to meet its Purpose and Need. Ocean Wind stresses that meeting the Project's Purpose and Need is not as simple as dividing the target generation by the turbine nameplate capacity (12.4 MW), and thereby deducing that a number of turbines can be removed for a calculated nameplate capacity exceeding 1,100 MW, as described in the DEIS.	developed alternatives that would reduce the number of WTGs. Descriptions of each alternative also state that the final number of WTGs excluded may be fewer than the maximum number to ensure consistency with an 1,100-MW nameplate capacity and annual OREC allowance to fulfill Ocean Wind's contractual obligations with BPU.
As the BPU itself has indicated, a more accurate and appropriate metric for the Project to meet the BPU requirements and Purpose and Need, is to evaluate the energy produced per year, which is how the BPU award to the Project measures energy delivery. The New Jersey Offshore Wind Economic Development Act of 2010 ("OWEDA") defines an offshore wind renewable energy credit ("OREC") as representing the environmental attributes of one MWh of electric generation from an offshore wind project. For each MWh delivered to the transmission grid, an offshore wind project will be credited with one OREC. As stated, Ocean Wind's Annual OREC Allowance is 4,851,489 MWh per year (after transmission losses). There is not a linear correlation between the Annual OREC Allowance and the nameplate capacity of the WTG, meaning that, as stated above, dividing the target generation by the turbine nameplate capacity is not an accurate method for defining alternatives that meet the stated Purpose and Need.	Comment noted.
Further, a key component of the Project's Purpose and Need and the BPU OREC award to Ocean Wind, is that the Annual OREC Allowance shall not be subject to reduction or modification during the term of the award unless otherwise agreed to by the BPU and Ocean Wind or its successor. To reach the Annual OREC Allowance as proposed under Alternatives B and D, with a 1,100 MW nameplate capacity and a	Chapter 2 of the Final EIS has been updated to note that any changes to the stated MW-hour allowance in the June 2019 order would need both BPU and Ocean Wind's consent.

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reduction to only 89 turbines x 12.4MW, the capacity factor would need to be 50.3 percent. The DEIS states that the capacity factor "…for the Project would most likely vary between 45 percent and 63 percent" (DEIS page 2-3). However, when accounting for both energy production efficiency and transmission losses, the Project's actual capacity factor is percent. As a consequence, 89 turbines at 12.4 MW at that capacity factor would result in an annual energy production percent below the Annual OREC Allowance of 4,851,489 MWh per year. Again, consistent achievement of the Annual OREC Allowance was the basis on which the BPU authorized Ocean Wind to increase the number of turbine positions from what had been contemplated when the Haliade-X was first approved. And the Project as proposed by Ocean Wind with the full 98 turbines as authorized by the BPU, is required to deliver 4,851,489 MWh per year to the grid on a consistent basis.	
When considering which technologies within the Project envelope could support alternatives, BOEM is required to provide a "reasonable range of alternatives framed by the purpose and need…" and BOEM further clarifies that: "The alternatives should be "reasonable," which the Department of the Interior has defined as those that are "technically and economically practical or feasible and meet the purpose and need of the proposed action (DEIS page 2-27)" Therefore, BOEM should only consider those technologies that are commercially available and within timing constraints of the Project to procure delivery of WTGs to meet the schedule outlined in the Section 1.2 of the DEIS. For example, alternative B-2 includes larger turbines which are currently unavailable. As such, alternative B-2 would not satisfy the BPU Order to deliver offshore wind energy to the transmission grid beginning in 2024 and does not satisfy the BOEM definition of a "reasonable alternative". In addition, the alternatives that could result in Project delays of up to 2 years (Alternatives C-1- and E) are also not feasible, as they do not meet the Project purpose and need and do not meet the BOEM requirement of "reasonable" as well. Therefore, the full number of turbines proposed by the Project (98 turbines) are necessary to enable Ocean Wind to produce the specified OREC allowance and meet the goals set for it by the BPU.	The proposed Project, as described in the COP, includes WTG dimensions that would allow for a 240-meter rotor diameter WTG. As such, BOEM analyzed larger turbines consistent with Ocean Wind's PDE parameters. BOEM's purpose as stated in Section 1.2 to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP is needed to fulfill BOEM's duties under the lease. The reduction in energy generation and Project delays expected to result from adoption of the alternatives would not prevent the Project from meeting BOEM's purpose and need.
1.1.2 Alternative C-1; Under Alternative C-1, the DEIS states on page 2-18 that "Additional site investigations may be needed for alternatives that would relocate WTG positions or compress the WTG layout.	BOEM's purpose as stated in Section 1.2 to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP is needed to fulfill BOEM's duties under the lease. Although

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Collecting and processing the additional survey data could lead to a Project delay of up to 2 years." The Project would like to emphasize that adding 2 years to the schedule prevents the Project from meeting the stated Purpose and Need to deliver offshore wind energy to the transmission grid beginning in 2024. Indeed, in its OREC Order the BPU reserved the right to penalize offshore wind projects for delays of more than six months to the scheduled start of deliveries, reflecting the importance to the State of minimizing delays to the extent practicable. As such, Alternative C-1 is not within a range of "reasonable" alternatives as defined by BOEM and should be removed from consideration. Furthermore, Alternative C-1 considers relocating eight turbines, four of which would be located closer than 13 nautical miles ("nm") to shore which would increase visual impacts to affected communities. Ocean Wind has spent considerable efforts to avoid and minimize visual impacts from the Project by siting WTGs 13 nm from shore.	delays to the Project schedule would affect Ocean Wind's Project goals, potential delays to the Project schedule alone would not prevent the Project from meeting BOEM's purpose and need. BOEM considered the potential schedule delay concerns raised here relevant to its application of 40 CFR 1508.1(z) ("Reasonable alternatives means a reasonable range of alternatives that are technically and economically feasible...") in the EIS but did not find sufficient support to dismiss Alternative C-1 from analysis in detail. The potential consequences to the Project from Alternative C-1 in terms of reduced expected annual energy production and the potential for up to a 2-year delay are disclosed in Final EIS Section 2.1.4.
1.1.3 Alternative C-2; Ocean Wind is fully committed to ensuring navigational safety and clearance as well as effective search and rescue in and around the wind farm. Therefore, Ocean Wind supports, in part, Alternative C-2 to the proposed action, which provides navigational clearance between the Ocean Wind Lease Area and the Atlantic Shores South Lease Area. To that end, Ocean Wind requests that BOEM adopt Alternative C-2, 0.81-nm buffer option, to promote navigational clearance by creating a buffer along the north-eastern boundary of the Ocean Wind Lease Area. Ocean Wind and Atlantic Shores Offshore Wind, LLC ("Atlantic Shores") have worked constructively with the U.S. Coast Guard ("Coast Guard") on this issue and as a result of the conversations, the Coast Guard has proposed measures for both Ocean Wind and Atlantic Shores to undertake in order to create a minimum spacing distance between the two lease areas. These measures include adjusting WTGs in column A of Ocean Wind's WTG layout to maintain a minimum distance of 1,500 meters (0.81 nm) between the Project and the western most column of the Atlantic Shores WTGs, as well as aligning WTGs in column A equidistant to those in column B at 1 nm. Furthermore, to meet this alternative, Atlantic Shores would need to microsite one WTG and remove two WTGs that fall within the minimum spacing distance (Exhibit A). Both Ocean Wind and Atlantic Shores have agreed to these measures in collaboration with the Coast Guard in	Subsequent to publication of the Draft EIS, Ocean Wind submitted an updated COP incorporating an array layout compression scenario analyzed under Alternative C-2, Wind Turbine Layout Modification to Establish a Buffer Between Ocean Wind 1 and Atlantic Shores South. This array layout compression scenario, depicted on Figure 2-9 of the Draft EIS, would modify the WTG array layout by compressing the WTG array layout to create a minimum 0.81-nm buffer between each project's WTGs. The Final EIS notes that a joint letter has been signed by Ocean Wind and Atlantic Shores Offshore Wind, LLC for this compressed array layout scenario. The impacts of Alternative C-2 on navigation and vessel traffic are analyzed in Section 3.16 of the Final EIS.

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the interest of facilitating navigation safety and effective search and rescue. Alternative C-2 would significantly enhance navigational safety by providing vessel traffic a clear and consistent buffer between the two lease areas.	
1.2 Aircraft Detection Lighting Systems; The DEIS includes a discussion of aircraft detection lighting systems ("ADLS") in relation to cultural resources, demographics, employment, and economics, land use and coastal infrastructure, recreation and tourism, and scenic and visual resources. ADLS is a mitigation measure used to reduce the impacts of nighttime WTG lighting on nearby communities by only activating certain lights when aircraft is detected approaching a wind farm. Ocean Wind appreciates that the duration of ADLS activation (less than 1 percent of the normal operating time of the WTGs) appears to have been considered in the impact analysis. However, there are inconsistencies within the DEIS, as to how ADLS is assessed as detailed below: Page 3.11-20 of the DEIS states "Such a system may reduce the amount of time that the lights are on, thereby potentially minimizing the visibility of the WTGs from shore and related effects on the local economy." Ocean Wind disagrees that ADLS 'may' reduce the amount of time the lights are on and asserts that ADLS 'will' reduce the amount of time that the lights are on and 'will' minimize the visibility of WTGs from shore.	Phrasing of "Such a system may reduce the amount of time that the lights are on, thereby potentially minimizing the visibility of the WTGs from shore and related effects on the local economy" on page 3.11-21 of the EIS has been updated to reflect "will" rather than "may."
Page 3.20-17 of the DEIS also states "It is anticipated that the reduced time of FAA hazard lighting resulting from an implemented ADLS would reduce the duration of potential impacts of nighttime aviation lighting to less than 1 percent of the normal operating time that would occur without using ADLS, although ADLS would have major impacts on viewers when activated". However, the duration of impacts with the implementation of ADLS could be characterized as fleeting, as shown in the ADLS simulation on BOEM's website. [Footnote 14: [Embedded Hyperlink Text (https://www.boem.gov/nighttime-aircraft-detection-lighting-system-adls-simulation)]] ADLS activates when an aircraft flies within three nautical miles of the wind facility area at an altitude of less than 2,000 feet. According to the simulation, when a jet flying at 1,900 feet approaches and flies over the wind farm, the lights are on for less than 6 minutes. This suggests that it would likely be missed by most viewers and would not last long enough to result in visual distraction (similar to passing ships, buoys, air traffic, etc).	Viewers' perception is variable, ranging from high to low acuity and awareness of the visual environment. The most conservative case in NEPA analyses considers those viewers with a high level of acuity and likelihood of project awareness. Although, when lit, the nighttime impacts of FAA navigation lighting would fall within BOEM's major impact definition, BOEM has concluded that the limited timeframe of ADLS-activated lighting would reduce the impacts from major to negligible. Moonlit nighttime views would increase the impacts from negligible to minor. This has been clarified in Section 3.20.3 and Section 3.20.5 of the Final EIS, and the impact level for KOP-13 (Atlantic City Beachfront – Nighttime) has been revised from major to minor in Table 3.20-12, Table 3.20-14, and in multiple tables in Appendix M.

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Appendix M of the DEIS states "ADLS would reduce nighttime impacts levels from major to moderate or moderate to minor, due to substantially limited hours of lighting." Ocean Wind is committed to the use of ADLS to minimize impacts of nighttime lighting on nearby communities and recommends that the FEIS address ADLS as reducing nighttime lighting impacts to negligible, since impact duration should be an important factor in the characterization of impacts.	
1.3 Air Quality; Appendix G on page 3.4-2, of the DEIS states that "The activities for which BOEM has authority are outside of any nonattainment or maintenance area and therefore not subject to the requirement to show conformity." Although the offshore components of the Project technically are not located in a nonattainment or maintenance area, 40 CFR Part 55 requires that the Project follow requirements for the [Italics: corresponding onshore area] ("COA"), which in the case of the Project, is New Jersey (which is a designated nonattainment area). As such, the Project must comply with nonattainment new source review ("NNSR") and is subject to requirements such as lowest achievable emission rates ("LAER") and emissions offsets. Per 40 CFR 93.153, General Conformity may apply to emissions which are not covered under the OCS air permit, such as transit emissions outside the 25-nm radius OCS air permit circle, emissions from vessels while in port, or other onshore construction emissions. Some of these emissions may occur in nonattainment or maintenance areas or in offshore areas that are treated as nonattainment or maintenance areas. Ocean Wind suggests that BOEM include a basis in the FEIS for the statement that General Conformity will not apply to the Project or provide an analysis to determine if applicable emissions exceed General Conformity de minimis thresholds.	The activities for which BOEM has authority are outside of any nonattainment or maintenance area and therefore not subject to the requirement to show conformity.
1.4 Bats; Appendix H of the DEIS as well as in the Ocean Wind Offshore Wind Farm Biological Assessment for the United States Fish and Wildlife Service, Table 2-2 ("USFWS") includes Applicant Proposed Measure ("APM") BAT-01 which states that "Onshore, the Project will avoid potential impacts by conducting tree clearing during the winter months, to the extent practicable" and APM BAT-02 which states "If tree clearing is required in areas with trees suitable for bat roosting during the period when northern long-eared bats may be present, develop avoidance and minimization measures in coordination with USFWS and NJDEP and conduct pre-construction habitat surveys."	BOEM acknowledges that Ocean Wind recently conducted acoustic bat surveys in potential northern long-eared bat habitat where tree clearing may occur during roosting periods. The results of the survey indicate that there is probable absence of northern long-eared bat in the locations were tree clearing may occur. BOEM notes that the survey locations in potentially suitable habitat were along Ocean Wind's preferred Oyster Creek onshore export cable route (i.e., the Holtec Route). Should Ocean Wind elect to construct an onshore export cable route option other than the Holtec route, Ocean Wind will coordinate with USFWS to develop conservation

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The Project may require tree clearing during the non-winter periods and as such, the Project is conducting pre-construction acoustic monitoring in areas where tree clearing may be necessary (at the onshore substations and along the onshore cable routes) to determine if northern long-eared bat and Indiana bat are present. If northern long-eared bat or Indiana bat are detected, Ocean Wind will develop avoidance and minimization measures in coordination with USFWS and NJDEP.	measures to be implemented to avoid take of northern long-eared bats. Measures may include conducting all tree clearing between October 1 and March 31, acoustic surveys, and habitat assessments.
1.5 Benthic Habitat; With regard to potential impacts on benthic habitat mentioned in the DEIS, Ocean Wind urges BOEM and the cooperating agencies to: Include in the FEIS site-specific data and characterization of the sand ridges conducted during summer 2022 that suggest impacts to troughs may be less than anticipated in the DEIS because the troughs in the Lease Area may contain coarser grain sediments than generalized reports predict; Reconsider proposed mitigation through micrositing and inter-array cable placement, especially as new cable placement would frustrate the purpose and need to deliver power to New Jersey by late 2024 and result in 30 kilometers of new cable, expanding impacts in other areas; and; Avoid using geophysical backscatter returns as a proxy for micrositing decisions, given the nuances in how data is normalized.	The vast majority of the impacts on habitats would be on soft bottom, with a small portion of impacts on complex (inclusive of coarse) habitats. Except for SAV habitat, the composition of benthic habitats in potential permanent and temporary impact footprints was similar to the composition in the Project area, indicating little difference among alternatives with respect to overall composition of benthic habitats affected by the Project. The Draft EIS reported the same number of acres of permanent/temporary impacts on complex habitats for the Proposed Action and Alternative D; new surveys and calculations (October 2022) indicate similar acres of impacts on complex habitats under Alternative A. Backscatter data are widely recognized as a valid tool in evaluating benthic habitats. BOEM will consider how they will be used in mitigation measures.
Ocean Wind respectfully requests that the FEIS incorporate site-specific data and characterization of the sand ridges from sampling conducted during summer 2022 as the Project believes the current characterization does not accurately represent the Lease Area. A description of the Offshore Project Area on page 3.6-3 of the DEIS states: “Troughs are characterized by finer sediments and higher organic matter, while ridges are characterized by relatively coarser sediments. Differences in benthic invertebrate assemblages, likely driven by differences in sediment characteristics, have been observed that include increased diversity and biomass within troughs (Rutecki at al. 2014).” The DEIS also states on page 3.6-27 that “These characteristics subsequently influence infauna and meiofaunal assemblages, which subsequently may influence assemblages of higher trophic-level fish and shellfish. These features aid in trophic interactions, linking planktonic communities and higher-level predators.” Ocean Wind notes that additional site-specific sampling	Text was expanded in Section 3.6.1 to include: “A 2022 survey (Inspire 2022a) of the ridge and trough habitats in the northeastern portion of the Lease Area also indicated physical and biological differences between the crests (ridges) and troughs of these habitats; however, compared to the regional study, ridge crests were more homogeneous than troughs, and the sediments on the crests were primarily fine to medium sands compared with troughs that exhibited greater variation in sediments, ranging from very fine sand to sandy gravel.” The following text was added to Section 3.6.5: “In the Mid-Atlantic Bight, infaunal assemblages and productivity differ between ridges and troughs (Byrnes et al. 2000; Slacum et al. 2010); for example, sand dollars were found to be more prevalent on shoal crests than in troughs (VIMS 2000). Similarly, the average numbers of sand dollars were distinctly higher on crests in a site-specific study of the

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was conducted within the sand ridge area during the summer of 2022. In August 2022, data results and a complete description of the resources in this area will be provided in an updated Benthic Habitat Mapping and Benthic Assessment to Support Essential Fish Habitat ("EFH") Consultation report. Preliminary data results indicate that the crests of the ridges are composed of fine to medium sand while coarser sands with shell fragments and hash are found within the troughs. Survey data collected in-situ for the explicit purpose of characterization of the sand ridges at the Ocean Wind Lease site differ, in fact are opposite, of that cited in the DEIS. The DEIS cites a reference report that provides generalized descriptions of sand ridges on the Atlantic and Gulf Coasts outer continental shelfs. [Footnote 15: Rutecki D, Dellapenna T, Nestler E, Scharf F, Rooker J, Glass C, Pembroke A. 2014. Understanding the habitat value and function of shoals and shoal complexes to fish and fisheries on the Atlantic and Gulf of Mexico outer continental shelf. Literature synthesis and gap analysis. Herndon (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. Contract # M12PS00009. BOEM 2015-012. 176 pp.] The site-specific data and characterization of the sand ridges in the Ocean Wind Lease site to be provided in the updated report in August 2022 will provide BOEM with the opportunity to update the characterization of the sand ridges provided in the DEIS and associated documents.	Lease Area (Inspire 2022). In addition, the trough portions (or flat bottom) of the habitat generally have greater abundance, species richness, and species diversity, as well as greater abundance of benthic finfish, pelagic finfish, and pelagic invertebrates than ridges (or shoals); ridges with steeper elevation gradients had greater abundance than those with more gradual elevation changes (Slacum et al. 2010)."
The first proposed mitigation listed within Section 3.6.9 (page 3.6-30) of the DEIS states: "Minimize adverse impacts on sand ridge and trough habitat features by micro siting the placement of two WTGs (D06 and E05) out of the sand ridge or trough centerline buffer areas. The buffer area extends 500 feet on both sides of the centerline of each ridge and trough. Micro siting would reduce benthic impacts on the most unique and spatially limited components of the ridge and trough features. While this would provide an incremental reduction of impacts on sensitive habitats, it would not reduce the impact rating for any of the Proposed Action's IPFs." It is a not clear from the data Ocean Wind has collected why WTGs D06 and E05 have been identified as being within the particularly "unique and spatially limited components" of the sand ridge area of the Ocean Wind lease site. The DEIS text refers to the sand ridge area as sensitive habitat however, there is little to no evidence in the literature that supports this statement, nor is there any reported	WTGs D06 and E05 are at the western edge of the steeper portions of the ridge and trough habitats in the Lease Area and directly adjacent to the 15 WTGs proposed to be removed under Alternative D. The two WTG locations are soft-bottom habitat, which is the dominant habitat type in the region. Micrositing WTGs to these locations (based on low backscatter) would reduce the extent of construction impacts on complex habitat. Literature supporting the sensitive nature of the habitat is briefly summarized in the previous NMFS finfish/benthic responses (and added to Section 3.6.5 of the Final EIS): "In the Mid-Atlantic Bight, infaunal assemblages and productivity differ between ridges and troughs (Byrnes et al. 2000; Slacum et al. 2010); for example, sand dollars were found to be more prevalent on shoal crests than in troughs (VIMS 2000). Similarly, the average numbers of sand dollars were distinctly higher on crests in a site-specific study of the Lease Area (Inspire 2022). In addition, the trough portions (or flat

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evidence to indicate that these features would be significantly impacted by construction of WTGs and installation of inter-array cables.	bottom) of the habitat generally have greater abundance, species richness, and species diversity, as well as greater abundance of benthic finfish, pelagic finfish, and pelagic invertebrates than ridges (or shoals); ridges with steeper elevation gradients had greater abundance than those with more gradual elevation changes (Slacum et al. 2010)... Therefore, impacts on ridge and trough habitats may be greater in the northeastern portion of the Lease Area.”
Additional proposed mitigation (inter-array cable placement) includes minimizing perpendicular crossings of sand ridge and trough areas by inter-array cables, in which an additional 30 kilometers of cable would be required, which would require additional surveys that would result in at least a two-year delay. This delay would result from the need for additional geophysical surveys, archaeological assessment, and potential unexploded ordnance (“UXO”) inspection prior to any ground-disturbing activities. As stated under Sections 1.1.1 and 1.1.2, alternatives or measures that result in delays of two years to the schedule prevent the Project from meeting the stated purpose and need to deliver offshore wind energy to the transmission grid beginning in 2024.	Comment noted.
The final proposed mitigation measure for impacts on benthic resources as described in Section 3.6.9 (page 3.6-30) recommends that WTG positions should be microsited to avoid areas with high geophysical backscatter returns. Ocean Wind notes that this recommendation is problematic and should not be carried forward as a proposed mitigation measure for the following reasons; Multibeam backscatter collects data on the relative seafloor hardness and surficial sediment characteristics, however before the collected data are incorporated into a mosaic image, the data are normalized to account for slight differences in the off- nadir angle while maintaining changes in the backscatter amplitude that indicate differences in the morphology of the seafloor. The resulting data product is then normalized to maximize the differences in data, however slight those may be. For areas containing both soft sediments as well as rocky outcroppings, these differences are both visually stark in their contrast of the mosaic image and physically stark in their habitat characteristics. However, this is not the case within the Ocean Wind Lease Area. Benthic habitat surveys including benthic grabs as well as SPI-PV imagery show that the relatively “high” backscatter areas are	Comment noted. Backscatter data are widely recognized as a valid tool in evaluating benthic habitats. BOEM will consider how they will be used in mitigation measures.

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typically shell hash and/or coarser grained materials with limited gravelly sand composed of washed pebbles/granules in ripple troughs. [Footnote 16: INSPIRE Environmental. 2020. Sediment Profile and Plan View Imaging Benthic Assessment Survey in Support of the Ocean Wind Offshore Wind Farm Site Assessment Data Report. Prepared for Fugro USA Marine, Houston, TX and Ocean Wind. Submitted by INSPIRE Environmental, Newport, RI. January 24, 2020; INSPIRE Environmental. 2021. Ocean Wind Offshore Wind Farm Benthic Habitat Mapping and Benthic Assessment to Support Essential Fish Habitat Consultation. Prepared for HDR Engineering. Submitted by INSPIRE Environmental, Newport, RI. June 28, 2021] Seafloor disturbance activities related to the construction, operation, and decommissioning of the Project are not expected to affect these benthic habitats in a manner that significantly differs compared to areas of low backscatter, which are typically characterized as fine to medium sands. Micrositing WTG locations based on backscatter would be overly restrictive and minimally protective given the nature of these areas within the Ocean Wind lease site. The Ocean Wind lease site has been well designed by BOEM to avoid complex habitats and minimize disturbances to biologically sensitive resources.	
In addition to the limited value that micrositing would provide, relocating a WTG requires a significant investment in additional geophysical and geotechnical sampling, marine archaeological analysis, engineering design, and logistical accommodation. A relocation based on backscatter may place a WTG in an alternatively sensitive area (e.g., archaeological concerns), potentially impacting resources of concern that would require subsequent consultations and mitigations. Additionally, there are significant lead times necessary to secure geophysical and geotechnical vessels, in addition to the multiple months needed to process and finalize the data. These geotechnical data are then used to inform engineering design and installation. Therefore, a micrositing decision could result in delays of years for the installation of a WTG. Given the physical and biological attributes of the seafloor, which have been well-characterized by geophysical and ground-truth sampling, micrositing WTGs for mitigation is not warranted given that these actions would offer little resource protection and result in potentially significant delays and costs. As stated under Sections 1.1.1 and 1.1.2, alternatives or measures that result in delays of two years to	Comment noted.

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the schedule prevent the Project from meeting the stated purpose and need to deliver offshore wind energy to the transmission grid beginning in 2024.	
1.6 Birds; Appendix H, Table H-2 includes a BOEM-proposed Bird and Bat Mitigation Measures (#2) that states “Install bird deterrent devices to minimize bird attraction to operating turbines and on the OSS, where appropriate and where Ocean Wind determines such devices can be safely deployed”. Consistent with industry best practice, Ocean Wind will install bird perching deterrent devices (e.g., spikes or similar) in areas where perching may create a health and safety risk for workers and where such devices can be safely deployed. Ocean Wind is not considering other methods of deterrence, such as visual, auditory, or frightening device systems at this time because they are highly susceptible to habituation by birds, do not have well established efficacy, and are impractical for deployment offshore. [Footnote 17: BOMEL Ltd/John Burt Associates Ltd. 2000. Bird guano accumulations and their effect on offshore helicopter operations. Prepared on behalf of BOMEL Consortium for the Health and Safety Executive. Offshore Technology Report No. 2000/131. Available online: [Embedded Hyperlink Text (https://www.hse.gov.uk/research/otopdf/2000/oto00131.pdf)]; Seamans, T.W. and A. Gosser. 2016. Bird dispersal techniques. Wildlife Damage Management Technical Series. USDA, APHIS, WS National Wildlife Research Center. Ft. Collins, Colorado. Available online: [Embedded Hyperlink Text (https://www.aphis.usda.gov/wildlife_damage/reports/Wildlife%20Damage%20Management%20Technical%20Series/Bird-Dispersal-Techniques-WDM-Technical-Series.pdf)]; and Sulaiman, I. Babawuya, A., Adedipe, O., Salihu, B.A., Adeoti, M.O., and Saraki, Y. 2021. A review of bird pest repellent systems in farms. 1st International Business and Management Conferences, Wukari, Taraba State., 19-21 February 2020. Available online: [Embedded Hyperlink Text (https://www.researchgate.net/publication/355927809_A_Review_of_Bird_Pest_Repellent_Systems_in_Farms)]] Ocean Wind respectfully requests that BOEM clarify the wording of Bird and Bat Mitigation Measures #2 to specify “bird perching deterrent devices” or “anti-perching devices.”	BOEM has revised Bird and Bat Mitigation Measure #2 in Appendix H and EIS Section 3.7.8 to clarify the deterrent as a “perching” deterrent.

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1.7 Burial Depth; Ocean Wind fully supports BOEM's dismissal of the "Alternatives for cable construction methods and protection including burying the cable deeper and remote monitoring of cables", discussed in Table 2-3, in Section 2 of the DEIS. Cables will be buried, where possible, and Ocean Wind is committed to a target burial depth of 4 to 6 feet (1.2 meters ["m"] to 1.8 m) for offshore export cables and inter-array cables. Where burial is not possible, sufficient depth cannot be achieved, or protection is required due to cables crossing other cables or pipelines, additional armoring or other cable protection methods may be used. Cable protection methods may include rock placement, concrete mattresses, frond mattresses, rock bags, and seabed spacers. The maximum amount of cable protection needed is not expected to exceed 10 percent of the total cable length. Cable burial depth will be monitored throughout the life of the Project.	Comment noted.
The target burial depth is determined based on an assessment of seabed conditions integrated from geophysical and geotechnical surveys, seabed mobility, and the risk of interaction with external hazards such as fishing gear and vessel anchors as contained within the cable burial risk assessment ("CBRA"), while also considering other factors such as maintained navigational channels and thermal conductivity. Increasing the burial depth of a cable, increases the thermal insulation surrounding it (i.e., reduce the ability of the soil to dissipate the heat away from the cable). This in turn, can lead to the cable overheating with the only mitigating factor to reduce the current (amps) that can be passed through the cable. Changes in burial depth from 3 feet to 10 feet show the largest reduction in current carrying capability, therefore mandated burial depths greater than what are necessary based on the assessment described above, will jeopardize the Project's ability to meet its required energy output and purpose and need. Ultimately, the final burial depth will be based on a post-COP approval, Cable Burial Plan to be reviewed and approved by the Certified Verification Agent ("CVA") and BOEM.	The text in Section 2.1.2.2.3 has been updated to include the identified feasibility concerns related to increased cable burial depth.
1.8 Cultural Resources, 1.8.1 Avoidance Buffers; Attachment A to Appendix N of the DEIS, page 4, states that "Ocean Wind will avoid potential shipwrecks and potentially significant debris fields previously identified during marine archaeological surveys by a [Italics: distance of no less than 300 meters from the known extent of the resource, unless the buffer would preclude the installation of facilities at their engineered	BOEM's approach for avoidance of potential shipwrecks and potentially significant debris fields previously identified in marine archaeological surveys specifies the 300-meter buffer or 100-meter buffer from the center of a detected anomaly (marine archaeological resource) when there are insufficient data to characterize the maximum extent of the magnetic signature and visibility.

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locations, but in no event would the buffer be less than 100 meters from the known extent of the resource].” Ocean Wind does not believe that the use of a 300-meter buffer is beneficial as the resources are defined by the maximum extent of their magnetic signature and maximum visible extent in the side scan sonar data. Ocean Wind proposes to avoid known or possible shipwrecks using a 50-meter avoidance buffer measured from maximum extent of the magnetic signature and visibility. Ocean Wind provides the following reference, as cited on page 114 of the Marine Archaeological Resources Assessment (“MARA”) (Appendix F-1 to Ocean Wind’s COP) in support of a 50-meter avoidance buffer. “A Minerals Management Service (precursor to BOEM) 2006 study assessed avoidance criteria for both known shipwrecks and potential shipwrecks represented by magnetic anomalies and acoustic contacts (Enright et al. 2006). The study considered survey trackline spacing, water depth, instrument layback and positional accuracy, contouring limitations, and the presence of magnetic anomalies versus acoustic contacts when assessing the effectiveness of avoidance buffers. Most importantly, the study determined that ‘avoidance from an anomaly’s margins virtually guarantees that its source is encompassed by the avoidance zone’ (Enright et al. 2006:144).” Furthermore, Ocean Wind notes that marine archaeologists have used a 50-meter avoidance buffer for decades for oil and gas projects developed under the Minerals Management Service. If any unknown resources are encountered, Ocean Wind will implement its Unanticipated Discoveries Plan to avoid and mitigate impacts to unknown resources. For the reasons listed above, Ocean Wind requests that BOEM consider the 50-meter buffer sufficient to protect shipwrecks and potentially significant debris fields and waive the requirement for a 100 and 300-meter buffers.	BOEM has reviewed the recommendations submitted in the revised Marine Archaeological Resource Assessment (COP Volume III, Appendix F-1, September 2022) prepared by Ocean Wind and finds the data provided are sufficient to justify 50-meter avoidance buffers measured from the maximum extent of the magnetic signature and visibility. This requested revision is reflected in the Final EIS.
1.8.2 Appendix H; Appendix H, Table H-2, of the DEIS, under “Other Agency-proposed Mitigation Measures”, #10 states that “No later than 90 calendar days after COP approval, the Lessee would contact the federally recognized tribal nations in government-to-government consultations with BOEM for the Project in order to solicit their interest in participating as active monitors on board vessels during construction and/or maintenance activities…”	BOEM will consult with tribes participating as Section 106 consulting parties to confirm tribal monitoring onboard vessels during construction and maintenance activities is a desired measure to support avoidance, minimization, and mitigation of adverse effects on ancient submerged landforms. All avoidance, minimization, and mitigation measures to resolve adverse effects are codified as stipulations in the Memorandum of Agreement and those stipulations, if included, will specify activities and areas to be

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Ocean Wind does not object to soliciting interest from federally recognized Tribal Nations in participating as active monitors onboard vessels during construction and/or maintenance activities. Additional information will be required from the interested federally recognized Tribal Nations to best accommodate any concerns or designate which activities are to be monitored.	monitored. In addition, processes for coordinating future submerged cultural resource monitoring activities with tribal monitors can be specified in Ocean Wind's Post-Review Discovery Plan for Submerged Archaeological Resources and in Ocean Wind's Treatment Plan for Ancient Submerged Landform Features.
Ocean Wind is committed to providing a safe working environment and strives to minimize and mitigate all potential hazards. The offshore working environment presents a unique set of circumstances and specialized training is required to ensure the safety and well-being of all persons present at the work site. As such, Ocean Wind's ability to grant requests for access to construction and/or maintenance vessels would depend upon a number of constraints, including Health, Safety, and Environment ("HSE") requirements, vessel berthing availability, and applicable insurance liabilities for Project owned vessels and/or contracted vessels. Furthermore, HSE requirements that apply to those aboard a construction and/or maintenance vessel would include, at minimum, Project-approved trainings for sea survival and a physical examination by a licensed physician. Additional trainings would be required for access to WTGs or to transfer onto the construction vessel itself. Any onboard monitors would also have to commit to the anticipated duration at sea for the vessel's activity (which can be up to 4 weeks) and be limited to the available berthings so as to not impact the availability to construction personnel.	Comment noted.
1.9 Fisheries; Page 3.9-43 of the DEIS states that "Some fishing vessel operators unwilling or unable to travel through or deploy fishing gear in the Wind Farm Area may be able to find suitable alternative fishing locations and continue to earn revenue, although it is difficult to predict the ability of fishing operations displaced by the Project to locate alternative fishing grounds that would allow them to maintain revenue targets while continuing to minimize costs, and some vessel operators may choose not to seek alternate fishing grounds." While each WTG structure itself does of course need to be avoided by vessel traffic, Ocean Wind believes there is sufficient room for nearly all commercial fishing vessels to transit safely through the Lease Area with only minor adjustments and course corrections. The statement above regarding fishing vessel operators being "unwilling" or "unable to travel	Many variables enter into the decision for commercial fishing vessels to enter the Wind Farm Area or navigate around the area. It is acknowledged that some vessels may be less affected; however, some would most likely choose not to enter the area. This section and paragraph present both scenarios for completeness and indicate that recreational fishing vessels, which are typically smaller, would likely be able to navigate the Wind Farm Area without issue.

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through" may wane as mariners and fishermen learn and adjust to the WTG layout, as has been the case at the Block Island Wind Farm and in Europe. Ocean Wind has taken action to ensure navigational safety throughout the Wind Farm. [Footnote 18: Smythe T, Bidwell D, Tyler G. 2021. Optimistic with reservations: The impacts of the United States' first offshore wind farm on the recreational fishing experience. Marine Policy, Volume 127, 104440. [Embedded Hyperlink Text (https://doi.org/10.1016/j.marpol.2021.104440)]] This includes an Ocean Wind specific full-mission navigation simulator at the Maritime Institute of Technology and Graduate Studies ("MITAGS"), which the Project has offered to commercial fishermen. The navigation simulator and other actions taken to ensure navigational safety are further described in Section 1.11 Navigation and Vessel Traffic.	
Additionally, Ocean Wind does not expect navigation through the Wind Farm Area to generate significant increases in fuel costs or time spent in transit. Furthermore, the Ocean Wind Lease Area has been well designed to avoid the areas of highest commercial fishing activity through the BOEM Planning and Analysis phase, which included input from commercial fisherman, thereby reducing impacts to the overwhelming majority of the commercial fisheries offshore of New Jersey. As such, Ocean Wind asserts the long-term impacts of the Project on commercial fisheries would be less than major on all commercial fisheries.	If a commercial fishing vessel chooses to navigate through the Wind Farm Area, there would likely not be a significant increase in operating costs. However, if a commercial fishing vessel chooses to navigate around the Wind Farm Area and find alternative fishing grounds, it is likely that operating costs would increase, which could thereby reduce the operator's overall revenue. While the Ocean Wind 1 Lease Area was designed to avoid certain commercial fishing activity, certain fisheries and fishing operations would still be affected and those impacts were determined to be long term and to range from minor to major.
Additional marine-based business and for-hire and recreational fishing industries are expected to see increases in revenue generated by additional vessel trips to the Lease Area, both for tourism as well as for increased fishing habitat generated by the WTG foundations. A recent study at the Block Island Windfarm has shown an increase in fish populations near the WTG locations. [Footnote 19: Wilber DH, Brown L, Griffin M, DeCelles GR, Carey DA. Demersal fish and invertebrate catches relative to construction and operation of North America's first offshore wind farm. ICES Journal of Marine Science, Volume 79, Issue 4, May 2022, Pages 1274– 1288, [Embedded Hyperlink Text: https://doi.org/10.1093/icesjms/fsac051)]] These beneficial effects are expected to translate to an increase in spending at marine-related businesses. Additionally, the DEIS does not attribute benefits from the artificial reef effect to commercial or for-hire fishing, even though many commercial or for-hire targeted species will benefit undoubtedly from	Minor beneficial impacts for certain commercial fisheries and for-hire recreational fishing operations due to the artificial reef effect have been included in Section 3.9.

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future artificial reefs. Two of the primary commercial fisheries that occur or are expected to occur within the lease are black sea bass and conch (whelk). As these are predominantly fixed-gear fisheries, the impacts of WTG foundations are expected to be beneficial to populations and gear interactions minimal. The FEIS should acknowledge anticipated benefits of the artificial reef effect.	
Further, New Jersey has a large artificial reef program intended, in part, to support the for-hire industry. The Project will augment that beneficial program. Fisherman will also benefit from the increased opportunities presented within the wind farm. This has been demonstrated at the Block Island Wind Farm, which has realized an increase in boating traffic and fishing activity since its installation. Finally, the DEIS recognizes that unmitigated climate change and the effects of fishing regulations will have a bigger impact than the Project on the potential adverse impacts on both fisheries and fisherman. The Project is part of the solution to minimizing the effects of a 'business as usual' climate change scenario.	Minor beneficial impacts for some for-hire recreational fishing operations due to the artificial reef effect have been included in Section 3.9.
For immediate impacts to commercial fishing gear, any direct losses will be mitigated by Ørsted's Fishing Gear Conflict Prevention Loss Compensation Program.	Compensation for gear loss is acknowledged within Section 3.9.4 of the EIS.
1.10 Marine Mammals; Page 3-15.34 of the DEIS states that "Activities associated with the Proposed Action that could cause underwater noise effects on marine mammals are impact pile driving (installation of WTGs and OSS [foundations]), vibratory pile driving (installation and removal of cofferdams at landfall sites), geophysical surveys (HRG surveys), detonations of UXO, vessel traffic, aircraft, cable laying or trenching, and dredging during construction and WTG operation. Decommissioning activities related to noise would likely be similar to those outlined for construction activities. Project construction activities could generate underwater noise and result in injury, behavioral disturbance, and masking effects on marine mammals. WTG operations have the potential to result in long-term behavioral disturbance and masking effects on marine mammals. Decommissioning activities related to noise would likely be similar to those outlined for construction activities." Data from existing farms in Europe and the U.S. indicate that WTG operations produce broadband low- frequency noise of low amplitude that is relatively localized.	Text related to the potential effect of operational wind turbines has been updated to reflect the analysis presented in Tougaard et al. 2020 and the constraints to the analysis conducted by Stöber and Thomsen 2021. As stated in Section 3.15, "Based on the currently available data, underwater noise from turbine operations from offshore wind activities (without the Proposed Action) are likely to reach ambient noise levels within relatively short distances of the foundations. It is unlikely operational noise would cause PTS or TTS in marine mammals but could cause behavioral and masking effects. at relatively short distances from the foundations (Miller and Potty 2017; Tougaard et al. 2009b, 2020). However, more acoustic research is warranted to characterize SPLs originating from large direct-drive turbines." Madsen et al. 2006 are already cited within the EIS.

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Ocean Wind concurs that there is a lack of data confirming these results for the proposed direct-drive GE Haliade-X 12-MW WTGs, but long-term behavioral impacts on marine mammals should not be necessarily inferred from the absence of information and we ask that BOEM revise the bolded sentence in the FEIS above to as these effects are highly unlikely. [Footnote 20: Evans, P. (2008). Offshore Wind Farms and Marine Mammals: Impacts and Methodologies for Assessing Impacts. Paper presented at European Cetacean Society's 21st Annual Conference, San Sebastian, Spain; HDR. 2019. Field Observations during Wind Turbine Operations at the Block Island Wind Farm, Rhode Island. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2019-028. 281pp; Madsen, P., Wahlberg, M., Tougaard, J., Lucke, K., & Tyack, P. (2006). Wind turbine underwater noise and marine mammals: implications of current knowledge and data needs. Marine Ecology Progress Series, 309, 279–295. [Embedded Hyperlink Text (https://doi.org/10.3354/meps309279)]; Mooney, T. A., Andersson, M. H., & Stanley, J. (2020). Acoustic Impacts of Offshore Wind Energy on Fishery Resources. Oceanography, 33(4), 14; Scheidat, M., Tougaard, J., Brasseur, S., Carstensen, J., van Polanen Petel, T., Teilmann, J., & Reijnders, P. (2011). Harbour porpoises (Phocoena phocoena) and wind farms: a case study in the Dutch North Sea. Environmental Research Letters, 6(2), 025102. [Embedded Hyperlink Text (https://doi.org/10.1088/1748-9326/6/2/025102)]; Wilhelmsson, D., Malm, T., Thompson, R., Tchou, J., Sarantakos, G., McCormick, N., Luitjens, S., Gullström, M., Patterson Edwards, J.K., Amir, O. and Dubi, A. (eds.) (2010). Greening Blue Energy: Identifying and managing the biodiversity risks and opportunities of off shore renewable energy. Gland, Switzerland: IUCN. 102pp.] These noise characteristics make injury, sustained behavioral disturbance, and/or masking highly unlikely. [Footnote 21: Bailey, H., Brookes, K. L., & Thompson, P. M. (2014). Assessing environmental impacts of offshore wind farms: lessons learned and recommendations for the future. Aquatic Biosystems, 10(1), 8. [Embedded Hyperlink Text (https://doi.org/10.1186/2046-9063-10-8)]; Madsen et al 2006, Tougaard, J. & Michaelsen, M. (2018). Effects of larger turbines for the offshore wind farm at Krieger's Flak, Sweden. Assessment of impact on marine mammals. Aarhus University, DCE –	

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Danish Centre for Environment and Energy, 112 pp. Scientific Report No. 286. [Embedded Hyperlink Text (http://dce2.au.dk/pub/SR286.pdf); Verfuss, U. K., Sparling, C. E., Arnot, C., Judd, A., & Coyle, M. (2016). Review of Offshore Wind Farm Impact Monitoring and Mitigation with Regard to Marine Mammals. In A. N. Popper & A. Hawkins (Eds.), The Effects of Noise on Aquatic Life II (pp. 1175–1182). [Embedded Hyperlink Text (https://doi.org/10.1007/978-1-4939-2981-8_147)].]	
Additionally, Ocean Wind respectfully disagrees that decommissioning activities related to noise would likely be similar to those outlined for construction activities. Based on available data and previous NMFS authorizations, decommissioning activities related to the removal of monopiles via cutting below the seabed will result in substantially lower noise levels and smaller ensonified zones than those associated with construction activities such as impact pile driving. [Footnote 22: Issued IHA for Fuel Pier Inboard Pile Removal Project at Naval Base Point Loma in San Diego Bay, California (2021): [Embedded Hyperlink Text (PointLoma_2021_final_IHA_OPR1.pdf (noaa.gov))]; and Federal Register notice for Pier Replacement Project at Naval Base Point Loma in San Diego Bay, California (2014): [Embedded Hyperlink Text (https://www.govinfo.gov/content/pkg/FR-2014-11-04/pdf/2014-26195.pdf)]] As one example, NMFS authorized the Navy in 2022 to remove piles with clippers, chainsaws, diamond saws, and vibratory hammers, all of which had reported Level A harassment zones of < 1 m and Level B harassment zones of < 600 m, as compared with 450 m/2,500 m Level A/B zones for installation of the same piles via impact piling. [Footnote 23: Naval Facilities Engineering Command Southwest (NAVFAC SW). 2020. Compendium of Underwater and Airborne Sound Data During Pile Installation and In-Water Demolition Activities in San Diego Bay, California. October 2020. Prepared by Tierra Data, Inc. Available at: [Embedded Hyperlink Text (https://s3.amazonaws.com/media.fisheries.noaa.gov/2020-12/NAVFAC%20SW%20%282020%29-NBPL_Acoustic%20Compendium_OPR1.pdf?null=)]] It is, however, a reasonable expectation that the noise generated by Project vessels during the decommissioning phase will be similar to vessel noise produced during the construction phase of the Project.	Final EIS text was revised to clarify that impacts from underwater noise from decommissioning activities will not exceed those outlined for construction and would likely be less than those presented for the Proposed Action during construction.
1.11 Navigation and Vessel Traffic; Section 3.16, Navigation and Vessel Traffic, states that information in the Section is drawn primarily from the project's Navigation Safety Risk Assessment ("NSRA"). Ocean Wind	Additional information about the NSRA contents and findings was incorporated into the second paragraph of Section 3.16 in the Final EIS.

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suggests that a fuller description of the NSRA be included in the FEIS so that readers are provided a more complete understanding of its relevance, highlighting that it: Conforms to the Coast Guard's comprehensive guidance on conducting such assessments (beyond a simple referral to the Coast Guard's NVIC 01-19), Estimates that the modeled increase in risk, with no mitigations applied, is 0.4 accidents per year, with three-fourths of that risk attributable to pleasure vessels, not commercial or fishing vessels. Finds the Project "poses very little risk" to navigation and vessel traffic. Finds no evidence that the Project would impact navigation and vessel traffic "to a degree beyond what is normally acceptable, including potential loss of vessels and life." Has been reviewed and accepted by the Coast Guard	
Ocean Wind further recommends that Section 3.16 in BOEM's consideration of the impact rating on the Project's effects on navigation and vessel traffic be considered in the context of the significant mitigations that will be implemented as permit conditions to facilitate navigation safety, including but not limited to: Enhanced marking, lighting, and sound signaling of all Project structures in accordance with recently issued guidance by both BOEM and the Coast Guard. Inclusion of Automatic Identification System ("AIS") signals and information on key structures. Real-time monitoring of the Project site to assist in searching for and locating mariners in distress. The Project's active full-mission simulator program hosted by MITAGS that provides a near-real- life experience of navigating within the Project area.	APMs were already considered in the analysis of impacts for the Proposed Action and other action alternatives. APMs NAV-03 and NAV-04 were specifically called out in the Draft EIS and specific reference to APMs GEN-07, NAV-01, and NAV-02 have been added to Section 3.16 of the Final EIS. Appendix H has no information about real-time monitoring of the Project site to assist in searching for and locating mariners in distress or information about the full-mission simulator program. It is unclear how the full-mission simulator program hosted by the Maritime Institute of Technology and Graduate Studies will directly influence/affect the navigation of vessels within the Project area.
In addition, it is noted that the Section describes "reasonably foreseeable environmental trends" as those actions that may, in BOEM's opinion, adversely impact navigation and vessel traffic. Ocean Wind believes further consideration should be made where reasonably foreseeable actions may have a positive impact on navigation and vessel traffic. For example:	Discussion of the Port Access Route Study has been added to Final EIS Appendix F (*Planned Activities Scenario*) and Final EIS Section 3.16.3.1. BOEM coordinated with USCG as a cooperating agency during development of the EIS and has reviewed and referenced the USCG Port Access Route Studies within the EIS. Impacts of the Proposed Action on navigation and vessel traffic are considered to be adverse. Planned development of offshore wind

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In section 3.16.1 (page 3.16-2), an assertion is made that “Existing lease areas…and recent lease sales…could contribute to increased vessel traffic…” Ocean Wind respectfully request that BOEM provide supporting information for this statement in light of the discussion included in the U.S. Coast Guard Port Access Route Studies, which recommend various routing measures to enhance navigation safety and safely guide vessel traffic in the proposed project area and beyond, as that these measures, which will likely be implemented, will have a positive impact on navigation and vessel traffic. In that same section (page 3.16-5) the DEIS discusses AIS vessel data from the NSRA, again making an assertion that “the NSRA data likely exclude most vessels less than 65 feet.” The DEIS then concludes that fishing vessel traffic in Table 3.16-1, which is not from the NSRA, is under- represented, suggesting the NSRA data/review is incomplete. But a holistic reading of the NSRA will show that all vessel traffic, combining both actual AIS transits and a conservative estimate of non-AIS transits, is included in all model calculations.	leases would add vessel traffic to the geographic analysis area during construction, O&M, and decommissioning of planned offshore wind projects that rely on vessels to facilitate these activities. The establishment of shipping safety fairways as defined in 33 CFR 166.105 would not negate the increased navigational complexity within lease areas where offshore wind development is planned. The NSRA makes a conservative estimate of non-AIS transits precisely because the AIS data under-represent this vessel population. The information shown in Table 3.16-1 is directly transferred from Table 2-2 of the NSRA. Because the information is from 1 year of AIS data, fishing vessel traffic is under-represented as described in the text immediately above the table. The transits added to AIS data for modeling are not included in this table. The added fishing vessel transits are discussed further down in the same section (3.16.1) within the *Ports, Harbors, and Navigation Channels* subsection where accident frequencies within the Lease Area are provided for the base case (case 0). Table 11-1 of the NSRA indicates the assumed number of commercial fishing vessel transits added into the base case for the modeling.
Lastly, Ocean Wind notes that in the FEIS for South Fork Wind Farm and South Fork Export Cable Project, August 2021, BOEM determined cumulative navigation and vessel traffic impacts would be moderate (page 2-24). It is for the reasons listed above that Ocean Wind requests BOEM reconsider its “major” impact rating for section 3.16 Navigation and Vessel Traffic for the proposed action and all subsequent potential alternatives.	The scale of the South Fork Wind Farm and South Fork Export Cable Project as discussed in the Final EIS for that project (August 2021) is significantly less than for the Ocean Wind 1 Project (15 versus 98 WTGs for Ocean Wind 1). Impacts of the Proposed Action on non-Project vessels would include changes in navigation routes, delays in ports, degraded communication and radar signals, and increased difficulty of offshore SAR or surveillance missions within the Wind Farm Area, all of which would increase navigational safety risks and the potential for marine accidents, which may result in injury, loss of life, property damage, and potential disruptions for other ocean users in the geographic analysis area. BOEM concluded and confirms that these impacts would be major because vessel traffic would experience unavoidable disruptions to a degree beyond what is normally acceptable, including potential loss of vessels and life.
1.12 Sea Turtle Monitoring; Ocean Wind notes that the “DRAFT Ocean Wind 1 Offshore Wind Farm Biological Assessment for National Marine Fisheries Service” dated June 2022 includes both pre- and post-	As noted in this comment, Ocean Wind’s APMs include post-construction passive acoustic monitoring. Section 3.19.4 notes that APMs are proposed in the Protected Species Mitigation and

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construction visual monitoring for sea turtles which was not included in the DEIS Appendix H. Ocean Wind has committed to post-construction passive acoustic monitoring in the Wind Farm Area. If required by NMFS, Ocean Wind will conduct sea turtle specific monitoring, which Ocean Wind suggests could be comprised of tagging and telemetry studies which are more informative on sea turtle behavior.	Monitoring Plan (COP Volume III, Appendix AA) and that Appendix H, Table H-1 provides a full list of the committed measures in greater detail.
1.13 Cable Protection; Ocean Wind notes that the DEIS includes conflicting recommendations related to the cable protection specifications. Section 3.6.9 of the DEIS includes the proposed mitigation measure: “Avoid the use of concrete mattress as cable protection (in all areas, but most critically within sand ridge/trough habitat features) to the extent possible; and minimize the installation of scour protection, especially within the sand ridge and trough habitat features”. However, DEIS Section 3.9.9 recommends that “cable protection measures should be trawl-friendly with tapered/sloped edges. Ocean Wind requests that BOEM confirm that both concrete mattresses and rock placement are suitable protection options where cable burial alone is not feasible or sufficient protection.	The proposed measures related to cable protection in Sections 3.6.9 and 3.9.9 were analyzed in the Draft EIS so that BOEM could choose to incorporate one or more of these additional mitigation measures in the preferred alternative.
1.14 Winter Flounder - Time of Year Restrictions; Page 3.13-38 of the DEIS states “Winter flounder time of year restriction. Avoid construction activities during winter flounder seasonal spawning activity from January 1 through May 31 of each year within Barnegat Bay. Winter flounders lay demersal, adhesive eggs on the bottom of Barnegat Bay, which can be crushed or destroyed via trenching and dredging. Additionally, winter flounder egg hatching success can be greatly reduced with as little as 2 to 3 millimeters of sediment via sedimentation. This stock is not making adequate rebuilding progress due to low productivity. Recruitment (i.e., survival of eggs to the juvenile and adult stages) has been declining despite low fishing mortality rates for the past 10 years. Therefore, it is important to minimize impacts on spawning success and egg/larval survival to rebuild this stock and achieve a sustainable commercial and recreational fishery for this stock.” Ocean Wind requests consideration to allow limited sediment-disturbing activities associated with cable installation during the winter flounder time of year restriction (January 1 through May 31). Ocean Wind has reviewed its planned construction and installation schedule and construction methodologies in an effort to limit sediment disturbing activities to the maximum extent practicable from January 1 through	BOEM coordinated with Ocean Wind regarding feasibility concerns related to winter flounder time-of-year restrictions, and Ocean Wind indicated that adherence to winter flounder time-of-year restrictions was feasible.

Comment	Response
June 30 to reduce impacts on both winter flounder eggs and anadromous fish. As a result of this review, Ocean Wind has revised its construction schedule to split cable installation activities into two separate seasons including: season 1 to occur from September 2023 to March 2024 and season 2 to occur from September 2024 to December 2024 for works within and adjacent to Barnegat Bay. As a result of this modification to the Ocean Wind construction schedule, the bulk of sediment disturbing activities in Barnegat Bay will occur from September through December in 2023 and 2024. The exception is in-water work associated with the Horizontal Directional Drill (HDD) operations for the landfall on the western side of Barnegat Bay which must be completed in the first season to enable cable installation to occur in the second season. Construction activities for which an exemption is being requested include dredging for the HDD exit pits and ultra-shallow areas needed to enable the HDD marine spread to access the HDD exit point, as well as all HDD operations, and ultimately the pull through of the conduit, within which the cable will be installed, upon completion of drilling. These activities would occur between December 2023 through the end of March 2024 within 2,000 feet of the shoreline. Ocean Wind has identified best management practices (“BMPs”) to avoid and minimize the impacts of these construction activities on winter flounder eggs. Potential BMPs under consideration for these works include the installation of silt curtains and/or a coffer dam surrounding the HDD exit pit during HDD operations. Additionally, during dredging for the HDD exit pits and ultra-shallow areas, a mechanical dredge fitted with a closed environmental bucket could be used to reduce turbidity and sediment resuspension. Finally, potential delays as a result of weather and equipment downtime may result in installation schedule overruns and/or delays in which flexibility would be necessary to enable Ocean Wind to complete the installation of the offshore export cable across Barnegat Bay, a critical element needed to allow the Project to meet the operational first power date in 2024.	
1.15 Vessel Speed; Ocean Wind has provided a Vessel Strike Avoidance Plan (revised June 2022) that differs from the Vessel speed restriction section on page 3.15-63 of the DEIS. The DEIS states “All vessels, regardless of size, would comply with a 10-knot speed	A more comprehensive description of the most current Vessel Strike Avoidance Plan has been added to the Final EIS.

Comment	Response
restriction in any Seasonal Management Areas, Dynamic Management Areas, or visually triggered Slow Zones." Ocean Wind is requesting that, when passive acoustic monitoring ("PAM") systems are operational as outlined by the Plan A of the Vessel Strike Avoidance Plan, all underway vessels (regardless of size) be permitted to travel at speeds greater than 10 knots in Dynamic Management Areas except when an active [Italics: action zone] is triggered by Ocean Wind's PAM network created by a localized North Atlantic right whale visual or acoustic detection. Ocean Wind's Vessel Strike Avoidance Plan (revised June 2022) does not address Slow Zones, however Ocean Wind has committed to an analogous, but more area-specific, action zone system as outlined above and described in-depth within the Vessel Strike Avoidance Plan.	
Additionally, Ocean Wind would like to clarify that it proposes to adhere to Plan A of the Vessel Strike Avoidance Plan. Ocean Wind would revert to Plan B only in situations where real-time marine mammal detection systems are not operational. Finally, Ocean Wind will comply with the Ship Strike Reduction Rule; as such, vessels 65 feet and greater will comply with the 10-knot speed restriction in Seasonal Management Areas.	Acknowledged. Compliance with the Ship Strike Reduction Rule has been included in the Final EIS. However, according to the Vessel Strike Avoidance Plan, there are no "real-time marine mammal detection systems" proposed for the Standard Plan (Plan A). Therefore, their being "offline" cannot cause a reversion to the Adaptive Plan (Plan B). It was made clear that the Adaptive Plan would only be employed if there is a risk to crew safety, and/or labor restrictions, vessel availability, costs to the project, or other unforeseen circumstances make the Standard Plan impracticable.
1.16 Visual Resources; Ocean Wind assessed several options for interconnection points, turbine layout, offshore and onshore substations, and export cable routes. These options were reviewed relative to the Project's purpose and need, schedule, and geographic requirements, as well as avoidance and minimization of potential impacts during construction, operation and maintenance, and decommissioning – including potential impacts to scenic and visual resources. Ocean Wind considered several turbine layouts and project boundary options within the confines of the Lease Area and selected a turbine layout a minimum 13 nm from shore to minimize visual impacts. Ocean Wind notes that while there are major visual impacts identified in the DEIS, the finding of major is limited to specific points within BOEM's analysis. Three Key Observation Points ("KOPs") are identified as having a major visual impact, including: KOP-13 Atlantic City Beachfront—Nighttime; KOP-31 Recreational Fishing, Pleasure, and Tour Boat Area; and KOP-32 Cruise Ship Shipping Lanes. Ocean Wind	Due to the ADLS limited time period, BOEM has reduced the previous major effect to a negligible effect. Moonlit nighttime views would increase the impacts from negligible to minor. Section 3.20 and Appendix M of the Final EIS have been updated to include this reduction in impact level from major to moderate.

Comment	Response
respectfully disagrees with the finding of major impact associated with these KOPs for the following reasons. With respect to KOP-13, Ocean Wind disagrees that the occasional lighting from the WTGs and offshore substations (equipped with ADLS) would have a major effect on the experience of someone enjoying the Atlantic City boardwalk or that the occasional lighting would cause a major character change to the boardwalk and its immediate surroundings or would have a dominant level of visual prominence within the boardwalk viewing area. The ambient light levels along the boardwalk (from large-screen advertising monitors, street-lights, and commercial lighting) are such that the additional lights from the Project are anticipated to not be noticeable. In addition, Appendix M of the DEIS states "ADLS would reduce nighttime impacts levels from major to moderate or moderate to minor, due to substantially limited hours of lighting." Since ADLS will be used, and the lights should be visible for less than 1 percent of the normal operating time without the use of ADLS, Ocean Wind believes the impact rating for the nighttime view from Atlantic City should be considered minor to moderate.	
Ocean Wind also notes that the visual effect of the WTGs would be variable depending on the distance from the observer; as such, the rating should indicate the effect would be negligible to major, depending upon viewer distance. In review of other offshore wind visual impact analyses ("VIAs"), the consensus of those VIAs is that under optimal viewing conditions, WTGs within 13± miles can be considered a high degree of visual impact; within 13 to 22± miles the impact can be considered moderate; within 22 to 30± miles the impact can be considered minor; and beyond 30 miles the impact is usually negligible. As such, Ocean Wind believes the impact ratings for these KOPs should be revised from major to moderate to address the variability of visual impact dependent on distance to a WTG. Based on the level of impact of all other KOPs, found in section 3.20 Scenic and Visual Resources of the DEIS, and with the request to reconsider the impact level of the three KOPs listed above, all impacts to scenic and visual resources would range from minor to moderate. It is for this reason, Ocean Wind respectfully requests that BOEM reconsider the minor to major alternative impacts rating for the proposed action and all alternative actions to minor to moderate.	KOP-31 and KOP-32 views range from less than 0.5 mile (0.8 kilometer) to greater than 39.6 miles (63.7 kilometers), based on boat and cruise ship heights, on the heretofore undeveloped ocean. At these distances and heights, consideration of horizontal and vertical FOVs, size, prominence, and contrasts (as described in EIS Appendix M) results in a designation of major effects at the view distances associated with KOP-31 (Commercial and Recreational Fishing and Tour Boat Area) and KOP-32 (Commercial and Cruise Ship Shipping Lanes). In addition, BOEM considers distance, noticeable elements, horizontal and vertical FOVs, visual contrasts, size, and prominence to determine the overall impact level (rather than distance alone) and confirms that the variability of effects for KOP-31 and KOP-32 would range from major to negligible and result in an overall impact on viewer experience of major as reported in Table M-12.

Comment	Response
2. Clarifications; Ocean Wind is providing the following clarifications on the DEIS: Page S-3, Figure S-1 and page 1-4, Figure 1-1, shows an outdated array cable layout in the wind farm area. Ocean Wind recommends this figure be updated in the FEIS to reflect the correct array cable layout to be consistent with the COP (i.e., COP Vol. I, Figure 4.1-2)	Figures S-1 and 1-1 have been updated to depict the correct inter-array cable layout.
Page 2-7, Figure 2-1 incorrectly shows the inshore cable routes on the bay side of Island Beach State Park. The export cable route is shown correctly in the DEIS and in Figure 3.22-2 (DEIS page 3.22-14). Ocean Wind recommends this figure be updated in the FEIS to reflect the correct export cable routes.	Figure 2-1 has been revised to correctly show the export cable routes.
Page 3.4-2 of the DEIS states that "Atlantic City and Repauno/Paulsboro also are in areas designated as maintenance for CO." Ocean Wind would like to clarify that the Atlantic City Area, Penns Grove Area, and Philadelphia-Camden County area were redesignated to maintenance on 02/05/1996. EPA policy provides that 20 years after an area is designated maintenance, the area reverts to nonattainment (see EPA letter to CALDOT dated March 21, 2018 and 73 Fed. Reg. 4434- 4435 [January 24, 2008]). Since it has been more than 20 years from the maintenance designation, these areas automatically reverted to normal attainment as of February 5, 2016.	The descriptions of county attainment status have been updated in the Final EIS.
Page 3.4-10, the DEIS states that "Preliminary results of air dispersion modeling of emissions conducted in support of the OCS air permitting are provided in Table 3.4-4 and Table 3.4-6". The Project would like to clarify that the information contained in tables 3.4-4 and 3.4-6 compares estimated Project emissions to the total inventory of emissions on a county level and is not related to air dispersion modeling conducted in support of the OCS permit application. However, results from the air dispersion modeling analysis were submitted to the U.S. Environmental Protection Agency (EPA) on July 18, 2022. Ocean Wind requests that the FEIS include reference to the submitted modeling results, which show compliance with applicable National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) allowable concentration increments	As the commenter notes, Ocean Wind performed NAAQS and Air Quality-Related Values analyses as part of its OCS air quality permit application to USEPA. A summary of these analyses has been added to the Final EIS.
Page 3.4-13 of the DEIS states "Emergency generators on the WTGs and the substations would operate only during emergencies or testing, so emissions from these sources would be small and transient." Ocean	The description of emergency and temporary backup generators has been corrected in the Final EIS.

Comment	Response
Wind would like to clarify that per Section 6.1.1.2.1 in the COP and Section 2.3.2 of the OCS permit application, the WTG design for Project does not include permanently installed diesel emergency generators at each WTG, rather a temporary backup diesel generator may be installed at the turbine during the commissioning phase until the grid connection is made. During the operations and maintenance phase, only the three offshore substations will be equipped with permanently installed emergency diesel generators	
Page 3.6-6 of the DEIS states "Sparse to moderate seagrass was identified near the proposed Peck Bay crossing during the 2019 aerial survey but additional characterization was not conducted. SAV does not appear at this location in historical imagery (NJDEP 1979)." The crossing at Peck Bay will be performed by HDD and therefore will have no expected impacts to SAV. This area has not been included in additional mapping or survey efforts as the cable will be installed underneath the habitat with no adverse impacts expected.	The Draft EIS (Section 3.22, *Wetlands*) includes a statement: "Impacts on tidal wetlands would be avoided and minimized by the proposed use of HDD at export cable landfalls and to cross waterbodies and the associated wetlands such as Oyster Creek and Crook Horn Creek/Peck Bay." The Draft EIS addresses Peck Bay crossing under Section 3.14.5, *Impacts of the Proposed Action on Land Use and Coastal Infrastructure*, and indicates HDD would be used under Peck Bay. The COP addresses Peck Bay crossing in greater detail (Appendix 1, Table 1): "Assessment of eastern black rail and saltmarsh suitable habitat…" The COP notes, "After making landfall in Ocean City, the BL England route would follow local roads west, cross Peck Bay at Roosevelt Boulevard Bridge, a currently undeveloped area, via trenchless technology methods, and then continue on existing county road right-of-way to the substation property…." HDD entrance and exit will occur outside of wetlands and will not affect wetlands or SAV. Appendix A, Figure 4 in the COP, notes: "Export cable route will pass under Crook Horn Creek to the south of Roosevelt Boulevard Bridge. Entry/Exit pits will be entirely within previously disturbed areas of the Roosevelt Boulevard right of way. Export cable will then be installed within the Roosevelt Boulevard right of way northwest to North Shore Road." Phase 2 SAV surveys were targeted to focus on areas where the routes are likely to cross back bay areas where SAV habitat is present and, therefore, were only conducted in Barnegat Bay.
Page 3.7-13 of the DEIS states "Bird collisions with turbines in the eastern United States is estimated at 6.86 birds per turbine per year (USFWS 2018). Based on this mortality rate, an estimated 20,210 birds could be killed annually from the 2,946 WTGs that would be added for offshore wind development. This represents a worst-case scenario and	BOEM agrees that the suggested edit provides further clarification on BOEM's conclusion that bird collisions with WTGs offshore would be anticipated to be lower than with WTGs onshore, given the much lower occurrence of birds in the offshore environment. Edits have been made in the Final EIS to provide this clarification.

Comment	Response
does not consider mitigating factors, such as landscape and weather patterns, or bird species that are expected to occur. Given that the relative density of birds in the OCS is low, relatively few birds are likely to encounter WTGs (see Figure 3.7-2).” Ocean Wind recommends that the last sentence be revised as follows (new text is in red): “Given that the relative density of birds in the OCS is low, relatively few birds are likely to encounter WTGs (see Figure 3.7-2) [Red: and annual per turbine mortalities are likely lower offshore than onshore].” Ocean Wind requests this change because onshore mortality estimates do not necessarily represent potential mortality offshore for the following reasons: offshore habitat is substantially different than onshore and supports different species groups; onshore mortality estimates are primarily songbirds and raptors, [Footnote 24: Allison TD, Diffendorfer JE, Baerwald EF, Beston JA, Drake D, Hale AM, Hein CD, Huso MM, Loss SR, Lovich JE, et al. 2019. Impacts to wildlife of wind energy siting and operation in the United States. Issues In Ecology. 21:24. [Embedded Hyperlink Text (https://www.esa.org/wp-content/uploads/2019/09/Issues-in-Ecology_Fall-2019.pdf)]] which only occur offshore during migration [Footnote 25: Brust V, Hüppop O. 2022. Underestimated scale of songbird offshore migration across the south-eastern North Sea during autumn. Journal of Ornithology. 163(1):51–60. doi:10.1007/s10336-021-01934-5. [Embedded Hyperlink Text (https://doi.org/10.1007/s10336-021-01934-5)].]; onshore mortality of songbirds are often dominated by relatively common breeding songbirds [Footnote 26: Erickson WP, Wolfe MM, Bay KJ, Johnson DH, Gehring JL. 2014. A Comprehensive Analysis of Small-Passerine Fatalities from Collision with Turbines at Wind Energy Facilities. PLOS one. 9(9):18. doi:10.1371/journal.pone.0107491. [Embedded Hyperlink Text (http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0107491)].]; raptor mortalities are dominated by soaring raptors, [Footnote 27: Hanssen F, May R, Nygård T. 2020. High-Resolution Modeling of Uplift Landscapes can Inform Micrositing of Wind Turbines for Soaring Raptors. Environmental Management. 66(3):319–332. doi:10.1007/s00267-020-01318-0.] which generally do not occur offshore [Footnote 28: Kerlinger P. 1985. Water-crossing behavior of raptors during migration. Wilson Bulletin. 97(1):109–113.]; and onshore mortality generally does not include any seabirds. [Footnote 29: Allison et al. 2019.] For these reasons, studies on bird mortality due to collisions with onshore and offshore wind turbines are evaluated separately.	

Comment	Response
[Footnote 30: Band W. 2012. Using a collision risk model to assess bird collision risk for offshore windfarms. SOSS-02. Report to The Crown Estate Commission, London UK. 62 pp. [Embedded Hyperlink Text (https://www.bto.org/sites/default/files/u28/downloads/Projects/Final_Report_SOSS02_ Band1ModelGuidance.pdf)]; Skov H, Heinanen S, Norman T, Ward RM, Mendez-Roldan S, Ellis I. 2018. ORJIP Bird Collision and Avoidance Study. Final Report - April 2018. Report by NIRAS and DHI to The Carbon Trust, U.K. 247 pp.]	
Page 3.10-13 of the DEIS states "However, the Project would encroach on the 50-meter avoidance buffers of two submerged archaeological resources in the BL England export cable route corridor." Ocean Wind is committed to avoiding any cultural resources to the extent practicable and through consultation under Section 106 of the National Historic Preservation Act ("NHPA") (Title 54 U.S.C. § 306108), Ocean Wind is working closely with all participants in this process across federal, state, and local governments, federally recognized tribes, as well as nongovernmental organizations or groups to minimize and/or mitigate any impacts to cultural resources where avoidance is not practicable. Ocean Wind would like to clarify that the Project will avoid construction related impacts within a 50-meter buffer around both target 13 and target 15, thereby avoiding any adverse impacts. This is reflected in the MARA.	BOEM has reviewed the recommendations submitted in the revised Marine Archaeological Resource Assessment (COP Volume III, Appendix F-1, September 2022) prepared by Ocean Wind and finds the data provided are sufficient to justify 50-meter avoidance buffers measured from the maximum extent of the magnetic signature. In addition, BOEM implemented the request to revise the Final EIS to specify the Project will avoid the 50-meter buffer around target 13 and target 15 to avoid impacts on those cultural resources under NEPA and adverse effects on those historic properties under Section 106. These revisions were implemented across Final EIS Section 3.10 and Appendix N, including the attached Memorandum of Agreement.
Page 3.16-17 of the DEIS states "Collision frequencies are also anticipated to increase (increase of 0.027 accident per year), which would be largely a result of the 23-percent increase in ship-miles due to vessels transiting around the Wind Farm Area." The NSRA does not suggest that the 23- percent increase in ship-miles is due to vessels transiting around the Wind Farm Area. The NSRA does not specify a precise cause of an increase in ship-miles, but a common reading of the entire relevant section of the NRSA (Section E.4) indicates that transits around the wind farm may contribute to additional ship miles, but so too do additional pleasure tour and recreational fishing vessels. It should be noted that the vessel traffic evaluated, and ship-miles calculated, relate to the entire NSRA study area, not the much smaller Project footprint. That distinction should be clarified in the FEIS	The NSRA modeled a Future Case (Case 2 and Case 3) that incorporated Project structures, traffic redistribution due to the Project, and any anticipated increases in traffic due to the Project (page E-19). The nature of the traffic redistribution is described in Section E.2.4 of the NSRA, *Traffic data*, in the subsection titled *Modification of traffic routes in the Future Case*. Modified traffic routes (specified in text and shown on Figures E-7 and E-9) are "deep draft ships were routed to the east of the Project Area and the adjacent wind farm lease area to the northeast" and that "tugs and tugs-with-tows are routed to the west of the Project Area and the adjacent wind farm lease area." In Section 11, *Collision, Allision, and Grounding Assessment* (page 131), the risk changes in the northwest sub-area shown on Figure 11-3 are "related to re-routing of deep draft and tug vessels around the lease areas." Section E.4.2 (comparing future Case 2 to Case 1, which uses unmodified Base Case traffic patterns plus including the Project structures) attributes

Comment	Response
	the increase in collision frequency to 23 percent more ship-miles in the geographic analysis area. Section E.5.1, Project risks difference: comparing Case 2 to Case 0 (no Project structures) also attributes the increase in collision frequencies to 23 percent more ship miles in the assumed Future Case. The EIS accurately reports this information, and no clarification is considered necessary.
Page 3.22-13, Section 3.22.8 Proposed Mitigation Measures - Ocean Wind would like to clarify that the Project is fully committed to providing mitigation for all permanent wetland impacts associated with the Project scope. As mentioned in Section 3.22.4.1, wetland mitigation options are being coordinated with the applicable state and federal agencies and may include wetland banking credits, onsite restoration, or a combination of these options.	Comment noted. BOEM understands that impacts on jurisdictional wetlands would need to comply with federal and state permitting and mitigation requirements.
Appendix H, Table H-1. The following APM was included in Ocean Wind's June 14, 2022 COP submittal to BOEM, but was not included in the DEIS. APM CUL-06 should be incorporated into the FEIS. "CUL-06: Develop an anchoring plan for vessels prior to construction to identify avoidance/no anchorage areas."	Appendix H, Table H-1 of the Final EIS was updated to include this APM.
Appendix N, Attachment A, pdf page 1256, 1258-1259 (of 1408) of the DEIS, show the Marine Archaeological Resources Area of Potential Effect ("APE"), which does not match the preliminary APE defined and shown in the COP (Volume II Figure 2.4-1 to 2.4-4) and the MARA. Ocean Wind recommends the DEIS figure be updated to reflect the expanded APE.	Marine archaeological resources APE figures were updated in the Final EIS to reflect the expanded analysis area in the in the approved COP.
The "DRAFT Ocean Wind 1 Offshore Wind Farm Biological Assessment for National Marine Fisheries Service" dated June 2022, includes the following text in Table 1-9 "Mitigation Monitoring, and Reporting Measures – Committed to be the Developer" No. 44 "Ramp-up will continue once the animal(s) has been observed exiting its respective clearance zone or until an additional time period has elapsed with no further sighting (i.e., 15 minutes for small odontocetes, 30 minutes for all other marine mammal species, and 60 minutes for sea turtles" Ocean Wind proposes 30 minutes for sea turtles, not 60 minutes. Ocean Wind notes the clarification email from BOEM dated 25 April 2022 which outlines clearance times for ESA-listed species.	Measure No. 43 (Ramp-up (soft start) for HRG surveys) in the NMFS BA (revised September 2022), previously identified as Measure No. 44 in the NMFS BA dated June 2022, states that, "Ramp-up will continue once the animal(s) has been observed exiting its respective clearance zone or until an additional time period has elapsed with no further sighting (i.e., 15 minutes for small odontocetes, 30 minutes for all other marine mammal species, and 30 minutes for sea turtles)."
The "DRAFT Ocean Wind 1 Offshore Wind Farm Biological Assessment for National Marine Fisheries Service" dated June 2022, includes the	Measure No. 26 (Shutdowns for impact pile driving) in the NMFS BA, revised September 2022, states that, "If a marine mammal or

Comment	Response
following text in Table 1-9 “Mitigation Monitoring, and Reporting Measures – Committed to be the Developer” No. 26: “If a marine mammal or sea turtle is sighted within the shutdown zones during a pause in piling, piling will be delayed until the animal(s) has moved outside the SZ and no marine mammals are sighted for a period of 30 minutes or sea turtles for 60 minutes”. Ocean Wind proposes 30 minutes for sea turtles, not 60 minutes, in line with BOEM’s recommendations for high-resolution geophysical (“HRG”) surveys and as noted in the clarification email from BOEM dated 25 April 2022.	sea turtle is sighted within the shutdown zones during a pause in piling, piling will be delayed until the animal(s) has moved outside the SZ and no marine mammals are sighted for a period of 30 minutes or sea turtles for 30 minutes.”
Page H-9 of the DEIS states that for marine mammals and sea turtles “Visual PSOs should begin surveying the monitoring zone at least 60 minutes prior to the start of pile driving.” However, the “DRAFT Ocean Wind 1 Offshore Wind Farm Biological Assessment for National Marine Fisheries Service” dated June 2022, includes the following text in Table 1-9 “Mitigation Monitoring, and Reporting Measures – Committed to be the Developer” No. 24 “Prior to the beginning of each pile driving event, PSOs and PAM operators will monitor for marine mammals and sea turtles for a minimum of 30 minutes and continue at all times during pile driving.” Ocean Wind has committed to a pre-start clearance duration of 30 minute for sea turtles in the Protected Species Mitigation and Monitoring Plan (“PSMMP”) and notes that the 60 minutes included in the DEIS should be revised to 30 minutes.	Draft EIS Appendix H, Table H-1, “Pre-start clearance for impact pile driving” (identified as Measure No. 24 in the June 2022 NMFS BA) states that, “Prior to the beginning of each pile driving event, PSOs and PAM operators will monitor for marine mammals and sea turtles for a minimum of 30 minutes and continue at all times during pile driving.”
Subsequent to our January 10, 2022, letter to you regarding a setback area—a minimum spacing distance at the common boundary between Lease Area OCS-A-0498 and Lease Area OCS-A-0499—the undersigned Lessees of the Lease Areas, Ocean Wind, LLC (OCW) and Atlantic Shores Offshore Wind, LLC (Atlantic Shores), respectively, have continued to have constructive conversations with the U.S. Coast Guard (Coast Guard) on this issue. The Cost Guard has proposed the following measures, as depicted in the attached graphic, Exhibit A: Adjust wind turbine generators (WTGs) in column A of the OCW array so that they align equidistant to column B at 1 nautical mile (nm) (indicated by letter “A” in Exhibit A). Maintain a minimum distance of 1,500 meters between column A of OCW and the westernmost column of Atlantic Shores (indicated by letter “B” in Exhibit A).	Alternative C-2 in the Draft EIS analyzes no surface occupancy along the northeastern boundary of the Ocean Wind 1 Lease Area to allow for a 0.81-nm to 1.08-nm buffer between the WTGs in the Ocean Wind 1 Lease Area and WTGs in the Atlantic Shores South Lease Area. Figure 2-9 of the EIS depicts the adjustment of the WTGs in column A of the array layout so that they align equidistant to column B at 1 nm.

Comment	Response
Microsite one Atlantic Shores WTG, so that it is at least 1,500 meters from the nearest OCW WTG (indicated by letter “C” in Exhibit A). Remove two Atlantic Shores WTGs, one within the setback area and one in front of the western entrance of the setback area (indicated by letter “D” in Exhibit A). Both OCW and Atlantic Shores agree to the Coast Guard’s setback area proposal in the interest of facilitating navigation safety and effective search and rescue. As requested in our January 2022 letter, we ask that BOEM provide us with written concurrence that the contemplated setback area described herein and in Exhibit A is acceptable for inclusion in the Draft Environmental Impact Statement for each respective project, and would otherwise provide the framework, as allowed under the National Environmental Policy Act review process, in order to allow each of OCW and Atlantic Shores to adequately plan for the construction, operations, and business case of our respective projects [See original comment for Exhibit A “Ocean Wind 1 Marine Traffic at Lease Boundary 1NM Row A to B” graphic.] Your prompt response to this request would be greatly appreciated.	

O.6. Responses to Other Agency, Stakeholder, and Public Comments on the Draft EIS

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O.6.1 Purpose and Need

Table O.6.1-1 Responses to Comments on the Purpose and Need

Comment No.	Comment	Response
0007-0008	Purpose and Need for Project: The DEIS should address changes that have occurred since the Programmatic EIS was prepared by BOEM in 2007. The purpose and need for the proposed project should be evaluated based on these changes. World peace has suffered due to a shortage of available energy supplies and its future security is threatened if energy can be used to influence war and peace decisions. The shortage of natural gas in Europe resulting from the war in Ukraine has led to the restarting of coal fired power plants in Germany France and the Netherlands with higher emissions of greenhouse gas emissions than previously when natural gas was used. The U.S. was recently energy independent due to the increased supply of natural gas. The increased use of natural gas in power generation replacing coal and oil has resulted in significant reductions in emissions of greenhouse gas emissions below 1990s levels. In addition as noted above there are other renewable carbon free technologies that have advanced since the Programmatic EIS was prepared including use of hydrogen as a fuel for transportation and power generation and anaerobic digestion of organics for power generation. So if the purpose and need of offshore wind is to provide needed power and to reduce greenhouse gas emissions that has already been done or started or is in the process of happening. That fact needs recognition in the DEIS.	The action analyzed in BOEM's *Programmatic EIS for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf* was the establishment of the Marine Minerals Management Service Alternative Energy and Alternate Use Program on the Federal Outer Continental Shelf. Changes to BOEM's renewable energy program are outside of the scope of this environmental review and would be analyzed through a separate process. Ocean Wind submitted a COP for Lease Area OCS-A 0498. BOEM's regulations require BOEM to analyze Ocean Wind's COP. As described in Section 1.2, *Purpose and Need for the Proposed Action*, of the Draft EIS, the purpose of BOEM's action is to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP.
0011-0001	BOEM begins its discussion of the purpose and need of the draft EIS as the need to follow the President's Executive Order 14008 "Tackling the Climate Crisis at Home and Abroad". As inferred by the Supreme Court in its decision West Virginia v. EPA the Executive Branch has no authority to regulate carbon dioxide without a law passed by Congress. As the purpose of the offshore wind project is to reduce carbon dioxide emissions the Executive Order is irrelevant and these comments should be removed from the DEIS	The purpose and need section of chapter 1 appropriately recognizes that Executive Order 14008 states one of the policies of the United States is to "spur[ ] well-paying union jobs and economic growth, especially through innovation, commercialization, and deployment of clean energy technologies and infrastructure." So, BOEM does not agree that the Executive Order is irrelevant. BOEM has authority under the OCSLA to authorize renewable energy activities on the OCS. The purpose of BOEM's action is

Comment No.	Comment	Response
		to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP. BOEM's decision on Ocean Wind's COP does not regulate sources of CO_2 emissions.
0984-0040	There are major changes in the project specifications since the publication of the draft EIS that alter the purpose and need. These major changes require a new public process inclusive of the new standards of removal of systemic racism contained in the actions previously used by BOEM and the applicant in the past.	BOEM issued a Technical Correction on July 22, 2022, regarding the updated Inshore Export Cable Route Option associated with the Bay Parkway Landfall. As noted in the Technical Correction, impacts resulting from cable emplacement and maintenance were not anticipated to change as a result of the update. On October 14, 2022, Ocean Wind submitted an updated COP, which included updates to the proposed Project. The updates to the COP do not alter BOEM's purpose and need. BOEM reviewed the updates and found that the changes to the Proposed Action relevant to environmental concerns are not substantial and do not require a supplemental EIS.
0984-0046	Atlantic Technical Resource The fact that BOEM refused to accept (Musical et al. 2016) scenario that the Industrial O?shore Wind lease sites will produce more energy than can be procured as unfeasible is a catalyst for misrepresentations. The self- serving job preserving actions by BOEM require the United States Attorney General to investigate the actions of this rouge federal agency that has already been sanctioned. It is important to note that Musical is the chairman of AWEA currently engaged in writing the standards for the United States O?shore Wind Industry. Any reasonable person (who has not been manipulated) would not discard his work as "unfeasible". The EO says there has to be a need. The applicant has failed to show a need that only exists to further their companies interest. There is no current need for additional electricity at a higher price than current clean energy and that creates more pollution and economic strife. The applicants EIS fails to meet the economic and environmental needs and should be denied any permits to proceed.	The 2016 Offshore Wind Energy Resource Assessment for the United States "refines and reaffirms that the available wind resource is sufficient for offshore wind to be a large-scale contributor to the nation's electric energy supply. Experience from other renewable technologies, such as land-based wind and solar energy, indicates that offshore wind site development will likely be highly selective. Therefore, the resource potential needs to significantly exceed the anticipated deployment to allow for siting flexibility. When developers and regulators have more siting options, projects can be built in the most economical and least conflicted

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		areas. Therefore, an abundant wind resource is one of the essential building blocks that compose the value proposition for offshore wind." New Jersey's demand for electricity generation from offshore wind continues to increase with OREC awards issued through the New Jersey BPU. OREC awards of 1,100 MW and 2,658 MW were issued in 2019 and 2021, respectively, to current lease holders. New OREC awards of at least 1,200 MW are anticipated to be awarded in 2023, 2025, and 2027. Governor Phil Murphy's Executive Order 307, signed in September 2022, increased the state's current goal of a 7,500 MW target to 11,000 MW by 2040, likely resulting in additional OREC awards.
0984-0047	Resource Potential BOEMs persisting model for self preservation by including a research set aside lease site is inconsistent with the EO. BOEM use of a set aside to validate the actions of lease sales is backwards. A set aside lease site should be developed first before any large commercial sites are sold and developed.	BOEM is actively studying the effects of small-scale wind facilities such as the Block Island Wind Farm and has completed a series of studies examining the impacts from the wind farm construction and early operation such as sound, scour, and artificial reef effects. The research was conducted as part of a BOEM-funded program called Realtime Opportunity for Development Environmental Observations. BOEM is actively incorporating study results from this program where relevant into the EIS and into the environmental and technical reviews of larger projects currently under review.
0984-0110	The purpose of the project is to develop an offshore wind generation project within the BOEM Lease Area to deliver competitively priced renewable energy and additional capacity to meet political state and regional renewable energy demands and goals. The project will not meet the competitiveness pricing	BOEM's purpose—as stated in Section 1.2 of the Final EIS is to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP—is

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	requirements without major public and ratepayer financial support and thus should be discontinued immediately. The political nature of the project should be seen a destructive and not maintainable. A investigation should be conducted on the money "lobbying" to get this project this far already.	needed to fulfill BOEM's duties under the lease. The 1,100-MW solicitation and a corresponding OREC allowance of 4,851,489 MW-hours per year were awarded to Ocean Wind via BPU on June 21, 2019. A copy of the OREC award, which includes information regarding OREC prices and ratepayer impacts, is available at: https://www.njcleanenergy.com/files/file/6-21-19-8D.PDF.
1012-0003	[Bold: The draft environmental impact statement (DEIS) Comments - Summary]1. [Bold: Its purpose and need] statements are misleading inconsistent with the current Administration's NEPA policy and rulemaking of April 20 2002 and make no sense.It is misleading in that it states climate change as a broad objective when it fact the project will have no discernable effect on that based on BOEM's own conclusions in Appendix A of the Vineyard Wind EIS and the sea level rise analysis presented in our comments on the Notice of Intent (NOI) that showed the only effect on future sea level rise was a delay on the order of days. Therefore reference to climate change benefit should be deleted.The purpose and need statement is based only on the applicant's application and therefore relies on National Environmental Policy Act (NEPA) rule provisions from the previous administration which have been explicitly removed and/or changed by the Biden administration in its rulemaking of April 20 2022.In removing that part related to the applicant's objectives the Council on Environmental Quality (CEQ) expressed concern that that provision could be interpreted to unduly constrain the discretion of agencies leading to the development of unreasonably narrow purpose and need statements which was inconsistent with many court decisions including several it cited. Yet that is exactly what the BOEM has done in this DEIS.	Executive Order 14008, Tackling the Climate Crisis at Home and Abroad, Sec. 207, Renewable Energy on Public Lands and in Offshore Waters, states that the "Secretary of the Interior shall review siting and permitting processes on public lands and in offshore waters to identify to the Task Force steps that can be taken, consistent with applicable law, to increase renewable energy production on those lands and in those waters, with the goal of doubling offshore wind by 2030 while ensuring robust protection for our lands, waters, and biodiversity and creating good jobs." BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Renewable Energy Lease Number OCS-A 0498. The purpose and need statement in the EIS reflects BOEM's requirement under those regulations. Section 1.2 of the EIS states that the purpose of BOEM's action is to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP and that BOEM's action is needed to fulfill BOEM's duties under the lease.

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		Consideration of Ocean Wind's goals is one of several factors on which BOEM's purpose and need is based. CEQ acknowledged in the 2022 rulemaking (87 *Federal Register* 23453) that, "Consistent with longstanding practice and to ensure informed decision making, agencies should have discretion to base the purpose and need for their actions on a variety of factors, which include the goals of the applicant, but not to the exclusion of other factors." BOEM does not believe that its purpose and need is too narrow.
1012-0018	[Bold: B. The Applicant's Purpose.]The alternatives to be presented in an EIS must obviously be tied to the purpose of the proposed federal action. The only clear purpose and need mentioned is that of the applicant's whose obvious need is to have their application approved. But this is a federally approved project a federally prepared EIS and the federal government must have its own purpose and need here. That federal purpose in the broad sense is to implement a fiscally and environmentally sound offshore wind program which may or may not coincide with the applicant's need which is rooted in financial gain. The DEIS describes some broad substantive national objectives such as addressing climate change environmental justice and air quality problems Although the degree to which this proposed action addresses those can be questioned they are at least plausible objectives to be examined and the EIS does not establish a connection between this proposed project and those goals. It says that the purpose of BOEM's actions is to determine whether to approve disapprove or approve with modifications the applicant's COP but that is an action not a purpose. This is also contrary to current Administrations NEPA policy and rules. The BOEM continues to exploit the rule language put in place by the previous administration that considered the goals of the applicant in determining purpose and need. But the current administration removed that in its rulemaking of April 20 2022. Yet the BOEM persists to try to exploit that deleted provision. In removing that part related to the applicant's objectives the CEQ expressed concern that that provision could be interpreted to unduly constrain the discretion of agencies leading to the development of unreasonably narrow purpose and need statements which was inconsistent with many court decisions. It cited a decision where the Court found that it would be contrary to NEPA for	BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Renewable Energy Lease Number OCS-A 0498. The purpose and need statement in the EIS reflects BOEM's requirement under those regulations. Section 1.2 of the EIS states that the purpose of BOEM's action is to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP and that BOEM's action is needed to fulfill BOEM's duties under the lease. Consideration of Ocean Wind's goals is one of several factors on which BOEM's purpose and need is based. CEQ acknowledged in the 2022 rulemaking (87 *Federal Register* 23453) that, "Consistent with longstanding practice and to ensure informed decision making, agencies should have discretion to base the purpose and need for their actions on a variety of factors, which include the goals of the applicant, but not to the exclusion of other factors." BOEM does not believe that its

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	agencies to "contrive a purpose so slender as to define competing reasonable alternatives out of consideration or even existence and that constricting the definition of the project purpose could exclude truly reasonable alternatives making the EIS incompatible with NEPA requirements. But that is exactly what the BOEM has done here. It has excluded all truly reasonable alternatives from NEPA review and has contrived a purpose and need so narrow that in fact there is no option left as explained below. but to approve the project as proposed by the applicant Now the purpose and need in the CEQ NEPA rule Section 1502.13 simply states that the statement shall briefly specify the underlying purpose and need to which the agency is responding and proposing the alternatives including the proposed action. In BOEM's desire to limit the range of alternatives in these EIS's it engages in double talk. The current statement in the DEIS that the federal purpose is only to approve or disapprove an application makes no sense. It's true that that is the decision to be made but then what BOEM is saying is that the purpose of its decision is its decision which makes no sense. It should be the reverse. The approval of a project should serve some substantive federal purpose.[Bold and Italics: In addition you cannot have a purpose that proposes two diametrically opposite things] either your purpose is to approve or it is to disapprove. If the BOEM persists with this nonsense then since its proposed action requires approval of the COP it should at least be honest and say its purpose is to approve the COP. The BOEM needs to enlighten us as to exactly what that federal purpose is so that alternatives can be properly crafted. Since the BOEM is apparently conflicted over its purpose we try to help below by showing that the real purpose here is to implement the State's offshore wind energy program for 7500 mw of power by 2035 and within that framework there are several reasonable EIS alternatives to consider that meet that program's energy goal. Those alternatives are described below and should have been included in this DEIS.	purpose and need is too narrow.
1086-0002	BOEM's Purpose and Need The mission of the Bureau of Ocean Energy Management is to manage development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way. [Footnote 3: BOEM's Mission Statement [Embedded Hyperlink Text (https://www.boem.gov/about-boem#:~:text=OUR%20MISSION environmentally%20and%20economically%20responsible%20way)]] BOEM is not however bound by any arrangement made by state or private party and therefore has the authority to require modifications to the project that may not satisfy Ocean Wind's contract with the State of New Jersey or the New Jersey Board of Public Utilities (BPU). In the Draft Environmental Impact Statement	BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Renewable Energy Lease Number OCS-A 0498. The purpose and need in the EIS reflect the requirement per those regulations, whereas BOEM's purpose as stated in Section 1.2—to determine whether to approve, approve with modifications, or disapprove Ocean Wind's

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	(DEIS) BOEM states that it rejects alternatives that would result in a project with less nameplate capacity (Appendix C). The County asserts that BOEM's rejection of alternatives is without merit and should not be used to justify the dismissal of alternatives which may result in reduced nameplate capacity relocation of the project area or a significant modification of the Proposed Action especially if the Proposed Action is environmentally or economically unsound or interferes with reasonable uses of the ocean such as fishing.	COP—is needed to fulfill BOEM's duties under the lease. BOEM considered reasonable alternatives during the EIS development process that would avoid or minimize adverse impacts in accordance with NEPA implementing regulations. BOEM's screening criteria are presented in Appendix C, *Additional Analysis for Alternatives Dismissed*, of the Final EIS. Under the NEPA regulations at 40 CFR 1508.1(z), "reasonable alternatives means a reasonable range of alternatives that are technically and economically feasible, and meet the purpose and need for the proposed action." In the case of Ocean Wind, an alternative that cannot meet the requirements of the offtake agreement that was awarded on a competitive basis would be economically infeasible. Offshore wind projects rely on offtake agreements to obtain upfront financing for the capital costs of constructing the project. Without its existing offtake agreement, Ocean Wind would not be able to construct its proposed Project or any of the action alternatives described in the Draft EIS.
1188-0003	The Ocean Wind 1 DEIS includes a lengthy purpose and need section. We recommend that the FEIS include a short purpose and need statement supported by additional background information. The purpose and need statement should indicate that renewable energy goals should be met while also avoiding risks to the health of marine ecosystems ecologically and economically sustainable fisheries and ocean habitats. To the extent that these risks cannot be avoided they should be minimized mitigated and compensated for.	BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Renewable Energy Lease Number OCS-A 0498. The purpose and need section of the EIS reflects BOEM's requirement under those regulations. NMFS and USACE are serving as cooperating agencies and intend to adopt the Final EIS after independent review and analysis to meet their NEPA compliance requirements; therefore, Chapter 1 of the

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		Final EIS includes their respective purpose and need statements.
1188-0004	We are concerned that including the New Jersey Board of Public Utilities procurement of 1100 MW as a component of the purpose and need limits BOEM's ability to approve a smaller project than that proposed by the developer. This will limit BOEM's ability to avoid and minimize negative impacts of the project while still meeting the purpose and need. In addition the DEIS does not indicate if all action alternatives can generate 1100 MW of electricity either independently or when combined. For example it appears that under a combination of Alternatives B C and D the number of turbines would be reduced from 98 to as few as 61. Without knowing the minimum number of turbines necessary to meet the purpose and need it is challenging to provide recommendations on how Alternatives B through E should be combined either partially or to their full extent.	The BPU Order is a contractual obligation of Ocean Wind and is acknowledged as such in Chapter 1. Reduction of the Annual OREC Allowance must be agreed to by BPU and Ocean Wind. Chapter 2 of the Final EIS describes alternatives developed to avoid and minimize resource impacts, noting that the combination of alternatives or sub-alternatives is subject to the combination meeting the purpose and need. The impacts of each alternative on expected annual energy production are also provided in Chapter 2. Under the NEPA regulations at 40 CFR 1508.1(z), “reasonable alternatives means a reasonable range of alternatives that are technically and economically feasible, and meet the purpose and need for the proposed action.” In the case of Ocean Wind, an alternative that cannot meet the requirements of the offtake agreement that was awarded on a competitive basis would be economically infeasible. Offshore wind projects generally rely on offtake agreements to obtain upfront financing for the capital costs of constructing the project. Without its existing offtake agreement, Ocean Wind would not be able to construct its proposed Project or any of the action alternatives described in the Draft EIS.
1192-0013	This Draft EIS was prepared in accordance with the requirements of the National Environmental Policy Act (42 United States Code 4321-4370f) and implementing regulations of the Council on Environmental Quality and the Department of the Interior. The purpose of this DEIS is "to inform the U.S. Department of the Interior Bureau of Ocean Energy Management (BOEM) Office of Renewable	BOEM’s regulations require BOEM to analyze Ocean Wind’s proposal to build a commercial-scale wind energy facility on the Renewable Energy Lease Number OCS-A 0498. The purpose and need in the

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	Energy Programs" (as well as the mentioned below Cooperating and Participating Federal Agencies and Cooperating State Agencies) decision on whether to approve approve with modifications or disapprove the Project's Construction and Operations Plan (COP). The purpose of the DEIS is to ensure agencies [Bold: consider the environmental impacts of their actions] - [Italics: not to inform the lead agency about a construction plan.][See original comment for image of 40 CFR 1502.1 Purpose of environmental impact statement.]· This is [Underlined: fatal flaw #1] and requires a new or supplemental EIS. Under NEPA the purpose of an environmental impact statement is inform decision makers and the public of reasonable alternatives that would [Bold: avoid or minimize adverse impacts] or enhance the quality of the human environment by identifying the proposed action purpose and need. Once a [Italics: preferred] alternative is identified it is then compared to other alternative(s) including the no action alternative searching for the final [Italics: preferred] alternative which should be the one that has a less deleterious impact on the environment - [Italics: not one that was prematurely chosen in another action with no notice and ability for the public to participate.]	EIS reflect BOEM's requirement under those regulations. Section 1.2 of the EIS states that the purpose of BOEM's action is to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP, and that BOEM's action is needed to fulfill BOEM's duties under the lease. BOEM considered reasonable alternatives during the EIS development process that would avoid or minimize adverse impacts, analyzed the No Action Alternative, and identified the preferred alternative in the Final EIS in accordance with NEPA implementing regulations.
1192-0014	The purpose need and proposed action is inadequate as the mission of the Lead Agency is limited -- the Bureau of Ocean Energy Management (BOEM) mission is to manage the energy in the Ocean. BOEM's purpose need and proposed action is based on decisions on the lessee's plans to construct and operate commercial-scale offshore wind energy facility within the Lease Area -- only concerns the Ocean. Therefore the DEIS neglects to fully explain the action not in the ocean but on the bay and the land. Cable placement in non-Ocean waterways under and on land not the mission of the BOEM is the concern of NOAA NMFS and USACE. This requires the purpose and need for the cable route under water land or on top to be described so as to identify the proposed action by NOAA and USACE. There is little or no documented evidence that these other agencies have participated in this DEIS. As evidenced by the comments of NOAA NMFS this agency has plenty to say on the reasons for rejecting alternatives which was [Italics: arbitrary and capricious] and rejected by BOEM despite scientific proof in the DEIS (see Appendix B) that the impact of ripping and anchoring across the bay on eelgrass is permanently irreversible and irretrievable.	As described in Section 2.1 of the Final EIS, BOEM's regulations (30 CFR 585.620) require that the COP describes all planned facilities that the lessee would construct and use for the Project, including onshore and support facilities and all anticipated Project easements. The impacts associated with construction and use of those facilities are analyzed in the EIS. As a result, those federal, state, and local agencies with jurisdiction over nearshore and onshore impacts are able to adopt, at their discretion, those portions of BOEM's EIS that support their own permitting decisions. NMFS and USACE are serving as cooperating agencies and intend to adopt the Final EIS after independent review and analysis to meet their NEPA compliance requirements.
1192-0019	The DEIS neglects to describe the electric grid and its electric-shed (like watershed or sewershed) for each of the on-land sites. A review the two maps	The proposed Project described in Ocean Wind's COP and analyzed in the EIS as

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	(below) that the Monmouth / Ocean County JCPL has less power plants and there is no proof they need of more electricity. In fact the renewable energy to replace is petroleum energy of only 13MW (see second table: Bayville and Seaside Heights); and even though Oyster Creek Nuclear Power Plant has closed its 660 MW - that did not serve the Ocean County Electric-shed for the for the franchise service territories of the four investor-owned electric utilities (IOUs) the EDCs Atlantic City Electric (ACE) Jersey Central Power and Light (JCP&L) Public Service Electric and Gas (PSE&G) and Rockland Electric Company (RECO).NJ Electric Utilities Territory Map of New Jersey [Footnote 20: https://njogis-newjersey.opendata.arcgis.com/datasets/d23845cc51454ee59affd226cff3fcd5_10/explore?location=40.412223%2C-74.277574%2C8.00][See original comment for NJ Electric Utilities Territory Map of New Jersey]The draft "Guidehouse" study entitled Grid Modernization Study: New Jersey Board of Public Utilities (Grid Modernization Study) [Footnote 21: Grid Modernization Study: New Jersey Board of Public Utilities (Grid Modernization Study) https://nj.gov/bpu/pdf/publicnotice/DRAFT%20Grid%20Modernization%20Report%206-20-22.pdf] is "designed to establish a baseline assessment for existing NJ resource interconnection processes gather stakeholder feedback and set a course for ongoing improvements to interconnection processes. … Grid modernization improvements reach beyond the narrow scope of interconnection reforms. This report provides information that can be leveraged for subsequent phases of the ongoing NJ BPU Grid Modernization program." [Footnote 22: Ibid page 7]	the Proposed Action includes WTGs and all infrastructure required to transmit power generated by the WTGs to two interconnection points with the PJM electric transmission system or power pool. BOEM sought feedback from BPU during the development of the Draft and Final EIS. BOEM's authority under the OCSLA to approve certain activity on the OCS does not include authority to regulate the electrical grid. Moreover, none of the information provided in this comment indicates that Draft EIS failed to analyze any particular impact of BOEM's action. Generally, analysis of the electric grid is outside of the scope of this EIS.
1192-0022	The proposed action is ocean energy. The purpose need and proposed action is flawed as the mission of the Lead Agency is limited -- the Bureau of Ocean Energy Management (BOEM) mission is to manage the energy in the Ocean.	BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Renewable Energy Lease Number OCS-A 0498. The purpose and need in the EIS reflect BOEM's requirement under those regulations. Section 1.2 of the EIS states that the purpose of BOEM's action is to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP, and that BOEM's action is needed to fulfill BOEM's duties under the lease.
TRANS-0069-	The DEIS states offshore wind will take fossil fuel projects offline but where is	The Draft EIS states that the electricity that

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0002	the evidence for this statement. I don't see it in the DEIS. There are many new fossil fuels facilities already proposed and moving forward in this region as we speak.	would have been generated by offshore wind would likely be provided by fossil fuel-fired facilities, and that the power generation capacity of offshore wind development could potentially lead to lower regional air emissions by displacing fossil fuel plants for power generation. The *New Jersey Energy Master Plan* (State of New Jersey 2020) states that successful implementation of strategies within the plan, including the accelerated deployment of renewable energy (including offshore wind), will result in a drastic reduction in New Jersey's demand for fossil fuels.
1241-0002	Finally the purpose and need for action under this section of OCSLA differs vastly from public messaging by BOEM OSW developers and states which cite climate change and job creation as the main justifications for OSW projects. If these are central to the purpose of the project they should be stated as such and thoroughly evaluated in this and other DEIS documents. If not they should not be cited in public statements as primary rationales for permitting.	BOEM's purpose and need references BOEM's authority under the OCSLA and its duties under Renewable Energy Lease Number OCS-A 0498 and also references Executive Order 14008 and the shared goals of the federal agencies to deploy 30 GW of offshore wind energy capacity in the United States by 2030.
1241-0002	Since states' OSW goals and private power purchase agreements are signed prior to (and outside of) environmental review predicating such review on their terms inherently predisposes its outcome. The only time sufficient planning flexibility exists to modify project plans to [Italics: avoid or minimize] fishing impacts is at the lease planning phase. Once lease boundaries are drawn [Italics: mitigation] is possible through project design but power procurement contracting greatly limits the flexibility to achieve such a goal. Thus BOEM's sequencing of its project review under NEPA significantly weakens any weight the agency has committed to afford robust and consequential mitigation for fisheries if it only reviews mitigation alternatives after these opportunities are lost. This regulatory sequence also prematurely limits environmental mitigation options such as siting in areas with low conflicts with fisheries or marine mammals. An agency policy to review fisheries considerations at the latest stages of project planning once projects are locked in to lease boundaries and procurement terms frustrates attempts to incorporate meaningful mitigation measures and we therefore again urge BOEM to reconsider its treatment of	BOEM's purpose and need for this environmental review are based on BOEM's authority under the OCSLA, Executive Order 14008, and the shared goals of the federal agencies to deploy 30 GW of offshore wind energy capacity in the United States by 2030. Alternatives and potential mitigation measures were developed in response to issues raised during the public scoping comment period, which include the exclusion of WTGs in sand ridge and trough habitat under Alternative D, measures to mitigate impacts on commercial fishing and for-hire recreational fishing analyzed in Section 3.9, and measures to mitigate impacts on

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	fisheries under NEPA. If anything the NEPA environmental analysis should inform power purchase contracts not the inverse. [Footnote 19: This shortcoming also highlights the need for a Programmatic EIS for the U.S. offshore wind leasing program.]	marine mammals analyzed in Section 3.15. BOEM delineated the New Jersey lease areas through consultation with the BOEM New Jersey Task Force (federal agencies and elected state, local, and tribal officials or their designated representatives), public input, and data available at that the time. BOEM utilized these to identify appropriate areas for wind development with the intent of protecting ecologically sensitive areas and minimizing user conflicts. As indicated in the New Jersey Call for Information and Nominations for Commercial Leasing *Federal Register Notice* (76 *Federal Register* 22130), BOEM identified numerous factors that that affected BOEM's decision-making in planning for the lease sale. Those factors included fishing hotspots and other uses of the area. BOEM considered comments received in response to the Call for Information as well as the Proposed Notice of Sale.
1241-0002	An appropriate purpose and need statement for this action would lead BOEM to prioritize OCSLA and NEPA's focus on environmental safeguards and eliminating damage to the environment. An agency cannot circumvent its NEPA obligations "by adopting private interests to draft a narrow purpose and need statement that excludes alternatives that fail to meet specific private objectives" nor can it "craft a purpose and need statement so narrowly drawn as to foreordain approval of" a project proposed by a private party. [Footnote 18: Nat'l Parks & Conservation Ass'n v. Bureau of Land Mgmt. 606 F.3d 1058 1072 (9th Cir. 2010).] Yet the Ocean Wind DEIS evidences how the combination of BOEM's new policy and its current sequencing of NEPA lead to exactly that unsavory result.	Section 1.2, *Purpose and Need for the Proposed Action*, of the EIS describes BOEM's purpose and need. While goals of the Applicant are a consideration, BOEM's decision will be made after weighing the factors in subsection 8(p)(4) of the OCSLA. These factors include protection of the environment, conservation of the natural resources of the OCS, and consideration of other uses of the sea or seabed.
1241-0002	B. [Bold: The "Purpose and Need" must not predetermine the agency's decision] BOEM's recently-announced policy to identify NEPA alternatives directly contradicts the suggestions from RODA and fishing industry representatives	Section 1.2, *Purpose and Need for the Proposed Action*, of the EIS describes BOEM's purpose and need. While goals of

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	across the country for nearly a decade to improve its approach to environmental analysis. [Footnote 14: BOEM has never responded to these requests directly or indirectly and its subsequent issuance of a new opposing policy outside of the notice and comment process is especially discouraging.] NEPA must be approached to fulfill the agency's purpose and need not that of a project applicant (although the applicant's interests and objectives may be taken into account). [Footnote 15: See 40 C.F.R. § 1501.7(h).] The purpose of NEPA is "to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation."[Footnote 16: 42 U.S.C. § 4321.] Typically a purpose and need statement must incorporate this overarching purpose in conjunction with action-specific legislation which in this case is the Outer Continental Shelf Lands Act (OCSLA). [Footnote 17: Such an approach is evidenced by BOEM's 5-year plan for oil and gas which has the stated purpose to implement requirements of OCSLA Sec. 18(a)(3) to "balance the potential for environmental damage the potential for the discovery of oil and gas and the potential for adverse impacts to the coastal zone." Following from this correctly framed purpose and need the 5-year plan then provides a thorough analysis of relevant energy demands and future needs forecasts. BOEM Outer Continental Shelf Oil and Gas Leasing Program: 2017-2022 Final PEIS (Nov. 2016) p. 1-2.]	the Applicant are a consideration, BOEM’s decision will be made after weighing the factors in subsection 8(p)(4) of the OCSLA. These factors include protection of the environment, conservation of the natural resources of the OCS, and consideration of other uses of the sea or seabed.

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O.6.2 Proposed Action and Alternatives

Table O.6.2-1 Responses to Comments on the Proposed Action and Alternatives

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No Action		
0837-0005	Within the DEIS BOEM prepared a [Italics: Summary and Comparison of Impacts Among Alternatives with No Mitigation Measures] identified as Table S-2 (Table). [Footnote 6: BOEM. Ocean Wind 1: Draft EIS S 10-14.] The Table presents a No Action Alternative along with proposed actions labeled Alternative A through Alternative E. The first column No Action Alternative lists a predetermined range of impacts and serves as the baseline against which all other action alternatives are compared. This baseline is created based on Alternative Impacts (AI) and Alternative Combined with Other Foreseeable Impacts (ACFI). While I credit BOEM for exploring AI and ACFI the actual baseline should not incorporate projections. BOEM should redefine a true baseline that reflects the current state of Resources based on definitive factual data barring assumptions.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. A detailed description of BOEM’s methodology for assessing impacts is provided in Section 1.6 of the Final EIS.
0837-0010	A review of the totality of BOEM's [Italics: Summary of Comparison of Impacts Among Alternatives with No Mitigation Measures] (Table) provides evidence to support BOEM's strategy of downplaying the effects of the proposed offshore wind farms. There are no impacts under the No Action Alternative that rise to a level higher than proposed Alternatives A through E. As previously noted the Alternative Combined with Foreseeable Impacts column was introduced to achieve that desired result. It is noteworthy that activities introduced under the No Action Alternative would occur notwithstanding the addition of construction offshore wind projects. Examples include military operations emplacement of submarine cables dredging and port improvements. Based on this combination of activity it is reasonable to acknowledge that impacts proposed for Alternatives A through E should be elevated to one higher adverse level (e.g. minor to moderate moderate to major). The Table would require a modification to insert a major+ or severe impact level . This is a moderate rational approach considering the details of the wind farm projects as described within the draft EIS. Briefly BOEM proposes that industrializing the offshore New Jersey ocean will have no greater impact on New Jersey's resources than if industrialization did not occur. This claim has been refuted in Resource categories such as Navigation and Vessel Traffic Recreation and Tourism Commercial Fisheries Employment and Economics and Marine Mammals. The request by the vested party to take	Detailed information regarding reasonably foreseeable offshore wind projects is provided in Appendix F, *Planned Activities Scenario*. BOEM analyzes the impacts of all reasonably foreseeable future planned activities, which include future offshore wind activities, in each resource-specific environmental consequences section in Chapter 3 of this Final EIS. The impacts of each alternative are analyzed in relation to the current baseline. Cumulative impacts of each alternative are also analyzed separately in relation to the future baseline. Impact levels are defined in each resource section, and conclusions drawn for each alternative align with the respective impact level. The analysis of the No Action Alternative has been reorganized to provide better clarity and impact-level conclusions for the No

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	marine mammals without liability is one realistic example of the forthcoming ramifications. The mortality rate of North Atlantic Right Whales will rise due to increased vessel strikes. According to the North Atlantic Right Whales Coalition only 350 remain in the world today. Considering the facts a foreseeable impact can be the extinction of this species. Unfortunately it is difficult to measure the impact of temporary and irreversible hearing loss to all marine mammals until after the damage is done. Environmental studies will be conducted; however they will be funded by the Project and conducted [Italics: contemporaneously].	Action Alternative have been reviewed and revised in the Final EIS.
1071-0002	The DEIS also dramatically overstates the negative impact of the no project scenario.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. A detailed description of BOEM's methodology for assessing impacts is provided in Section 1.6 of the Final EIS.
1259-0029	B. Lack of a Fair Presentation and Assessment of Alternatives. The "Alternatives" section of the Draft EIS and accompanying analysis are not full nor fair as they are skewed and inaccurate for two reasons. First the "No Action Alternative" presented by BOEM in the Draft EIS is not a true "no action" alternative. In fact the so-called "No Action Alternative" in the document actually presumes that offshore wind energy will definitely continue to be developed at other BOEM lease sites in the area. As a result the "No Action Alternative" repeatedly described throughout the Draft EIS in fact involves quite a lot of industrial action-just not by Ocean Wind 1 specifically. The contrast that this document is supposed to make between the "No Action Alternative" and the other alternatives all of which involve industrial-scale offshore wind energy development at Lease Site OCS-A 0498 thus hardly appears to be much of a contrast at all to many readers. Consider for example that the Draft EIS classifies some impacts of the Proposed Action (i.e. construction and operation of Ocean Wind 1) as lower overall than the impacts of the "No Action Alternative" provided. [Footnote 12: In Table S-2 the summaries and comparisons of impacts among alternatives shows these questionable assessments: Birds (page S-10) - impacts under 'No Action" are alleged to be minor while impacts for the "Proposed Action" are characterized as negligible to minor; Coastal Habitats (S-11) - impacts of "No Action" are projected to be moderate while impacts for the "Proposed Action" are classified as minor; Commercial Fisheries (S-11) - the consequences of "No Action" are shown to be	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. Ongoing activities include permitted offshore wind projects. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Reasonably foreseeable future actions include the build-out of executed renewable energy lease areas. A detailed description of BOEM's methodology for assessing impacts is provided in Section 1.6 of the Final EIS. Further clarification of ongoing activities contributing to impacts of the No Action Alternative and planned activities contributing to cumulative impacts has been included in the Final EIS. BOEM has reviewed and revised impact-level conclusions, as appropriate.

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	moderate to major but those of the "Proposed Action' are described as minor to major; Finfish (S-12) - no action is minor to moderate but proposed action is negligible to moderate; Marine Mammals (S-12) - no action is minor but proposed action is negligible (to major); Sea Turtles (S-14)- no action is minor but proposed action is negligible to minor.] Such an outcome is plainly absurd. How can introducing infrastructure to an area of the ocean where it did not previously exist cause fewer impacts than not building it at all? Instead of the analysis presented in this Draft EIS BOEM should be required to re-submit the Draft EIS for public review and comment with an analysis that reflects a "No Action Alternative" which actually involves no offshore wind energy development. Or in the alternative the EIS for Ocean Wind 1 must include a more narrowly tailored analysis that does not obfuscate the likely impacts of development at this site by only presenting them against a background of widespread offshore wind growth across the region.	
0984-0010	S.5. Environmental Impacts. The greenwashing of the cumulative Environmental impacts of the Sand Ridge are a [Bold: Major Impact] and does not meet the environmental safeguards (43 USC :1332(3)). The Trough Avoidance has significant economic impacts to other marine users: A direct conflict with the policy of the United States to produce clean and safe domestic energy (EO 13783 of March 28 2017) does not take into consideration natural resources and existing ocean uses to the extent necessary to receive any action; therefore the environmental and socioeconomic impacts and benefits of the action alternatives would should not occur with a decision of [Bold: NO Action Alternative]	BOEM describes the estimated reduction to annual energy production resulting from each action alternative in Section 2.1.5 of the Draft EIS and analyzed the impacts, both adverse and beneficial, of each alternative in Chapter 3.
0984-0061	Any of the applicants denial stating there is "No Action Alternatives Impacts" is unacceptable. It show the lack of sincerity to the environment that the applicant seeks to industrialize and destroy in current form.	Impacts of the Proposed Action and action alternatives are evaluated in comparison to the No Action Alternative.
1012-0021	[Bold: DEIS Presentation Problems][Bold: 1. The Comparative Presentation of the No Action and Proposed Action] NEPA regulations at §1502.14 call for a comparison of the "environmental impacts of the proposed action and the alternatives" The no action alternative is one. The presentation throughout the DEIS of the no action impact versus the proposed action and alleged alternative action impacts especially in the alternative comparative tables is not logical and not in accord with those EIS requirements. Using marine mammals as an example there is no doubt that bad things will happen to marine mammals in the future without this project. However the addition of the project can only add to those things it does not occur in isolation without them as the comparative Tables portray. So the impact of the proposed action [Bold: must always be	Under the No Action Alternative, impacts from the proposed Project would not occur as proposed; however, impacts from past, present, future non-offshore wind, and future offshore wind activities would still occur. BOEM recognizes that the environment is not static and changes overtime and therefore uses the approach as outlined by Magee and Nesbit (2008) and Eccleston (2011) of examining in the EIS what happens if the Ocean Wind 1

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	greater] than the impact of no action. But this is not what the Tables show. In a number of cases it shows the impact of the project to be less than the impact of no action. This makes no sense and appears to be another attempt to minimize the impact of the project. To further muddy the water here the BOEM is using two different base cases from which to measure no action and the proposed action. It's no action impacts are apparently measured from a current base case to a future situation. But its proposed action impacts are measured from one future situation to another. You simply cannot compare two things measured against a different starting yardstick. Finally the BOEM's logic here is backwards. It implies for example that because a large number of right whales may die in the future from vessel strike and entanglements that it's not so bad if a smaller number die from noise a new stress. But rather a responsible decision maker would look at it the other way in context that because bad impacts are happening over which the decision-maker has little or no control then he/she should be especially concerned with adding any additional impact to that situation. This would be especially important e.g. regarding endangered species where the addition of an added stress even if smaller in magnitude than ongoing ones can be quite detrimental to the species. If the BOEM wants to make the case that a particular impact of one thing is less or more than the impact of another thing it can do so in a separate Table. But that is a comparison of different impacts which is very different than a comparison of alternatives which is what the NEPA rules require. The BOEM should dispense with this presentation of the no action alternative in the comparative tables and roll that discussion into the affected environment section current and future and then just show the new impact of the proposed action and the other alternatives on that affected environment. Therefore the BOEM needs to restructure its discussions and clarify these distinctions throughout the document and redo the alternatives comparison Tables.	Project is not built.
1012-000	It's comparative presentation of alternatives is logically flawed the impact of the proposed action and alternatives can never be less than the impact of no action.	Under the No Action Alternative, impacts from the proposed Project would not occur as proposed; however, impacts from past, present, future non-offshore wind, and future offshore wind activities would still occur. BOEM recognizes that the environment is not static and changes overtime and therefore uses the approach as outlined by Magee and Nesbit (2008)

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		and Eccleston (2011) of examining in the EIS what happens if the Ocean Wind 1 Project is not built.
Alternative B		
0984-0009	S.4.3 Alternative B-No Surface Occupancy at Select Locations to Reduce Visual Impacts. The alternative of "No Surface Occupancy" should NOT be limited in cause to "Visual Impacts" especially the reduction of. This alternative exemplifies the conflict of interest BOEM has within the permitting process. As the financially benefited agency and employees the leasee is purposely reducing the options to the commenters on the EIS. BOEM has a prolific documented criminal past and should be investigated by the United States Attorney General for conflicts of interest. Specifically for taking money from leases for development sites with promises to assist in the awards of permits during the permitting process. The Depart of Interior (BOEMs') parent has additional conflicts since they also have a fee structure in place based on water depth length of cable and electric output. In any small town or big city in the USA this type of pay-to-play permitting process is a criminal offense.	BOEM developed alternatives to address issues raised during the public scoping process. Visual impacts of the Project were raised as a concern during public scoping; therefore, Alternative B was developed to reduce visual impacts of the Project. Three action alternatives that would reduce the number of WTGs were assessed in the EIS. As described in Section 1.2, *Purpose and Need for the Proposed Action*, the purpose of BOEM's action is to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP.
1252-0003	Alternative B: 3. No Surface Occupancy at Select Locations to reduce Visual Impacts. Atlantic Shores asserts that an alternative that removes 9 WTG Positions (Alternative B-1 smaller turbine model) or 19 WTG Positions (Alternative B-2 larger turbine model) simply based on proximity to shoreline is unjustified. The Ocean Wind 1 DEIS provides no justification for why a universally applied setback is necessary or preferred under the circumstances. A well-established and practiced approach for assessing visual impacts is through the selection of representative viewpoints where the project would be prominently visible often called key observation points (KOPs). KOP identification is important as they are either from historic areas designated scenic areas and/or other visually significant resources. KOPs also represent typical views of a project to representative viewer/user groups and are also illustrative of typical views of a proposed project. KOPs typically represent the worst-case and most conservative approach to assessing viewsheds. A universally applied setback is reflective of an unorthodox methodology of approaching assessments and determinations of Visual Impacts. A universally applied setback and the significant removal of turbines could significantly burden ratepayers with increased energy costs as well as jeopardize the federal and state government's policy goals related to meeting clean energy targets as expressed in the Purpose and Need in the Notice of Intent for the Ocean Wind 1	BOEM developed alternatives to address issues raised during the public scoping process. Visual impacts of the Project were raised as a concern during public scoping; therefore, Alternative B was developed to reduce visual impacts of the Project. While visual impacts are assessed from KOPs consistent with BOEM's *Assessment of Seascape, Landscape, and Visual Impacts of Offshore Wind Energy Developments on the Outer Continental Shelf of the United States*, exclusion of WTG positions nearest to coastal communities is an equitable method of developing an alternative to reduce visual impacts on coastal communities.

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	project. Well-accepted strategies demonstrate a clear path to reducing and minimizing potential visual impacts while maintaining technical and economic feasibility practicality and flexibility in consideration of the multitude of other environmental factors. As such appropriate alternatives for reducing visual impacts to be considered by BOEM should: 1.Clearly indicate the target level of visibility impact mitigation or acceptable threshold for visibility impact. 2.Include within its analysis whether a combination of WTG size reduction select removal of turbines and/or a combination of the two could achieve the same or improved result. These standards provide a more targeted assessment of visual impacts and effective mitigation measures instead of the blunt instrument of imposing a blanket setback. Prior to making a decision to impair the buildout of a leasehold interest it is imperative that BOEM considers other options that are less disruptive to the original design of the Project which is feasible here based on the techniques identified above.	
Alternative C		
1247-0005	Alternative C. The Network recognizes that the lack of provisions requiring setbacks within the BOEM lease agreements for Atlantic Shores South and Ocean Wind 1 has created potential safety and navigation concerns with the spacing and alignment of the Proposed Action and the adjacent project. The Network encourages the developers and the USCG to find a satisfactory solution that satisfies all parties including BOEM. Should an agreement fail the Network suggests BOEM examine an alternative that does not add to the project's overall timeline. BOEM suggests that any relocation or compression could result in an two-year delay that could harm supply chain formation - numerous contracts have already been signed persons hired and investments made assuming a timeline previously laid out by BOEM and the developer. The Network suggests that BOEM examine further the compression (as long as such actions can be accomplished without the two-year delay offered by BOEM) as an option that may be possible by the developer and eliminate the options which reduce the number of WTG locations. Given the extensive studies completed and ongoing throughout the lease area it seems likely that these options could be examined in an expedited manner. The Network recommends that BOEM address alignment and buffer concerns in the leasing process overall as well as within agreements under development.	Subsequent to publication of the Draft EIS, Ocean Wind submitted an updated COP incorporating an array layout compression scenario analyzed under Alternative C-2, Wind Turbine Layout Modification to Establish a Buffer Between Ocean Wind 1 and Atlantic Shores South. This array layout compression scenario, depicted on Figure 2-9 of the Draft EIS, would modify the WTG array layout by compressing the WTG array layout to create a minimum 0.81-nm buffer between each project's WTGs. The Final EIS notes that a joint letter has been signed by Ocean Wind and Atlantic Shores Offshore Wind, LLC for this compressed array layout scenario. The Final EIS analyzes this compressed array layout scenario documented in a joint letter signed by Ocean Wind and Atlantic Shores Offshore Wind, LLC and coordinated with USCG under the Proposed Action.

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1252-0003	Alternative C: Wind Turbine Layout Modification to establish Buffer between Ocean Wind 1 and Atlantic Shores South. Ocean Wind 1 and Atlantic Shores have had constructive conversations with the U.S. Coast Guard (Coast Guard) on the issue of the common boundary between Lease Area OCS-A-0498 and Lease Area OCS-A- 0499. The Coast Guard proposed a series of measures that Ocean Wind 1 and Atlantic Shores agreed to in a memorandum issued to BOEM via electronic mail on July 14 2022. This memorandum directly addressed the Coast Guard's setback area proposed in the interest of facilitating navigation safety and effective search and rescue. Atlantic Shores requests that BOEM confer with the Coast Guard to obtain the document. The Alternative C2 with a 0.81 nm buffer and relocation of turbines per Figure 2-9 in the Ocean Wind 1 DEIS most closely algins with the collaborative efforts between Coast Guard Atlantic Shores and Ocean Wind as defined in the signed memorandum. Atlantic Shores supports the Alternative C2 and requests that BOEM give no further consideration to Alternative C1 as it goes beyond what was determined to be necessary to meet the needs of the Coast Guard.	Subsequent to publication of the Draft EIS, Ocean Wind submitted an updated COP incorporating an array layout compression scenario analyzed under Alternative C-2, Wind Turbine Layout Modification to Establish a Buffer Between Ocean Wind 1 and Atlantic Shores South. This array layout compression scenario, depicted on Figure 2-9 of the Draft EIS, would modify the WTG array layout by compressing the WTG array layout to create a minimum 0.81-nm buffer between each project's WTGs. The Final EIS notes that a joint letter has been signed by Ocean Wind and Atlantic Shores Offshore Wind, LLC for this compressed array layout scenario.
Alternative D		
1222-0002	[Bold: Choice of Alternatives:] Surfside Foods LLC favors Alternative D: Sand Ridge and Trough Avoidance. The 15 eliminated turbines overlap with historical surfclam fishing grounds. The following plots show heat maps of Atlantic surfclam activity within the Ocean Wind 1 lease area. This was taken from a Fishing Route Analytics Report done for the surfclam / ocean quahog fleet of vessels using VMS data from 2009 to 2019 [Footnote 1: Last Tow LLC - Fishing Route Analytics Report: Ocean Wind / Azavea 03/21/2020]. This is the only alternative that would allow for even minimal surfclam fishing within the wind energy area. [See original comment for images pulled from Draft Environmental Impact Statement]	The commenter's preference for Alternative D, due to the minimization of overlap with historical surfclam fishing grounds, is noted.
1247-0005	Alternative D. The Network recommends that BOEM carefully consider any WTG position removals for Ridge and Trough Avoidance to evaluate whether the loss of generation capacity is balanced by documentable ecosystem benefits. The analysis in the DEIS does not provide sufficient benefits to justify elimination of WTG positions. The ridge and trough environmental impacts through the project duration from OSW installations will be isolated and dispersed. Only the structures and surrounding scour protection (up to 73' at each location) would displace existing seabed. Cables will be buried resulting in only temporary seabed impacts. BOEM's study of existing research literature and knowledge gaps [BOEM 2015-012] highlights the variability in geologic	Alternative D was developed to minimize impacts on sand ridge and trough habitat. Ecosystem impacts of Alternative D are analyzed in the Final EIS. BOEM will consider expected annual energy production of each alternative when selecting an alternative or combination of alternatives in the ROD. The benthic monitoring proposed in

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	formation and physical dynamics of different systems emphasizing that modeling of effects to one system may not apply to others. It also highlights that biologic studies to date have been sporadic and varied and that a holistic approach to future study design is needed. The BOEM study was considerably related to BOEM's responsibilities managing OCS sand gravel and shell resources - extensively used for beach replenishment particularly following Tropical Storm Sandy. The dredging of Sand from within Ridge and Trough habitats is potentially a much larger concern for ecosystem management than OSW development. Instead BOEM could engage Before and After Control Impact (BACI) studies are recommended in order to properly evaluate the effects that result from projects in ridge and trough environments. Rather than commit to extensive avoidance measures BOEM could request that suitable BACI studies be conducted to evaluate the actual impacts and benefits of structures within this region. These studies related to the OSW projects could help BOEM fill these knowledge gaps. The lease term (35 years nominal) is a reasonable amount of time to evaluate the impacts from the structures. If at the end of the lease it is determined that significant harm has occurred the leases could expire and decommissioning would return the seabed to near preconstruction conditions or the leases could be extended and additional mitigation measures imposed.	Ocean Wind's Benthic Monitoring Plan (Inspire 2022) will include focused surveys within the Wind Farm Area along the inter-array cables, specifically where sand ridges exist in the northeastern portion of the Wind Farm Area, to track any changes and recovery along segments of the inter-array cables that traverse the sand ridge features prior to and following Project construction.
1252-0003	Alternative D: Sand Ridge and Trough Avoidance. This alternative proposes the removal of up to the stated 15 WTG Positions from an area defined roughly as "ridge and swale complex" that are "found throughout the OCS in the mid-Atlantic." This alternative should not be adopted and a relocation alternative should be pursued to better comport with NEPA standards for the development of alternatives. Specifically the record does not reflect that the turbines and associated equipment will pose a "significant issue" for existing habitat in the ridge and swale complex nor is there a sufficient scientific basis supporting the need for removal of said equipment. Under BOEM's recently issued NEPA guidance for identifying alternatives for offshore wind (June 22 2022) an alternative should address a significant issue related to the proposed project which involves a significant effect has a cause-and-effect relationship with the proposed action and is susceptible to scientific analysis and not conjecture. Furthermore there must be scientific evidence that the removal of WTGs avoids or substantially lessons that significant effect. Alternative D does not meet these standards. Atlantic Shores also notes that the prior NEPA review for the designation of the New Jersey Wind Energy Area (WEA) [Footnote 2: Mid-Atlantic Final EA 2012] stated that the area was developed using the boundary of the Ocean/Wind Power Ecological Baseline Studies (OWPEBS) which	BOEM developed alternatives to address issues raised during the public scoping process. During the alternatives development process, BOEM evaluated the alternatives and dismissed from further consideration alternatives that did not meet the purpose and need, did not meet the screening criteria, or both. BOEM's alternatives development process for the Project occurred prior to the June 2022 Alternatives Screening Criteria. Screening criteria used for the Ocean Wind 1 alternatives development process are provided in Appendix C, *Additional Analysis for Alternatives Dismissed*. Exclusion of areas from the proposed WEAs utilized benthic mapping available at that time. As part of the site

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	previously considered and excluded areas from development for the preservation of Shoals and Fishing Hot Spots. As part of this process the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS) responded to the assessment of impacts to essential fish habitat (EFH) and provided conservation recommendations including the recommendation that 6 fishing hotspot locations be excluded from the proposed WEAs including Old Grounds Mussel Bed Inside Mud Hole Middle Mud Hole Triple Wrecks and Outer Mud Hole. The siting of the current Ocean Wind and Atlantic Shores Lease Areas were carefully selected during a robust NEPA process which included the Commerce Department and most notably the process did not identify a ridge and swale area as significant or remove the areas identified by NMFS from development consideration. It is unclear why now there is concern being raised about habitat areas within the Ocean Wind 1 leasehold area and why such concern was not raised earlier. Based on the foregoing Atlantic Shores respectfully requests that BOEM not select any of the problematic alternatives identified in the Ocean Wind 1 DEIS as there are effective mitigation measures that can address impacts ensuring responsible development of the Project in furtherance of state and federal clean energy targets in the fight against climate change.	characterization for OCS-A 0498 additional HRG survey was conducted, allowing for a finer-scale identification of ridge and swale features. The scope of the of 2012 Mid-Atlantic Environmental Assessment for Commercial Wind Lease Issuance analyzed the impacts from two distinct activities: (1) lease issuance (including reasonably foreseeable consequences associated with shallow hazards and geological, geotechnical, and archaeological resource surveys); and (2) site assessment activities (including reasonably foreseeable consequences associated with the installation and operation of a meteorological tower or meteorological buoys). The scope and analysis of the Environmental Assessment did not cover construction or operational activities associated with a commercial wind facility, which the 2022 Mid-Atlantic indicated would be covered under a site-specific NEPA analysis once a COP was submitted. The Ocean Wind 1 EIS analysis is utilizing the site-specific data provided as part of Ocean Wind 1's COP. This site-specific data includes HRG data, geotechnical data, and photo/video documentation. NFMS did recommend the removal of the several fishing grounds as part of its review of BOEM's 2012 Environmental Assessment. While BOEM shared NMFS's concern with impacts on fishery resources, BOEM deferred a decision on their removal until specific data on the benthic habitat and fish abundance were

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		collected during site characterization activities pursuant to 30 CFR 585.626(3) and submitted with a COP. The results of these site characterization are incorporated into the Ocean Wind EIS 1 and informed BOEM's alternatives and potential mitigation measures.
Alternative E		
1087-0003	ANJEC is supportive of further considerations of BOEM's proposed Alternatives E to minimize the impacts of submerged aquatic vegetation by altering the export cable route and / or Alternative D reducing the number of turbines in the sand ridge / trough habitat zone because of its biological significance for benthic communities and for migrating and spawning fish species - with the contingency of using some larger turbines to compensate for any reduced energy production.	Use of a larger turbine with a 240-meter rotor diameter, and otherwise having dimensions that fall within the Project PDE, is dependent upon this alternative being commercially available when BOEM issues its ROD as well as its technical and economic feasibility, and consistency with the purpose and need.
General Alternatives		
0984-0037	Alternatives. The EIS have not proven why the United States standard requirements of fixed structure in and around shipping lanes in the Gulf of Mexico should not be consistent with the Atlantic. "No structure may be placed within two Nautical miles of any shipping lane". That goes for transit lanes also. The developer wanting to maximize the development site for electric generation should not be at the cost of life and property. The standards for placement of structures to the proximity of shipping lanes should be consistent in all US waters.	USCG's Marine Planning Guidelines, as published in enclosure 3 to Navigation and Vessel Inspection Circular 01-19, January 2019, recommend a 2-nm distance between offshore structures and the parallel outer or seaward boundary of a traffic lane be considered to achieve a low level of navigation safety risk. This recommended distance assumes size of the vessels between 300 and 400 meters in length. USCG recognizes that larger or smaller distances may be considered depending on the predominant size and type of the vessel traffic transiting in the area. While the safe distances provided in the Marine Planning Guidelines are highly recommended, smaller or larger distances may be acceptable depending on the structures, vessel traffic, and risk tolerance.

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		During the initial planning process for the New Jersey lease areas, the TSS in the approaches to New York and a traditional transit route (approximately 7 nm along the New Jersey coast) used by tug and barge operators was removed from leasing consideration. Additional information on these areas was requested from the maritime community to ascertain the need for additional refinements through the New Jersey Call for Information and Nominations *Federal Register* Notice (76 *Federal Register* 22130). Based on input from the maritime community (e.g., USCG, American Waterways Operators) and analysis of vessel traffic data, OCS blocks directly south of the Ambrose to Barnegat traffic lane were removed from leasing consideration. OCS blocks where high navigation safety concerns remained and could be subject to potential future restrictions based on a lessee's project design and site-specific analysis were identified in subsequent leasing notices. Those OCS blocks are identified in the Atlantic Wind Lease Sale 5 for Commercial Leasing for Wind Power on the Outer Continental Shelf Offshore New Jersey—Final Sale Notice (80 *Federal Register* 57862). Neither Ocean Wind's' COP nor any alternatives in the Draft EIS contain offshore structures in these identified areas.
1012-0019	[Bold: Conclusions and Recommendations.][Bold: EIS Structural Issues][Bold: 1. Need for A Clear Federal Purpose and Need.] 2. [Bold: The scope of the EIS Needs to be expanded to include reasonable alternatives per 40CFR §1508.1(z)	BOEM considered a reasonable range of alternatives during the EIS development process that emerged from scoping,

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	and "Connected Actions" per 40 CFR §1501.9 (e)(1)(iii).] The Biden administration recently adopted new NEPA rules that retained the language in 40 CFR 1502.14 to "evaluate reasonable alternatives to the proposed action" and amended section 1508.1 (z) to define reasonable alternatives as "a reasonable range of alternatives that are technically and economically feasible and meet the purpose in need for the proposed action". Assuming that the purpose and need is to further an offshore wind program and facing such technically economically feasible options in other lease areas and with different power levels the alternatives in this DEIS are not consistent with that definition.	interagency coordination, and internal BOEM deliberations. Alternatives were reviewed using BOEM's screening criteria, presented in Appendix C, *Additional Analysis for Alternatives Dismissed*. Alternatives that met the screening criteria (i.e., were found to be infeasible or did not meet the purpose and need) were dismissed from detailed analysis in the Draft EIS. Alternatives considered but dismissed from detailed analysis and the rationale for their dismissal are described in Section 2.1.7 and Appendix C.
1012-0021	[Bold: 5. No True Alternatives Presented it the DEIS] Instead of presenting any real meaningful alternatives the DEIS merely attempts to give the appearance of having considered a range of alternatives. It concocts several that place a few turbines one way or the other which have the same power level and results in virtually no change in environmental impact as shown in the comparative tables in the DEIS. Therefore for NEPA purposes they are identical to the proposed action do not represent a "reasonable range" of options and serve no environmental purpose. They are window dressing not real NEPA alternatives. That leaves the no action alternative as the only option. And since BOEM isn't willing to consider any other proposals in alternate areas outside the lease area or modification to the power level (essentially determining the number of turbines) to allow for siting within only sections of the lease area it has left itself no choice but to approve the COP in order to further its program goals. So from BOEM's perspective the no project alternative cannot be reasonable and to cement its anticipated approval of the project BOEM despite its extensive scoring of impacts presents no environmental criteria under which the project would be disapproved. This leaves us with an EIS that includes no reasonable alternatives which is exactly what the Act and its attendant case law forbids. This must be rectified.	BOEM considered a reasonable range of alternatives during the EIS development process that emerged from scoping, interagency coordination, and internal BOEM deliberations. Alternatives were reviewed using BOEM's screening criteria, presented in Appendix C, *Additional Analysis for Alternatives Dismissed*. Alternatives that met the screening criteria (i.e., were found to be infeasible or did not meet the purpose and need) were dismissed from detailed analysis in the Draft EIS. Alternatives considered but dismissed from detailed analysis and the rationale for their dismissal are described in Section 2.1.7 and Appendix C.
1012-0021	In addition to the New Jersey program alternatives described above in section 4 the DEIS must include other reasonable mitigating alternatives such as: A. Turbine exclusion zones from shore based on visual impact adverse impact on historic properties and local climate changes at the shore and B. Turbine exclusion zones away from the primary migration corridor of the right whale to	Alternative B was developed through the scoping process for the Draft EIS in response to public comments concerning the visual impacts of the Project. This alternative includes no surface occupancy

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	allow its migration to continue in compliance with the Endangered Species Act and the Marine Mammal Protection Act.	at select WTG positions to reduce the visual impacts of the proposed Project. BOEM is consulting with NMFS under ESA and will incorporate mitigation measures that come out of the ESA consultation and the final MMPA Letter of Authorization. BOEM is incorporating measures to protect marine mammals, including NARW, through ESA consultation and through adoption of Letter of Authorization requirements into the COP decision.
1125-0002	While I realize that BOEM is following NEPA's avoid/minimize/mitigate mantra together with your interpretation of the necessary level of alternatives analysis I think the document is lacking in an upfront assessment of the broad environmental and economic benefits against some specific modest well mitigated impacts.	In the Final EIS, BOEM analyzes the potential biological, socioeconomic, physical, and cultural impacts of the Project through IPFs. Table S-2 in the Executive Summary presents a summary of the anticipated impacts and comparison among the alternatives.
1125-0005	While there are locational and project specific factors which should be addressed it would seem that the level of detail could be reduced in many instances based on findings of negligible to minor impacts in prior analysis. Similarly much of the rote repetition in the alternatives analyses could be reduced or eliminated by focusing on the core impacts which each alternative seeks to reduce (for example eliminating 9 to 19 WTG positions to reduce potential visual impacts). As an aside this potential reduction represents eliminating the potential for as much as 250MW of OSW generation a step that should not be taken lightly given the tremendous needs of the East Coast.	The Final EIS discusses impacts in proportion to their significance, in accordance with NEPA implementing regulations. The impacts of each alternative on expected annual energy production are provided in Chapter 2 and were evaluated by the decision-maker when identifying the preferred alternative.
1188-0005	[In recognition of the wide range of adverse impacts on fisheries fishery species and habitats across all action alternatives as described in the DEIS we recommend approval of a combination of Alternatives B-E to minimize the footprint of the project and therefore reduce the magnitude of adverse impacts. Specifically we recommend approval of a combination of Alternatives B-2 (remove up to 19 turbine locations to reduce visual impacts) Alternative C-1 (remove 8 turbine locations to create a buffer between this project and the Atlantic Shores South project - without compressing the layout to maintain the same number of turbines) Alternative D (remove all 15 turbine locations in sand ridge and trough habitat as identified under this alternative) and Alternative E	BOEM will consider all comments received on the Draft EIS during development of the preferred alternative. Section 3.13 of the Draft EIS stated that the HAPC that could be directly affected by Project activities is specific habitat for both juvenile and adult summer flounder. The summer flounder HAPC includes all native species of macroalgae,

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	(limit the export cable route traversing Island Beach State Park to the northern option to minimize impacts to SAV). As noted above it is unclear if the full extent of each of these alternatives could be combined while achieving the purpose and need. If the full extent of these alternatives cannot be combined we support approval of Alternatives D E and C prior to consideration of Alternative B as visual impacts are outside the realm of the mission of the Councils. We strongly support all efforts to avoid impacts to SAV. The Mid-Atlantic Council has designated all native species of macroalgae seagrasses and freshwater and tidal macrophytes in any size bed as well as loose aggregations as habitat areas of particular concern (HAPC) for summer flounder. In defining this HAPC the Council also noted that if native species of SAV are eliminated then exotic species should be protected because of functional value; however all efforts should be made to restore native species. SAV also provides important habitat for many other species.	seagrasses, and freshwater and tidal macrophytes (i.e., SAV) in any size bed, as well as loose aggregations, within currently designated adult and juvenile summer flounder EFH. No change to the Final EIS in response to this comment is warranted.
1192-0002	The purpose need and proposed action is flawed as the mission of the Lead Agency is limited-- the Bureau of Ocean Energy Management (BOEM) mission is to manage the energy in the Ocean. The Alternative Analysis is fatally flawed because it selected the most impacted site for the cable connection in Barnegat Bay and on land both at Island Beach State Park and Oyster Creek.	BOEM's purpose as stated in Section 1.2—to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP—is needed to fulfill BOEM's duties under the lease. BOEM analyzed the proposed Project as it was described in Ocean Wind's COP. Alternatives were developed in response to issues raised during the public scoping comment period. BOEM identifies the preferred alternative in the Final EIS and will select an alternative(s) in the ROD.
1192-0012	Alternative analysis could be on the site or sites infrastructure types or other actions. If the study finds no alternative with less deleterious impacts from the [Italics: preferred alternative] and if the preferred alternative has identified irreversible and irretrievable impacts then the lead agency is compelled to take the [Italics: "hard look"] and reconsider choosing an alternative with a [Italics: lesser impact]. It's hard to change the preferred alternative if there is only one alternative (albeit modified). In this case the Lead Agency did not take the hard look for the siting of the route to the land at the Oyster Creek Nuclear Power Station including use of Island Beach State Park.	BOEM analyzed multiple alternatives for the Oyster Creek export cable route, including an alternative that would avoid making landfall on Island Beach State Park. Information regarding BOEM's evaluation and dismissal of alternatives is provided in Table 2-3 and Appendix C, *Additional Analysis for Alternatives Dismissed*.
1192-0015	This makes the Alternative Analysis [Underlined: fatal flaw #3] as it chose the wrong alternative that is the one with the most impact -- one that has irreversible and irretrievable loss in natural resources.[See original comment for image of 40	BOEM analyzed the Proposed Action (i.e., the proposed Project as described in Ocean Wind's COP), as well as a

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	CFR 1502.16 Environmental consequences]Instead of doing the right thing the Lead Agency chose a plan that takes parkland destroys trees with no plans for native tree replacement (their plan is to buy plants within 250 or so mile radius?) on Island Beach State Park builds in a power plant substation on wetlands at Oyster Creek submarines through the Bay's most fragile areas of eelgrass and based on old stormwater rules. NOAA NMFS USACE and NJDEP need their own EIS to consider a reasonable range of alternatives that can accomplish the purpose and need (for a 40-mile-long cable through parkland and through an estuary) and a substation (to link to the grid) of the proposed action (to build a power plant in a coastal community). The irreversible and irretrievable commitments of resources was never described and address.· This is [Underlined: fatal flaw #4] and there should be a new or supplemental EIS. The alternative analysis should review the project site in the ocean AND delivery routes to landfall and project site on the land including the size of each facility the impacts to the environment and the amount of renewable electricity produced and/or needed. In terms of climate change it is critical to replace and decommission the existing polluting power.	reasonable range of alternatives.
1192-0020	Why is this important? Well it would seem that the Bureau of Public Utilities (BPU) has approved Ocean Wind to use the interconnection to the grid at Oyster Creek in 2018. Now it seems that was premature and violates the idea that an EIS should be started as early as possible. There may be other alternatives to review which can achieve the goals of the project in an area that protects the connection from severe storms. (A complete discussion of the Oyster Creek Nuclear Power Plant during Superstorm Sandy is found in section 6 below.)Power Plants of New Jersey by NJDEP [Footnote 23: https://gisdata-njdep.opendata.arcgis.com/datasets/njdep::power-plants-of-newjersey/explore?location=40.125837%2C-74.305328%2C8.00][See original comment for Power Plants of New Jersey by NJDEP]Table from map of Power Plants of New Jersey in Monmouth and Ocean County [Footnote 24: https://gisdata-njdep.opendata.arcgis.com/datasets/njdep::power-plants-of-newjersey/explore?location=40.110763%2C-74.305328%2C8.00&showTable=true][See original comment for Map of Power Plants of New Jersey in Monmouth and Ocean County Table] Continued table to show the primary source ….[See original comment for Map of Power Plants of New Jersey in Monmouth and Ocean County Table] Interestingly the NJ 2019 Energy Master Plan (EMP) focuses on Grid Modernization to adapt for future energy needs that is off shore wind renewable energy resources including community solar and zero emission Distributed Energy Resources (DER). This	Renewable Energy Lease Number OCS-A 0498 only authorizes the submission of a COP for offshore wind energy. Information regarding BOEM’s evaluation and dismissal of alternatives, including alternatives for alternate energy sources, is provided in Table 2-3 and Appendix C, *Additional Analysis for Alternatives Dismissed*.

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	is instead of the "prior paradigm where the output of large energy centers (power plants) to load centers." 9Footnote 25: Ibid. page 4]If the BPU wants to generate use and manage energy in ways "consistent with economic climate and societal demands to realize EMP goals" [Footnote 26: Ibid.] then why not look at additional alternative sites inland and protected from sea level rise. Suggested sites that meet the energy "weather test" does not fill wetlands cut down trees and does not disturb the natural resources of Island Beach State Park and Barnegat Bay (see the Barnegat Bay section herein) are: Ciba Gigey Heritage Minerals ….	
1192-0023	The Alternative Analysis is fatally flawed as it selected the most impacted site for the cable connection the on-land contact both at IBSP and Oyster Creek.	BOEM analyzed a reasonable range of alternatives in the EIS and will not select an alternative until the ROD. The EIS describes the environmental consequences of the alternatives in accordance with the NEPA implementing regulations.
1192-0027	Finally this DEIS is severely deficient in analyzing the impact of Barnegat Bay's ecosystem and economy by not considering alternate routes and methods of laying the cable. There is no data on the impact of the cables' heat on SAVs clams and oysters. There is no reason given for the cable to be deeper in the Bay bed not 4' in silt. What consideration was given to hang the cables from any of the bridges over the water?	As noted in Section 2.1.2.2.3, target cable burial depth is determined based on an assessment of seabed conditions, seabed mobility, and the risk of interaction with external hazards such as fishing gear and vessel anchors, while also considering other factors such as maintained navigational channels and thermal conductivity. Details regarding BOEM’s coordination with the New Jersey Department of Transportation regarding the feasibility of attaching export cables to the Route 72 bridge can be found in Section C.2.3.
1252-0003	Atlantic Shores appreciates BOEM's consideration of many (26) alternatives when preparing the Ocean Wind 1 DEIS and the screening criteria consistent with law and regulations technical and economic feasibility environmental impact and geographic considerations in the selection of the six (6) alternatives being carried forward for further analysis. However we have concerns with specific alternatives and the potential precedent these alternatives could set for offshore wind development. We strongly encourage BOEM to consider the consequences of these alternatives on current and future projects in the New Jersey and New	This EIS analyzes a reasonable range of alternatives framed by BOEM’s purpose and need and the definition from 40 CFR 1508.1(z) (“Reasonable alternatives means a reasonable range of alternatives that are technically and economically feasible...”). Details regarding BOEM’s purpose and need are provided in Section

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	York Bight and collectively how these alternatives could restrict BOEM's ability to reach the Biden Administration's offshore wind goals.	1.2.
Proposed Action / Project Design Envelope		
0007-0010	Security Terrorism War: When compared to onshore energy facilities hundreds of wind turbines and several substations located 10 miles or more from shore are more vulnerable to attack by terrorists and war time adversaries. The Coast Guard will not have the resources to protect this vast infrastructure and the Navy will be preoccupied with battles elsewhere. If developed how will this electric infrastructure on which we will be so dependent be secured and protected. It is not sufficient to say in the DEIS (Section 2.2) that such actions are unlikely (so was the attack on the World Trade Center in 2001) and impacts would be the same as outcomes already described for severe weather or seismic activity (short term natural events) therefore not further analyzed. I ask is it wise to have such a vital resource so vulnerable to deliberate destruction be relied upon so heavily. This issue needs to be studied and addressed in the DEIS from the perspective of national security. What is the backup system that would provide reliable and secure energy? Appendix L.3 of the DEIS says that a long term goal of the Proposed Action is to promote reliable safe and secure clean energy. This concern for security is further heightened when one looks at the cumulative impact from all the offshore wind projects proposed off the East Coast.	Terrorist attacks are identified in Section 2.2 as a non-routine event. Impacts from terrorist attacks would be similar to impacts from other non-routine events in that they would result in safety concerns and economic damage through loss in electricity transmission. Security in regard to utility system regulation is under the purview of BPU. Section 3.4.3.1 notes that in 2020, the generation mix of the PJM Interconnection, the regional grid that serves New Jersey, was approximately 40 percent natural gas, 34 percent nuclear, 19 percent coal, 3 percent wind, 2 percent hydroelectric, and 2 percent other sources, on an annual average basis (Monitoring Analytics 2021).
0984-0002	Figure S-1 Ocean Wind 1 Project The cables from any lease sight should be laid and maintained within the leaseholders site and subsequent lease sites until the cable can be redirected directly towards the site of landfall. Public outreach by BOEM during the lease sale process did not include the use of the sea floor outside of the lease areas. Areas of the sea floor to be disturbed or removed from use by other existing marine industries needed to be fully disclosed during the leasing process. The placement of cables along the ridgeline on the seafloor is disturbing essential fish habitat (EFH). The ridge line is where most fish congregate and travel. Underwater ridglines provide shelter from currents and is used as an area for predation by foraging fish. The placement of cables along the ridgeline as proposed will increase the impacts on marine life increase the disruption of fishing grounds and increase mitigation costs. The applicant needs to reconfigure the cable route to be inside their lease area to avoid interactions with other marine uses outside of their lease site and avoid EFH. The placement of cables along the ridgeline outside of the lease site is a [Bold: Major Impact.]	BOEM’s regulations at 30 CFR 585.200(b) state that a lease issued under this part confers on the lessee the right to one or more project easements without further competition for the purpose of installing gathering, transmission, and distribution cables; pipelines; and appurtenances on the OCS as necessary for the full enjoyment of the lease. Impacts of the proposed export cables on benthic resources, commercial fisheries and for-hire recreational fishing, and finfish, invertebrates, and EFH are analyzed in the Final EIS.
0984-0004	Three Maximum 275 kv Alternating current export cables The proposed cable area is not adequate to supply the name plate of the build out. Cable failure is	The description of the Proposed Action in Chapter 2 of the EIS includes a

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	imminent over the lifespan of the project. Cable replacement and removal needs to be included in the EIS. The continued placement and removal affects impacts identified within the applicants EIS. The continued "walking down the same path" increases the environmental impact exponentially. Mitigating the prolonged "same path" process is not included in the EIS. The placement of second and third cable routes during the lifespan of the development site needs to be included in the EIS. The replacement of a cable failures is a [Bold: Major Impact.]	description of cable installation, O&M, and removal (decommissioning). The Final EIS includes an expanded description of anticipated maintenance activities. The impacts of these activities are analyzed in Chapter 3 of the EIS.
0984-0005 & 0006	Final Burial Depth The lack of the applicant to finalize the burial depths in any realistic detail emphasizes the need to reject the EIS as being incomplete. The burial depths of the cables have overwhelming scientific proven effects on marine life. A incomplete EIS requires the applicant to resubmit the EIS and re-start the public comment period. The cable burial depth is a [Bold: Major Impact.] Inter-Array Cables A preliminary layout of inter-array cables is helpful to the applicants engineering department but is unacceptable in a EIS. The amount of scientific evidence on the impacts of cables on marine life is what an Environmental Impact Statement is to disclose. The public process is so the developer can gain knowledge about potential impacts that have not been foreseen. The applicants rush to produce this document and start the public process in advance of providing the required information necessary to provide comprehensive commentary can only be viewed as an attempt to intentionally reduce exposures of environmental impacts. The applicant clearly states that the application is incomplete in the EIS. BOEM needs to reject the EIS for being incomplete and require the applicant to resubmit the EIS and re-start the public comment period. The cable layout has is a [Bold: Major Impact.]	Consistent with BOEM's draft guidance,[1] Ocean Wind's COP proposes the Project using a PDE concept. This concept allows Ocean Wind to define and bracket proposed Project characteristics for environmental review and permitting while maintaining a reasonable degree of flexibility for selection and purchase of Project components. The EIS assesses the impacts of the PDE described in the Ocean Wind COP using the "maximum-case scenario." The maximum-case scenario is composed of each design parameter or combination of parameters that would result in the greatest impact for each physical, biological, and socioeconomic resource. If the COP is approved, the Project must be implemented within the defined PDE. If there are future changes to the Project design that are outside the PDE, additional review could be required.
0984-0038	Transfer stations outside of the Industrial Energy Development Zones and their impacts have also been left out of the public comment opportunities. The applicant and many of the offshore wind industry bidders along with BOEM have purposely left out transfer stations in their presentations and have cut them out of pictures shown. The placement of residences on these platforms and the	BOEM is unfamiliar with transfer stations outside of the Industrial Energy Development Zones; however, the description of the Proposed Action in Chapter 2 of the EIS includes a

[1] BOEM's draft guidance on the use of design envelopes in a COP is available at: https://www.boem.gov/sites/default/files/renewable-energy-program/Draft-Design-Envelope-Guidance.pdf.

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	need to run additional cables and utility lines to the individual stations is an impact that should have been documented and contained in scoping process prior to the draft EIS. The mere fact that BOEM and the developers have purposely omitted transfer stations is another reason to reject this application and deny the permit. They have not acted in good faith or within the scope necessary to achieve good will and public trust.	description the onshore substations with connections to the existing electrical grid. Export cables would be buried onshore until they reach the vicinity of the substation. Visual simulations of the onshore substations are provided in Volume III, Appendix L of the COP.
0984-0087	Sediment deposition impacts are known within the multiple scientific reports that can be used to do computer generated calculations. The applicant is aware of the major impacts that the maintenance of the cables require. The constant reburial process will have permanent [Bold: major impact]. The failure of the applicant to disclose such calculations within the EIS is an act in violation of public trust. The EIS should be rejected. The applicant does admit that the construction and development of industrial energy offshore site will contribute to climate change contrary to those whom are advocates for the industrialization. The statement within the application of not being able to do the calculations is an admission of failure to provide the required information within the application. The applicant did find the impacts to climate change of the energy industrialization of the Atlantic to be minor to moderate without the supporting documentation. This is unacceptable. If the applicant is found to be paying individuals or companies to advocate inclusive of multi-media campaigns the need for offshore wind turbine industrialization zones to reduce climate change the application should be denied on the premiss of violation of the public trust for misleading advertisements "Greenwashing". The United States Attorney General and the FCC should investigate the claims to the rate payers and the tax payers made by the industry as a whole.	Section 2.1.2.3.2 of the Draft EIS included a description of anticipated cable monitoring and maintenance activities, and an expanded description has been provided in the Final EIS. Cables would be monitored during operation and after major storm events. The impacts of these activities are analyzed in Chapter 3 of the EIS. The net energy gain from an offshore wind project is evident when looking at life cycle emissions, which, when harmonized across other generation technologies, comes out as one of the most efficient commercial-scale generator technologies. The emissions from construction would quickly be offset by the emissions avoided by the facility’s energy generation. Section 3.4 provides an analysis of air quality impacts during construction, O&M, and decommissioning.
0984-0113	The disposal of ammunition during at sea construction should be part of the EIS. BOEM's policy of permitting contractors of programs funded by a government agency is unacceptable. BOEM has a responsibility to safely remove and destroy ammunition found by recipients of federal funds and permits. A protocol needs to be contained in the EIS on how the applicant will dispose of the ammunition other than throwing it back in the water.	Site preparation activities include UXO/ MEC risk mitigation, as described in Section 2.1.2.2.1 of the Final EIS.
1012-0022	Regarding its use under NEPA the PDE requires that the parameter having the maximum impact for a given resource be used in the analysis. This is not specified now in the COP but if and when that identification is done and the PDE is the proposal it means that the BOEM is proposing an action that will have the	BOEM provides lessees, including Ocean Wind, the option to use the PDE approach. The PDE parameters and identification of which parameters are

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	worst environmental impact possible. Assuming the BOEM would never select this then it is proposing something that it will never choose which makes little sense.The BOEM needs to separate the PDE concept from the proposed action. The PDE may have some use to show a maximum impact and possibly avoid supplemental analyses but it should not be used as the proposal. They are two different things and the use of a PDE does not absolve the BOEM of presenting an actual proposal under NEPA rules. Further the PDE proposed thus far is not an envelope at all because it does not specify which parameter will be used to determine the maximum impact for a given resource. In addition vague terminology like "up to 200 turbines" does not create an envelope. The PDE stated also does not include key parameters like the plan for the northern portion of the lease area and the turbine power and drive type which are essential to analyzing maximum impacts. It also presents as options parameters that have already been decided through the State's project approval like the use of monopile foundations and Vesta-236 turbines.	relevant to the analysis for each resource section in Chapter 3 are provided in Appendix E of the Final EIS.
1116-0008	The DEIS has failed to ensure safety and protection of the environment and conservation of the natural resources of the outer Continental Shelf because no structural analysis of the Haliade wind turbines was done or reviewed in the DEIS. No offshore wind turbine that exists today can survive a Category 3 or greater Atlantic hurricane. The DEIS has failed to examine any safety or engineering issues with respect to the untested and unbuilt Haliade wind turbines planned for the Project and failed to take a hard look at the impact of oil and contaminant spills from the wind turbines.	Section 2.2, *Non-Routine Activities and Events*, of the Draft EIS described how WTGs are designed to sufficiently withstand storm events and actions that would be taken in the event of a spill or release.
1154-0002	With these points in mind in addition to the points we made in a letter dated today with our partners we urge you to consider the following as well: BOEM should require Ocean Wind I wind turbine obstruction lighting or FAA L-864 aviation lights which appear as red flashing strobe or pulsed obstruction lights to activate only with low passing aircraft in the evening hours after sunset. BOEM should require Ocean Wind to provide an AIS Automatic Identification Systems on turbines to allow for better navigation for recreational and commercial fisherman around and within wind farms. Ensure that there are responsible plans and policies for sustainably decommissioning transmission lines and turbines once they have surpassed their usefulness. Thank you for your careful consideration of our comments on this important DEIS.	Ocean Wind has indicated that it will implement ADLS on WTGs and equip select structures with strategically located AIS transponders, and the implementation of ADLS and AIS transponders is analyzed in the Final EIS. BOEM’s regulations at 30 CFR 585 and commercial Renewable Energy Lease OCS-A 0498 require that Ocean Wind remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the seafloor of all obstructions created by the proposed Project.
1188-0006	[Bold: Additional Terms and Conditions] The recommendations outlined in our	BOEM’s draft Guidelines for Mitigating

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	offshore wind energy policies referenced above should be reflected as terms and conditions for approval of the US Wind 1 project. We provided a separate comment letter on the draft Guidelines for Mitigating Impacts to Commercial and Recreational Fisheries. [Footnote 3: Available at https://www.mafmc.org/correspondence.] We support many of the mitigation measures recommended in that draft guidance. We recommend that all final mitigation guidelines be reflected in terms and conditions for BOEM's approval of the Ocean Wind 1 project. For example the project design envelope for Ocean Wind 1 includes burial depths of 4 to 6 feet for inter-array and substation interconnection cables. BOEM's draft fisheries mitigation guidelines recommend a minimum cable burial depth of 6 feet. Although the Councils have not endorsed a specific cable burial depth to minimize impacts to fisheries we strongly support the draft guidance recommending a minimum burial depth of 6 feet. We recommend that BOEM not approve any cable burial depths of less than 6 feet for US Wind 1 or any other wind projects.[Bold: Conclusion]We appreciate the opportunity to provide comments to ensure that issues of social and ecological importance are considered in the final EIS for Ocean Wind 1. We look forward to working with BOEM to ensure that wind development in our region minimizes impacts on the marine environment and can be developed in a manner that ensures coexistence with our fisheries.	Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR Part 585 recommend a minimum burial depth of 6 feet below the seabed where technically feasible. Thermal conductivity is a technical feasibility factor when determining target burial depth.
1234-0007	[Bold: Transmission] While we understand the goals and timelines laid out by the BOEM process there is still a lack of transparent information on power generation pricing and economic impacts. This information would help identify the number of turbines necessary to meet the capacity goal. It also could impact cabling site layout and many other possible issues including impacted habitat. Recent federal rulings also call the entire projects wind turbines into question. And this this question must be addressed before project approval. Current plans also call for separate transmission infrastructure for each project which should be negotiated to minimize the potential impact to commercial and recreational fishing grounds. Existing projects have already shown the problems that can arise when cables are only minimally buried. The need for deep cable burial suggests that a 6foot burial depth be maintained and micro-siting with fishers' input is required in order to build these projects with limited impacts on fishing. The most recent BOEM fisheries mitigation program call for a 6 foot burial but that is not represented in this COP/DEIS proposal. The COP proposes connecting the project to shore via three cables along two distinct cable routes one 72 miles and other 32 miles to reduce impacts to the onshore power grid. The EIS should explain why the use of multiple cables is necessary and	BOEM's purpose as stated in Section 1.2—to determine whether to approve, approve with modifications, or disapprove Ocean Wind's COP—is needed to fulfill BOEM's duties under the lease. The 1,100-MW solicitation and a corresponding OREC allowance of 4,851,489 MW-hours per year were awarded to Ocean Wind via BPU on June 21, 2019. A copy of the OREC award, which includes information regarding OREC prices and ratepayer impacts, is available at: https://www.njcleanenergy.com/files/file/6-21-19-8D.PDF. BOEM's regulations at 30 CFR 585.200(b) state that a lease issued under this part confers on the lessee the right to one or more project easements

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	acknowledge that the use of two cable routes greatly increases offshore impacts including habitat disturbance and modification as well as safety concerns for fisheries that use bottom tending mobile gear and cost to consumers. Also the project must remove cables. Leaving cables in place a s propose in section 3.8 in unacceptable to the GSSA. We appreciate the opportunity to provide these thoughts and concerns. We look forward to our organizations continued work with BOEM to ensure the needs of our fishing communities are considered and addressed.	without further competition for the purpose of installing gathering, transmission, and distribution cables; pipelines; and appurtenances on the OCS as necessary for the full enjoyment of the lease. Impacts of the proposed export cables on benthic resources, commercial fisheries and for-hire recreational fishing, and finfish, invertebrates, and EFH are analyzed in the Final EIS. Section 2.1.2.4 describes decommissioning activities, and that, per BOEM regulations, Ocean Wind would be required to remove all cables and clear the seafloor of all obstructions created by the proposed Project. Ocean Wind would need to obtain separate and subsequent approval from BOEM to retire in place any portion of the proposed Project. Approval of such activities would require compliance under NEPA and other federal statutes and implementing regulations.
1252-0002	To counteract climate change and to realize the economic opportunities forthcoming we encourage BOEM to consider two key things:1. to move expeditiously and deliberately in finalizing the Ocean Wind Environmental Impact Statement (EIS) and issuing a Record-of-Decision (ROD); and2. to select an alternative that maximizes energy potential from the lease sites and adopts reasonable mitigation measures obviating the need for significant changes in the design or layout of the Project. Reducing buildable lease acreage for Ocean Wind 1 is counter to the policies set forth by the Biden Administration the prior selection of these Lease Areas as fit for offshore wind development based on prior National Environmental Policy Act (NEPA) review and the use of carefully-crafted mitigation measures can address impacts to species and other protected resources as well as other marine users in an effective manner. Furthermore NEPA alternatives must be feasible and practical-which is not the case with alternatives that reduce buildable acreage jeopardizing the deliverability of the projects and their ability to meet state commitments. Atlantic Shores appreciates	After consideration of the public comments on the Draft EIS and analysis of those comments and other information (including the adverse and beneficial impacts of each alternative), BOEM has identified a preferred alternative in the Final EIS.

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	the rigorous environmental standards that BOEM and the cooperating agencies apply to offshore wind projects that has guided the formation of these projects' Project Design Envelopes (PDEs) and the siting decisions brought forward in the associated Construction and Operations Plans (COPs). We recommend that BOEM consider the same rigor to applying economic and climate benefits that these projects bring in the review of the alternatives carried forward for further analysis in the Ocean Wind 1 DEIS. Going forward Atlantic Shores encourages BOEM to recognize the collaborations that exist between developers like Orsted and us through both state and regional initiatives to ensure the collection and evaluation of sound science and data to support the socially and environmental responsible development of offshore wind. These efforts are also aimed at protecting biodiversity and promoting ocean co-use that align with BOEM's authority under the Outer Continental Shelf Lands Act (OCSLA) to authorize renewable energy activities.	
1259-0193	Operations & Maintenance Impacts Not Addressed. Of additional concern and importance is operation and maintenance of the turbines. BOEM and Ocean Wind 1 claim that the project will generate over 1100 MW of electricity. However this is based on the rated capacity of the wind turbine rather than the actual output. This information prevents a meaningful analysis of how much fossil fuel usage will actually be displaced by Ocean Wind 1 as the actual output of offshore turbines is around 50% or possibly 60%. For example three miles off Rhode Island the Block Island Wind Farm has five 6 MW turbines that are said to produce 30 MW of electricity. However they actually produced far less and on average less than 12.5 MW per month according to data from the Energy Information Administration from January 2017 to May 2022. [Footnote 195: Electricity data browser U.S. Energy Info. Admin. (last accessed Aug. 23 2022) https://www.eia.gov/electricity/data/ browser/#/plant/58035?freq=M&start=201612&end=202205&ctype=linechart &ltype=pin&columnchart=ELEC.PLANT.GEN.58035-ALL-ALL.M&linechart= ELEC.PLANT.CONS_TOT_BTU.58035-WND-WS.M~ELEC.PLANT.GEN.58035-WND-WS.M~ELEC.PLANT.CONS_EG_BTU. 58035-WND-WS.M&maptype=0&pin=.] This is approximately less than 42% actual generation. What is the proven reliability commitment of the energy to be produced by the proposed project? Transparency and accountability is critical as alternatives to fossil fuels are developed. What are the actual reliability factors over time as studies suggest larger turbines lose efficiency over time? In fact large turbines (12 MW and above) have been found to lose up to 4.5% efficiency per year which calls into question the reliability for energy production.	Section 1.2 of the Draft EIS noted that 1,100 MW is the nameplate capacity of the Project and the Ocean Wind's annual OREC allowance is 4,851,489 MW-hours per year per the 2019 award by BPU. Furthermore, footnote 1 in Table 2-1 notes that capacity factor plays a role in estimating the expected annual energy production, and for the Project would most likely vary between 45 percent and 63 percent.

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1259-0194	Moreover the turbines are also prone to fires [Footnote 196: Craig Richard Siemens Gamesa and Ørsted probe offshore wind turbine fire at Borssele I & II WindPower Monthly (last accessed Aug. 23 2022) https://www.windpowermonthly.com/article/1731732/siemens-gamesa- orsted-probe-offshore-wind-turbine-fire-borssele-i-ii.] which can make them dangerous to fishermen boaters first responders and commerce. This is also significant for those ships containing dangerous cargo as well as the lives of those servicing the turbines and those on the ships and boats. The DEIS fails to address these concerns regarding operations and maintenance. A carefully developed and implemented pilot project would enable an assessment of turbine reliability and potential risks for fishermen boaters and commerce.	Section 2.2 of the Final EIS has been updated to assess the potential for fires. In the Draft EIS, BOEM considered but dismissed from further consideration an alternative to build a much smaller pilot facility to confirm the benefits and impacts before building out the complete Project as proposed. Additional detail is provided in Table 2-3, *Alternatives Considered but not Analyzed in Detail*, in the Final EIS.
1267-0004	The Draft Environmental Impact Statement and the Construction and Operation Plan both mention the Joint Transition Bay/Vault which are needed for transition from the Ocean Export Cable to the Onshore Cables. The structure depicted in Figure 6.2. 1-4 of the Construction and Operation Plan is sixteen foot tall twelve foot wide and 70 feet long and would be placed at the landward end of the Horizontal Drill operations. During the drilling operations a dike or sheeting will be needed to control drilling fluids with the sixty foot long drill rig extending landward all not more than 29 to 35 feet from the adjacent dwellings. The Draft Environmental Impact Statement on Page 2-10 states "Installation of the Onshore export Cable would require up to a 50-foot wide construction corridor and up to a 30 foot wide permanent easement excluding landfall locations and cable splice locations. The EIS does not say what the exception is. The existing public Right-of-Way is fifty foot wide. The project is then limited to a maximum of fifty feet for all facilities and the required setback and safety areas required for the construction and operation of the proposed export cable. This fifty foot wide area may need to be reduced further to maintain access to the properties. Any encroachment onto the adjacent property owners is a taking (SCOTUS 458 U.S. 419(1982)). Obstructing access can also be seen as a taking.The Joint Transition Bay/Vault cannot be placed on the beach or in the dunes as its mass would reflect waves. Traffic Safety and property access concerns would limit the location of the Joint Transition Vault with the least harmful locations between Central Avenue and Asbury Avenues or Asbury Avenue and West Avenue. One Year will be needed for permanent utility relocation and one for the Directional Drill and Joint Transition Vault Construction. A discharge pipe to the Bay will be necessary for the discharge from the sump pump in the Joint Transition Vault. To allow water to remain in the vault will cause corrosion. Provision for cooling the vault will also be needed. None of which is discussed in the Draft	Figure 6.2.1-4 of the COP depicts the indicative onshore transmission cable splice vault, while Figure 6.2.2-5 depicts the indicative 275-kV TJB design. Section 2.1.2.2.2 of the Final EIS has been updated to provide an expanded discussion of TJB construction and to note that permanent easements are expected to be larger at splice vaults and TJB locations.

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	Environmental report or the Construction and Operations Plan.	
1267-0007	The Oyster Creek Export Cable is shown in Figure 2-1 at a scale of 1:3600 with the nearest structure 1900 feet from the proposed cables. The ratio of the measurement over the map scale is 5.2/10The Onshore Cable Route Options to BL England Substation (Ocean City) is shown on Fig 2-3 at a scale of 1:50000 with the nearest dwellings 29 feet from the proposed cable. The ratio of the measurement over the map scale is 5.8/10000. One Thousand fold less readable.	Figures 2-2 and 2-3 in Chapter 2 are scaled to depict the onshore Project components in one figure.
1275-0007	I heard at one of the public hearings that I attended that the analysis you completed was based on a smaller footprint of a Wind Turbine Generator or WTG. If that is the case you need to evaluate your findings across the board to account for the proper dimensions of these systems which are much larger stand taller and require larger/deeper sea floor support structures.	The Draft EIS analyzed the dimensions of the WTGs proposed in Ocean Wind's COP as the Proposed Action. The Proposed Action is described in Section 2.1.2 of the EIS.
1275-0012	[Bold: Backup system analysis]: has the EIS looked at the emissions from all the backup systems required to support the offshore wind farm to continue energy production when there is little no wind or too much wind? Will we need to build more traditional generation to support Ocean 1? Will they be coal diesel or other? What will the emissions look like for the backup systems and how do those backup systems compare if the project is not undertaken? Have you calculated shutdowns during a typical extreme storm event? Since storms are increasing in frequency and impact has that increase been incorporated in those calculations? At what wind velocity do these systems shut off? Have you looked at the frequency of those exceedances and added in the emissions calculations from backup systems?	Potential emissions from construction and operation of the Proposed Action and alternatives are analyzed in Section 3.4, *Air Quality*. Estimated emissions include those from diesel engines associated with backup power/emergency generators.
1278-0006	In fact I could not even find the general coordinates of the Wind Turbine Generator Area that forms a rough rectangle (4 corners) as shown on the Executive Summary S-3 in the DEIS. Obviously any DEIS that does not include even the rough coordinates of the primary wind farm area is deficient. I would think that would be the first and most important information in a DEIS. Was this an oversight?	Section 1 of the Draft EIS noted that the Project is sited 15 miles southeast of Atlantic City, New Jersey, within the area of Renewable Energy Lease Number OCS-A 0498. Appendix G of the COP provides coordinates for the WTGs and OSS.
1281-0006	[Bold: NEPA AND BOEM'S OWN MISSION STATEMENT AND RULES AND REGULATIONS ENACTED THEREUNDER REQUIRE A FAR MORE COMPREHENSIVE COST BENEFIT ANALYSIS OF ENVIRONMENTAL AND ECONOMIC RISKS WITH DEFENSIBLE CALCULATIONS ARISING THEREUNDER.]As per comments rendered at the virtual hearing conducted as to the within proposal of "Ocean Wind 1" the Draft Environmental Impact	Impacts on commercial fishing and for-hire recreational fisheries have been analyzed and were described in Section 3.9 of the Draft EIS. Chapter 3 of the Draft EIS provided an analysis of the direct, indirect, and

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	Statement contains woefully inefficient calculations or in many instances not even references to the vast economic and environmental value of the tracks of ocean involved the commercial and recreational fisheries and indeed the value of the ocean environment and certain species in and of themselves. Such a comprehensive scientific cost benefit analysis is required under NEPA as well as BOEM's own Mission Statement. Similarly the DEIS does not include the previously referenced NEPA valuation and the potential diminution of value in cumulative and indirect impacts of the project.Again as I have argued previously at various BOEM related forums the value of the fisheries from an environmental standpoint and simply as a current and future life generating food source for future generations has been seriously discounted if not totally ignored. The statutory outlines enacted under the National Environmental Policy Act (NEPA) and BOEM's own Rules and Regulations require such an economic analysis. The current DEIS contains a paucity of such information and barely attempts calculations necessary to reference the vast risks involved in the current proposals and collateral damage and quantifiable defensible true values associated therewith. As difficult as this process might be a comprehensive evaluation process must be engaged in. This area of valuable ocean eco-system along with its current value a cost benefit analysis of various risks to fisheries our commercial and recreational fishing industry the values of species themselves our tourism industry and the impact upon the shore and shipping all should be factored into such assessments and conclusions. Such an evaluative cost benefit analysis of the cumulative and indirect impacts the various risks and current values of the eco-system and the species of fishes involved is an essential undertaking in order to appropriately consider the within narrow yet massive proposal along with the other eleven (11) other projects proposed off the New Jersey/New York coastline. Additionally as per testimony rendered on the virtual record the current DEIS factually ignores the inevitable impact from at least one devastating hurricane or storm event during the construction operation and dismantling/decommissioning phase of even one of these gigantic industrial projects.Absent such a study I would again urge BOEM to reconsider the current proposal as configured. I would respectfully urge BOEM thoroughly to consider the numerous reasonable alternatives including but not limited to more readily achievable already scientifically vetted faster and safer onshore land-based energy alternatives. In the rush to judgment and zeal in fueling the non-scientific rubber stamp of the within windfarm project I fear that this proposal if granted even with minor modifications will once again run the risk of making the precious ocean off the New Jersey Shore an industrial pollution generating dumping ground.	cumulative impacts of the proposed Project. Section 2.2, *Non-Routine Activities and Events*, of the Final EIS describes how WTGs are designed to sufficiently withstand severe storm events. BOEM’s regulations require BOEM to analyze Ocean Wind’s proposal to build a commercial-scale wind energy facility on the Lease Area.

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TRANS-0003-0004	Construction and operations of Ocean Wind 1 will require ships that are specifically suited for these purposes but no such vessels have been built in the U.S. to date. In fact 27 special ships will be needed to be built to support offshore wind in New Jersey. Given these requirements and production constraints how can Ocean Wind 1 possibly meet the timeline that's been proposed in its COP.	Ocean Wind is not required to use vessels built in the U.S. to support the construction, O&M, and decommissioning of the proposed Project. Chapter 2, Section 2.1.2.2.3, describes how the Project would make use of both construction and support vessels.
TRANS-0010-0002	A delay in the project is not in our interest. Therefore to the extent possible we ask BOEM to work with the project to incorporate the minor relocation of the substation to the location preferred by the township the project and the current property owners and ongoing environmental review without causing an impact to the project schedule. The change in location is only a matter of approximately 500 feet. The township does not see any environmental impact by permitting a relatively limited change to the substation location. In fact there appears to be less environmental impact including less wetlands impact at the new proposed site. We are confident that without regulatory hurdles these changes could be accommodated without significant delay to the overall project.	Ocean Wind submitted an updated COP to BOEM on October 14, 2022, which included the shift of the BL England substation approximately 500 feet northwest within the same parcel. The description of the Proposed Action and impact analysis in has been updated in the Final EIS.
TRANS-0069-0005	How is moving forward with such large scale industrial development with all these identified uncertainties as well as the major and moderate impacts identified in the DEIS responsible and reasonable. There needs to be more transparency and due process. It's estimated that facilities will last 20 to 25 years in the harsh offshore conditions. What is the decommissioning plan for this project. There are clearly environmental impacts that will be associated with decommissioning when will decommissioning get assessed and considered in this whole review process.	Section 2.1.2.4 of the Final EIS describes decommissioning of the proposed Project. The conceptual decommissioning plan, as proposed by Ocean Wind, is analyzed in the Final EIS. BOEM would require Ocean Wind to submit a decommissioning application for technical and environmental review.
TRANS-0069-0008	In addition there is much focus that needs to be made overall on energy waste and the alternatives. How is energy waste being addressed by the Ocean Wind 1 project. According to the Energy Information Administration or EIA 66 percent of the primary energy used to create electricity is wasted by the time the electricity arrives at the customer meter. No matter what energy is created so much is wasted. Offshore wind is no different as a name plate energy promise is not what will reach customers. Can we need less energy generating facilities and less environmental impacts by focusing and reducing waste and improving efficiency. In many cases efficiency investments are the cheapest way to control electricity costs and needs.	Section 1.2 of the Final EIS notes that 1,100 MW is the nameplate capacity of the Project and the Ocean Wind's annual OREC allowance is 4,851,489 MW-hours per year per the 2019 award by BPU. Furthermore, footnote 1 in Table 2-1 notes that capacity factor plays a role in estimating the expected annual energy production, and for the Project would most likely vary between 45 percent and 63 percent.

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Alternatives Considered but Not Analyzed		
1048-0008	I also am shocked that you would consider using old technology- there are floating turbines that can be placed further out do not blast the sea bed! Sea bed blasting will be detrimental to the ocean ecosystem and marine mammals! I ourpose the ide of floating turbines if this project moves foward AND at minimal push this back into the ocean as we are no different then the folks in the Hampton's- you sited adverse visual impact on the scenic water shed! There are no other projects such as this using this gigantic turbines in close proximity to thriving coastal communities!	Alternative wind turbine foundations were considered by Ocean Wind, but were not suitable for development of the Project due to local site conditions as well as technical and supply chain considerations. BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Renewable Energy Lease Number OCS-A 0498. Additional detail is provided in Table 2-3, *Alternatives Considered but not Analyzed in Detail*.
1259-0003	The Draft EIS fails to consider a true No Action Alternative which would focus on energy-use reduction through conservation and efficiency land-based renewables and improvements to transmission nor a pilot-sized alternative to the massive industrial complex proposed.	BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Lease Area.
Relocate Project Outside the Lease Area		
0658-0008	Advocate for a superior alternative gov't approved Hudson South Call Area at 30-57 mi out will produce MORE WIND & be SAFER for our marine life and recreational visitors.	In the Draft EIS (Chapter 2, Table 2-3), BOEM considered but dismissed from further consideration alternatives for alternate locations for the wind energy facility outside of the Lease Area. Additional information regarding the feasibility of the Great Egg Harbor inlet export cable route has been added to the Final EIS in Appendix C. BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Lease Area. This alternative would effectively be the same as selecting the No Action Alternative.
1048-0010	Consider the Hudson south site as an alternative compromise to elucidate some of the adverse impacts this will have both on the whales and the coastal communities irises- but also co sister floating turbines as a replacement for this already antiquated technology.	
1183-0002	I respectfully request that strong consideration is given to Hudson South Call Area - already approved by the federal government for wind turbines as a more appropriate location for a wind farm of this magnitude. The proposed plan is the most dense tallest and closest wind farm in the world.	
1187-0001	[Italics: The DEIS Does Not Analyze Relocation Outside the Lease Area] Another alternative is listed as "considered by not analyzed in detail": moving the project further offshore. Moving the wind energy facility further offshore would mitigate its visual impact on the ocean shoreline beach and dune areas as well as the seascapes with national state or local designations listed in Table 3.20-4 which include the Ocean City Boardwalk Wonderland Pier and Ocean City's beaches jetties and piers. All of these assets are designated as high-sensitivity	

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	seascapes areas and as such are "highly vulnerable to the type of change proposed distinctive and highly valued by residents and visitors." DEIS page 3.20-6 The DEIS indicates that BOEM's regulations require it to analyze the proposal to build within the lease area. By failing to evaluate the degree to which the negative impacts of the proximity of this project to Ocean City could be mitigated or eliminated through an extension or modification of the lease area BOEM tacitly accepts the negative impacts as inevitable. BOEM's DEIS cannot be considered to be complete until BOEM has considered the benefits of moving this project further out to sea and balancing those benefits against the negative impact of having the WTG's offshore of Ocean City for 25 years.[Underlined: Conclusion] The construction of the Ocean Wind 1 project is treated in the DEIS as a foregone conclusion regardless of its impact on Ocean City and its natural resources. Ocean City requests that BOEM perform a comprehensive evaluation of the utilization of the Great Egg Harbor route between the WTGs and BL England and a comprehensive evaluation of the benefits of shifting the entire project further away from Ocean City's shoreline.	
Pilot Project		
TRANS-0042-0002	I also repeat Clean Ocean Action's request for a pilot project off the New Jersey coast before you rush ahead with industrial scale offshore wind development off our shores	In the Draft EIS, BOEM considered but dismissed from further consideration an alternative to build a much smaller pilot facility to confirm the benefits and impacts before building out the complete Project as proposed. Additional detail is provided in Table 2-3, *Alternatives Considered but not Analyzed in Detail*, in the Final EIS.
1259-0015	COA urges BOEM to select an alternative not considered by the Draft EIS- "Alternative F"-involving a pilot OSW off the NJ coast which will avoid the risks and harms posed by Ocean Wind 1 as currently proposed to NJ and the region.	
1259-0013	Moreover there is no demonstrated need to rush straight into industrial-scale OSW off the NJ coast without a local pilot project.	
1259-0023	In light of the foregoing reasons especially the lack of due process and lack of analysis concerning cumulative impacts to which this project will contribute Clean Ocean Action urges BOEM to pursue a pilot-scale offshore wind development project before allowing Ocean Wind 1 to move forward at the proposed industrial scale.	
1259-0028	Finally no reasonable pilot project has been conducted to make meaningful comparisons for the large-scale offshore wind development of the Proposed Action. Despite assurances that data from OSW in Europe or the five-turbine project off Rhode Island can justify the safety of Ocean Wind 1 near New Jersey these claims are not appropriate for reasons expanded upon below in Section 2. Given the scientific uncertainty lack of transparency and extensive onshore and offshore impacts of Ocean Wind 1 as well as the size scope and scale of this	

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	new industrial development of a public resource Clean Ocean Action recommends BOEM consider a new alternative: Alternative "F" a pilot-scale sized project. A pilot project would allow the information needed to understand the risks and impacts of this development on resources and communities before large-scale development such as the Proposed Action would occur.	
1243-0004b	During all three public hearings on Ocean Wind 1 many commenters requested that the development of Ocean Wind 1 proceed slowly with a pilot project first before constructing all 98 of the proposed turbines. Responses from BOEM have stated that there are 2 pilot studies being conducted now one off VA (Dominion Energy) and the other off RI (Block Island Sound) but the BOEM responses fail to state the failures being experienced at the Block Island Sound site where only 1 of the 5 turbines (6.5 MG) is operable since the transmission cable was incorrectly installed and became unearthed from the sea bottom. The RI rate payers are now having to finance the correct installation of the main transmission cable at considerable cost. I have heard of no problems with the Dominion Energy site perhaps they have learned from the catastrophe that occurred off Block Island.	
1259-0197	Additionally BOEM failed to consider an "Alternative F" whereby a pilot OSW project is performed off the New Jersey coast before moving ahead with industrial scale development which unnecessarily forecloses the most effective path for resolving the many outstanding environmental logistical and economic unknowns that continue to persist with respect to OSW off NJ. Both of these omissions in BOEM's Alternatives analysis must be fully incorporated and addressed in the Final Environmental Impact Statement ("Final EIS") for Ocean Wind 1.	
1259-0030	The Draft EIS wrongfully fails to consider a pilot project. Clean Ocean Action suggests an "Alternative F" that would require a pilot offshore wind energy project to be conducted off the New Jersey coast before rushing into industrial-scale development. This is a reasonable alternative and should be fully evaluated in the DEIS. Experience with this new industry is lacking not only in New Jersey and New York but across the United States as well. Thus there are simply too many remaining unknowns associated with offshore wind development of this scale in this area. The cost and economic viability of offshore wind energy for example is actively undergoing much scrutiny around the country [Footnote 13: Sarah Vogelsong What's 'reasonable and prudent' when it comes to Dominion offshore wind project's costs? Virginia Mercury (May 16 2022) https://www.virginiamercury.com/2022/05/16/whats-reasonable-and-prudent- when-it-comes-to-dominion-offshore-wind-projects-costs/.] while	In the Draft EIS, BOEM considered but dismissed from further consideration an alternative to build a much smaller pilot facility to confirm the benefits and impacts before building out the complete Project as proposed. Additional detail is provided in Table 2-3, *Alternatives Considered but not Analyzed in Detail*, in the Final EIS. The Final EIS assesses impacts that could result from construction, O&M, and conceptual decommissioning of the proposed Project using reliable existing data and resources in accordance with 40

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	uncertainty also continues to abound with respect to the degree to which offshore wind-related development in coastal areas will exacerbate local sea level rise. One of the main reasons why so much remains unknown about Ocean Wind 1's true environmental and economic impacts is because the project is being justified based on studies from the wind farm at Block Island Rhode Island and others from European projects. However neither of these are appropriate comparisons for offshore wind energy development off the New Jersey coast. These projects and their local environments are not comparable to the Ocean Wind 1 lease site or the NewYork/New Jersey Bight more generally. In fact recently studies on OSW development in the Mediterranean Sea have observed that North Sea or Baltic Sea OSW may not be comparable due to changes in ocean bathymetry and other factors. [Footnote 14: See Josep Lloret et al. Unravelling the ecological impacts of large-scale offshore wind farms in the Mediterranean Sea 824 Science of the Total Environment 153803 (2022) https://www.sciencedirect.com/science/article/pii/S0048969722008956.] This supports COA's opinion that the NY-NJ OSW region must be viewed as its own entity and studied more thoroughly. To start the waters of the North Sea and Northern Europe do not have nearly as much variety of marine mammals including the critically endangered North Atlantic Right Whale. Second New Jersey has warmer waters than Northern Europe or Rhode Island ("RI") and turbines placed off the NJ coast will realistically need to be able to withstand Category 3 or Category 4 hurricanes. Offshore turbines have not had to withstand weather events of that magnitude in Europe or Rhode Island. Similarly studies from Europe or Block Island are inapt because they involve different technology than the type that will be used by Ocean Wind 1. Block Island Wind Farm for example uses six (6) megawatt ("MW") turbines with brace-jacket foundations which plainly contrast with the twelve (12) MW turbines using monopile foundations expected to be found at Ocean Wind 1. BOEM must recognize that a pilot project offers value for more than matters of quantitative scientific observation-which is why the logistic importance of a local pilot project cannot be overstated. Siting five 6-MW turbines off the coast of Rhode Island for the wind farm at Block Island is hardly the same as siting nearly 100 12-MW turbines in the waters off New Jersey which include vital shipping lanes for one of the busiest ports in the country. Studies such as the one by Strobach et al. (2018) on the impacts of inland terrain on offshore wind development in Maryland for example reconfirm that a lot of factors remain unknown and need to be investigated in greater depth and detail in the proposed	CFR 1502.23. Section 2.2, *Non-Routine Activities and Events*, of the Final EIS describes how WTGs are designed to sufficiently withstand severe storm events. Impacts of the proposed Project on navigation and vessel traffic are described in Section 3.6 of the Final EIS.

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	WEA and this Project. While there are definitely some aspects of the Rhode Island process that would benefit the development of offshore wind near NJ such as the creation of a Special Area Management Plan before completing the BOEM review process neither it nor the European studies are appropriate scientific or logistical stand-ins for New Jersey's uniquely busy coast. A small local pilot project that uses the proposed technology and can be robustly evaluated before during and after construction is the only way to address the shortcomings identified above and begin the path toward responsible development of offshore wind energy in these waters through a process that reflects fair responsible and good governance.	
0948-0002a	POINT IIPRIOR TO ANY FURTHER REVIEW AS TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT A COMPREHENSIVE SCIENTIFICALLY DEFENSIBLE PILOT PROJECT SHOULD BE PROPOSED AND IMPLEMENTED WITH THOROUGH SCIENTIFIC REVIEW IN THE VETTING PROCESS. If BOEM elects to proceed with the current far too limited comment period available I would again respectfully request that the Draft Environmental Impact Statement be redirected toward the implementation of a useful pilot project from which numerous scientific economic studies could also be generated. Such a pilot project would then facilitate comprehensive review scientific scrutiny and a true economic cost benefit analysis of the more extensive project proposed and the eleven (11) other pending projects off the New Jersey Coast. While wind power and perhaps even some proposals entailing offshore wind energy combined with onshore projects may ultimately become part of a vital environmentally acceptable component and aspect of New Jersey and the nation's energy needs the within project simply is too much too fast! (emphasis added). As commented upon during the virtual public hearings there does not exist a full reliable and realistic pilot project from which accurate scientific conclusions could realistically be drawn. The mere five (5) windmills of less dimensions existing off the Rhode Island Coast in no way adequately can compare to the large industrial project of ninety-eight (98) turbines as tall as New York's Chrysler Building which are now proposed for industrialization just off the Coast of Atlantic City. With blades taller even than the Statue of Liberty the turbines for these ninety-eight (98) turbines proposed for Ocean Wind 1 must be reviewed with a realistic scientific eye to take into account the cumulative impact of the other nine hundred (900) turbines also currently pending for construction off the Coast of New Jersey. Not only is the Rhode Island site inadequate for scientific review and transferable studies of impact so too the European sites referred to	BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Lease Area. In the Draft EIS, BOEM considered but dismissed from further consideration an alternative to build a much smaller pilot facility to confirm the benefits and impacts before building out the complete Project as proposed. Additional detail is provided in Table 2-3, *Alternatives Considered but not Analyzed in Detail*, in the Final EIS.

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	in the Orsted and PSE&G's industrial proposal are not constructed in such a valuable biologically diverse economically vital section as the magnificent Coastal waters off the State of New Jersey. In no way does the diversity of marine life the wealth of commercial and recreational fishing industries the vast economic wealth of tourism and the precious food sources and ocean areas which currently have threatened species all off of New Jersey's Coast compare to what the applicant has wrongfully characterized as existing "Pitot Projects." Besides the above referenced numerous vital concerns and inadequately studied impacts the Ocean Wind 1 project is proposed for construction in one of the most vulnerable areas of massive hurricane and storm events as exists in the world. Inevitable pollution generating impacts will take place during the construction operation and decommissioning stages of this gigantic industrial project proposed along with the currently pending eleven (11) additional projects off our most valuable New Jersey Coast. Accordingly a true and exact pilot project must be envisioned by all "Stakeholders" to learn of the numerous unexplored and even unknown impacts of the current proposal. Comprehensive independent scientifically proven review and research are critical. This project should technically receive a "no further action" option unless and until an adequate pilot project has been envisioned proposed and subjected to prereview and scientific scrutiny.	
1281-0002	[Bold: PRIOR TO ANY FURTHER REVIEW AS TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT A COMPREHENSIVE SCIENTIFICALLY DEFENSIBLE PILOT PROJECT SHOULD BE PROPOSED AND IMPLEMENTED WITH THOROUGH SCIENTIFIC REVIEW IN THE VETTING PROCESS.]If BOEM elects to proceed with the current far too limited comment period available I would again respectfully request that the Draft Environmental Impact Statement be redirected toward the implementation of a useful pilot project from which numerous scientific economic studies could also be generated. Such a pilot project would then facilitate comprehensive review scientific scrutiny and a true economic cost benefit analysis of the more extensive project proposed and the eleven (11) other pending projects off the New Jersey Coast. While wind power and perhaps even some proposals entailing offshore wind energy combined with onshore projects may ultimately become part of a vital environmentally acceptable component and aspect of New Jersey and the nation's energy needs the within project simply is [Underlined: too much too fast!] (emphasis added)As commented upon during the virtual public hearings	BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Lease Area. In the Draft EIS, BOEM considered but dismissed from further consideration an alternative to build a much smaller pilot facility to confirm the benefits and impacts before building out the complete Project as proposed. Additional detail is provided in Table 2-3, *Alternatives Considered but not Analyzed in Detail*, in the Final EIS.

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	there does not exist a full reliable and realistic pilot project from which accurate scientific conclusions could realistically be drawn. The mere five (5) windmills of less dimensions existing off the Rhode Island Coast in no way adequately can compare to the large industrial project of ninety-eight (98) turbines as tall as New York's Chrysler Building which are now proposed for industrialization just off the Coast of Atlantic City. With blades taller even than the Statue of Liberty the turbines for these ninety-eight (98) turbines proposed for Ocean Wind 1 must be reviewed with a realistic scientific eye to take into account the cumulative impact of the other nine hundred (900) turbines also currently pending for construction off the Coast of New Jersey. Not only is the Rhode Island site inadequate for scientific review and transferable studies of impact so too the European sites referred to in the Orsted and PSE&G's industrial proposal are not constructed in such a valuable biologically diverse economically vital section as the magnificent Coastal waters off the State of New Jersey. In no way does the diversity of marine life the wealth of commercial and recreational fishing industries the vast economic wealth of tourism and the precious food sources and ocean areas which currently have threatened species all off of New Jersey's Coast compare to what the applicant has wrongfully characterized as existing "Pitot Projects." Besides the above referenced numerous vital concerns and inadequately studied impacts the Ocean Wind 1 project is proposed for construction in one of the most vulnerable areas of massive hurricane and storm events as exists in the world. Inevitable pollution generating impacts will take place during the construction operation and decommissioning stages of this gigantic industrial project proposed along with the currently pending eleven (11) additional projects off our most valuable New Jersey Coast. Accordingly a true and exact pilot project must be envisioned by all "Stakeholders" to learn of the numerous unexplored and even unknown impacts of the current proposal. Comprehensive independent scientifically proven review and research are critical. This project should technically receive a "no further action" option unless and until an adequate pilot project has been envisioned proposed and subjected to pre review and scientific scrutiny.	

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Great Egg Harbor Inlet Alternate Route		
1187-0001	DEIS page 2-35. BOEM has ignored the requests to consider the alternative Egg Harbor inlet route for reasons which are specious despite the undisputed facts that the preferred path directly impacts Ocean City's beaches and wetlands and that this impact would be eliminated but for Ocean Wind's refusal to use the Great Egg Harbor inlet for the export cable route. Two of the conditions cited as insurmountable in Great Egg Harbor inlet exist in Barnegat Bay yet Ocean Wind has devised means of dealing with them. First Ocean Wind claims that sediments in the Great Egg Harbor inlet are dynamic requiring additional cable protection such as cable mattresses which would result in additional impacts on natural resources. Ocean City acknowledges that the Great Egg Harbor inlet contains dynamic sediments. The same is true of Barnegat Bay which tradition says was originally named "Barendegat" or "inlet of the Breakers" in recognition of its shoals and breakers [Footnote 1: Lloyd John Baily. "Eighteen Miles of History on Long Beach Island." p. 42. 1994 Down The Shore Published and The SandPaper Inc.]. It is to be expected that additional cable protection would be required in these inland waterways. Ocean Wind deems this condition which could require additional cable protection such as cable mattresses to be fatal to the use of the Great Egg Harbor inlet route. Yet in its plan to cross through the Barnegat Bay for the Oyster Creek project Ocean Wind proposes to develop a Cable Burial Risk Assessment and "in the event cables cannot achieve proper burial depths or if cables would cross existing infrastructure" Ocean Wind has options including (1) rock placement (2) concrete mattress placement (3) frond mattress placement (4) rock bags or (5) seabed spacers. ([Italics: emphasis added]). Page 2-14 BOEM should question why the use of cable mattress is unacceptable in Great Egg Harbor inlet but acceptable in Barnegat Bay.	Alternatives to onshore export cable routes, including use of Great Egg Harbor Inlet for the export cable route, were considered but dismissed from further consideration, as discussed in Table 2-3, *Alternatives Considered but not Analyzed in Detail*, in the Final EIS. Additional information regarding the feasibility of the Great Egg Harbor inlet export cable route has been added to the Final EIS in Appendix C.
1187-0001	Ocean Wind's second basis for rejecting the Egg Harbor inlet route is that the access to the inlet by other vessels would be restricted during construction. Construction in Barnegat Bay would similarly interfere with normal navigation yet this is not a disqualifying problem for the preferred route to Oyster Creek. Further elsewhere in the DEIS this concern is addressed and dismissed: Anchoring vessels used in the construction of offshore wind energy projects would pose a navigational hazard to fishing vessels. All impacts would be localized (within a few hundred meters of anchored vessel) and temporary (hours to days in duration). Although anchoring impacts would occur primarily during project construction some impacts could also occur during O&M and conceptual decommissioning. Therefore the adverse effects of offshore wind	

Comment No.	Comment	Response
	energy-related anchoring on commercial fisheries and for-hire recreational fishing are expected to be long term and minor though periodic in nature. (emphasis added) DEIS page 3.9-29 Additionally restriction of other vessels during construction in this wide inlet does not equate to a closure of the inlet. Navigation would continue during the temporary period of construction as it did during the construction of the Ocean City-Longport Bridge in and around 2002. By contrast the preferred route would traverse a much much narrower but equally heavily traveled Peck's Bay. The impact on navigation would arguably be much greater in this preferred bay crossing. The reduced distance between the WTGs and BL England utilizing the preferred route likely translates to lower costs for Ocean Wind however it requires disturbance of the barrier island beach and wetlands. This disturbance would be eliminated by utilizing the Great Egg Harbor route. A comprehensive evaluation comparing the preferred route to the Great Egg Harbor inlet route is necessary.	
1187-0001	The third and final reason listed in the DEIS for abandoning the Egg Harbor inlet route is the existence of an USACE borrow area at the mouth of the inlet. The US Army Corps of Engineers borrow area is on the Ocean City shoreline of this wide inlet. There has been no analysis of whether this inlet could be used as a path between the WTGs and BL England without impacting the borrow area through strategic placement of the cable. It should be noted that this allegedly disqualifying condition did not prevent the 2000 to 2002 project for the reconstruction of the Ocean City-Longport bridge which spans the Great Egg Harbor inlet. Ocean City objects to BOEM's apparent acceptance of Ocean Wind's excuses for eliminating the Great Egg Harbor inlet route. BOEM's DEIS cannot be considered to be complete until BOEM has evaluated the Great Egg Harbor inlet route.	

O.6.3 Air Quality

Table O.6.3-1 Responses to Comments on Air Quality

Comment No.	Comment	Response
0007-0012	Impact on Global Climate Change: The DEIS makes it clear in Appendix L.3 that one of the objectives of the Proposed Action is to combat climate change. The DEIS further makes it clear that the Proposed Action in itself will have negligible impact on global climate change. I concur. When compared to the increase in global emissions of greenhouse gases resulting from expanded use of coal by China and India and more recently a return to coal in Europe the Proposed Action will have no noticeable impact on climate change. When BOEM addressed impact on climate change did they take into consideration the increased use of coal by several European countries and by China and India which is likely to be both short and long term. Such use has eliminated all the gains in the U.S. as it switched from coal to natural gas for electric generation. Globally there are increases in greenhouse gas emissions that far exceed any small reductions resulting from the Proposed Action. Increased use of coal oil natural gas and other fossil fuels short term and continued long term use of these fossil fuels by China India and other countries should be considered as part of Foreseeable Impacts for each of the environmental issues and scenarios analyzed in the DEIS for the Proposed Action and for the No Action Alternative.	BOEM expects the Proposed Action to lead to reductions in fossil fuel usage in the U.S. The Proposed Action would not affect fossil fuel use in other countries. Any increased use of fossil fuels in other countries would add to the overall human impacts on climate.
0222-0011	I have yet to see a [Bold: definitive statement on the Carbon Neutrality] of the project?	The Project over its lifetime would be carbon negative because the reduction in carbon emissions from fossil fuels would be greater than the increases from Project construction, operation, and decommissioning.
0658-0004	Unsupported Science & Math. Paltry climate impact. Alternative energy benefits of this destructive project will likely delay future sea level rise by about 9 days in 2100.	BOEM concurs that the Project would have a beneficial impact, even if small, on global climate change.
0658-0007	Turbines reduce shore breezes & increase air temperatures in surrounding areas.	Wind turbines extract kinetic energy from the atmosphere and thus can reduce wind speeds downwind of the turbine. Wind turbines increase vertical mixing in the atmosphere and thus can increase (or decrease) air temperatures downwind depending on local meteorological

Comment No.	Comment	Response
		conditions. However, these effects dissipate with distance downwind. Because of the distance of the Project from land (approximately 15 miles), substantial effects on wind speed and temperature are unlikely to occur over land.
0837-0003	"In reference to the Project Ocean Wind 1 has been awarded a commercial Renewable Energy Lease OCS-A-0498 for the purpose of an offshore wind energy farm. The legal basis for the development of this Project is cited as Executive Order (EO) 14004 [Italics: Tackling the Climate Crisis at Home and Abroad]. One of the primary goals of EO 14008 is to conserve our lands waters and biodiversity through clean energy technologies and infrastructure. While wind energy is presented to the general public as clean energy the details of the Project present a counterargument to the basic tenets of EO 14008. ""Each WTG will contain approximately 1585 gallons (6000 liters) of transformer oil and 146 gallons (553 liters) of general oil (for hydraulics and gearboxes). Use of other chemicals would include diesel fuel coolants/refrigerants grease paints and sulfur hexafluoride. COP Volume I Section 8.1 provides additional details related to proposed chemicals and their anticipated volumes (Ocean Wind 2022)"" [Footnote 2: BOEM. Ocean Wind 1: Draft EIS 2-10.] Spillage of oils in the WTGs can occur during transportation construction maintenance and decommissioning. In addition to the oils WTGs contain sulfur hexafluoride (SF6). This is noteworthy because the Environmental Protection Agency (EPA) identifies SF6 as the [Italics: most potent] greenhouse gas known to date. ""Over a 100-year period SF6 is 22800 times more effective at trapping infrared radiation and an equivalent amount of carbon dioxide (CO2). SF6 is also a very stable chemical with an atmospheric lifetime of 3200 years. As the gas is emitted it accumulates in the atmosphere in an essentially un-degraded state for many centuries. Thus a relatively small amount of SF6 can have a significant impact on global climate change.""[Footnote 3: United States Environmental Protection Agency (EPA) ""Sulfur Hexafluoride (SF6) Basics"" accessed August 2022 https://www.epa.gov/eps-partnership/sulfur-hexafluoride-sf6-basics.] Further the EPA addresses the circumstances that could result in a spillage of SF6. ""SF6 containing equipment is designed to avoid emitting any of this gas into the atmosphere. However SF6 gas can inadvertently escape into the atmosphere as leaks develop during various stages of the equipment's lifecycle. In some cases significant leaks can occur from aging equipment. Gas can be	The EIS analyzes the potential impacts of chemical spills and sulfur hexafluoride. Section 3.21, *Water Quality*, discusses chemical spills and Section 3.4, *Air Quality*, discusses sulfur hexafluoride leakage.

Comment No.	Comment	Response
	released at the time of equipment manufacturing installation maintenance and services and de-commissioning."" [Footnote 4: EPA ""Sulfur Hexaflouride""] Due to the scale of installing maintaining and decommissioning 1370 WTGs the likelihood of spillage is a credible threat to the environment. Moreover this example is just one viable danger raised by the instant Project. All projects will require offshore substations offshore export cables offshore substations interconnector cables onshore substations onshore export cables and onshore interconnector cables. The combination of these activities will impact the plethora of resources discussed within the DEIS such as Marine Mammals Birds Vessel Navigation Commercial Fisheries Birds and Tourism."	
0984-0011	Table S-2 Summary and Comparison of Impacts Among Alternatives. [Bold: That need Mitigation Measures] 3.4 Air Quality The manufacturing production placement maintenance and decommissioning all has a direct impact and indirect impact on air quality that needs to be captured in unrelated carbon credits by the applicant. The intentional "Greenwashing" by the applicant and quite frankly by BOEM in the analysis of the application is with intent to fraud the public. A criminal investigation by the US Attourney General should be initiated. The applicant and BOEM should be held accountable. The suggestion that the United States needs to create more air pollution to build a temporary Industrial wind utility energy site at sea to reduce air pollution is a fraud on the American People. The applicant has failed to provide the effects of all the air pollution created by the additional vessels needed to develop the energy industrial site. Most of the Jersey Shore municipalities already suffer from ozone alerts for air quality. The construction of an Industrial site that adds to the air pollution will where food deserts and the largest population in an area where minorities of color live is a violation of the states Environmental Justice legislation. There is also scientific evidence that the manufacturing of steel in Pennsylvania is the number one non-direct contributor to water pollution in Barnegat Bay NJ. The additional air born pollutants from the manufacturing of the industrial turbine masts will have a [Bold: Major Impact] on the estuary.	As discussed in EIS Section 3.4, *Air Quality*, the analysis accounts for the impacts of vessels and equipment used to construct the Project. Once operational, the wind energy generated by the Project will displace fossil-fueled power and the associated emissions, which will result in a net reduction in pollutant emissions that will benefit regional air quality.
0984-0058	BOEM is aware of future wind activities that are being and should be forthcoming with any conversations that have not been put as formal applications. The applicants acknowledgment of the impacts of GHG on coastal fauna is stated but fails to quantify the increased GHG the manufacturing of the components installation maintenance of the industrial offshore wind Development site will generate. The applicant has also failed to address the sale of the carbon credits or the deductions of carbon output by investors in the project. By not including the cumulative impact of GHG on the fauna it leaves the	EIS Section 3.4, *Air Quality*, discusses and quantifies GHG emissions from construction and maintenance of the Project. The Project would, by displacing fossil-fueled electricity generation, lead to reductions in regional GHG emissions.

Comment No.	Comment	Response
	door open to increase the value of the sale of GHG carbon credits. By reducing the value of the GHG carbon credits the economic valuation of the industrial wind development zone may not be economically feasible and in direct violation of the EO BOEM uses to further this applicants request.	Such reductions are not, in themselves, carbon credits. Ocean Wind currently does not plan to create carbon credits based on the Project.
0984-0077	The reference to Climate change by the developer does not but should be in regards to the impact of the mixing of the three stratus of air by the turbines during slack tide in the cold water pool area. Wind wave development will take place and is scientifically proven to do so. This additional moisture coming to land during the sea breeze after a tide change in the mornings will have a [Bold: major impact] on tourism. Even if the wind waves don't make it to land How much is seeing the sum rise worth? On the occasions that they do make it to land [Bold: major impact] to Agricultural will be felt. There is already a study being conducted to identify what farms will be affected and the reduction in crop selection. Depending on the additional moisture levels and the salinity a buy out program maybe required by the developer for properties. A president has already been established in the courts where properties around cogeneration plants had to be purchased due to the increased moisture levels and reduction in sunlight that increased the mold count on the properties. A closer analysis of the [Bold: major impacts] on land based tourism animals and agriculture from wind waves needs to be conducted.	Wind turbines extract kinetic energy from the atmosphere and thus can reduce wind speeds downwind of the turbine. Wind turbines do not affect visibility nor the amount of sunlight reaching the Earth's surface. Wind turbines increase vertical mixing in the atmosphere and thus can affect meteorological conditions downwind. Increased mixing near the ocean surface can take up moisture from the ocean, increasing the humidity and salinity of the air. However, these effects dissipate with distance downwind. Because of the distance of the Project from land (approximately 15 miles), substantial effects on tourism, animals, and agriculture are unlikely to occur.
0984-0097	The representation that the warmer water temperatures impacts "are expected to be localized" is unsupported. The Industrial energy offshore wind zone in this EIS combined with other call sites in the Northeast is over 1500 square miles. I guess if you consider the size of the Atlantic Ocean 1500 square miles could be consider localized; but not in this EIS format. Avoidance of the overwhelming impacts of at sea industrial energy development zones negative climate change impacts that effect many states and industries by foreign investors of an outdated dying industry grasping at any last dollar before they go bankrupt is should be addressed in the EIS. There is no posable reason to approve this application with so many environmental economic and social [Bold: major impacts].	The Draft EIS covers the effects from the presence of wind turbines on water quality under the *Presence of Structures* IPF in Section 3.21.3.2 and 3.21.5; the analysis includes effects on water temperature. The analysis is based on extensive modeling BOEM conducted in the mid-Atlantic Bight—*Hydrodynamic Modeling, Particle Tracking and Agent-Based Modeling of Larvae in the U.S. Mid-Atlantic Bight*—cited in Section 3.21 as BOEM 2021c. Details can be found in the report here: https://espis.boem.gov/final%20 reports/BOEM_2021-049.pdf. The referenced report indicates the change is less than the natural variance in thermocline depth (40-meter range).

Comment No.	Comment	Response
		Modeled hydrodynamic modeling temperature stratification results showed a relative deepening in the thermocline of approximately 1 to 2 meters and a retention of colder water inside the offshore wind farm area through the summer months compared to the situation where the offshore wind structures were not present.
1012-0017	[Bold: A. Climate Change.] The purpose and need section for the proposed action links the proposed action to Executive Order 14008 titled "Tackling the climate crisis at home and abroad" January 27 2021 and states that the proposed action will "increases resilience to the impacts of climate change". It's not clear exactly what that means but it implies some benefit of the project to climate change. But that is inconsistent with statements in the final environmental impact statement for the Vineyard Wind project which states in Appendix A Table A.8-1-1 that ([Bold: emphasis added]) "Therefore the Proposed Action would have negligible impacts on climate change during these activities and an overall minor beneficial impact on GHG emissions compared to the generation of the same amount of energy by the existing grids. Because GHG emissions spread out and mix within the troposphere the climatic impact of GHG emissions does not depend on the source location. Therefore regional climatic impacts are a function of global emissions. Development of offshore wind projects and the construction implementation operation maintenance and the eventual decommissioning activities would cause some GHG emissions increases primarily through emissions of CO2. However these contributions would be minuscule compared to aggregate global emissions. In context of reasonably foreseeable environmental trends the combined GHG emissions on air quality from ongoing and planned actions including the Proposed Action would likely result in a minor beneficial impact from the net decrease in both GHG emissions and criteria pollutants including ozone precursors such as NOx as fossil-fuel-type facilities reduce operations as a result of increased energy generation from offshore wind projects. [Bold: Overall it is anticipated that there would be no collective impact on global warming as a result of offshore wind projects including the Proposed Action alone] though they may beneficially contribute to a broader combination of actions to reduce future impacts from climate change". In support of this as shown in our comments on the NOI this project will have no appreciable effect	EIS Section 3.4, *Air Quality*, discusses and quantifies the GHG emission reductions associated with the Project. No single project can reduce GHG emissions enough to produce a measurable climate impact. The Project's GHG emission reductions would make an incremental contribution to reducing climate change.

Comment No.	Comment	Response
	on future sea level rise other than to delay whatever is coming by about 9 days. Therefore reference to a climate change benefit in the Purpose and Need Section should be removed. If it is retained the comment should be supported with numbers quantifying the impact.	
1125-0003	First and foremost the primary environmental benefit of the Project the elimination of an estimated 110 million tons of CO2 over a 25 year operating life is completely lost in the weeds. This is the primary purpose of the Project and the benefit against which the Project's modest and well mitigated impacts must be weighed and balanced.	EIS Section 3.4, *Air Quality*, discusses and quantifies the GHG emission reductions associated with the Project.
1192-0004-1	"A discussion of Climate Change belongs in every renewable energy project. The DEIS neglects to protect against Climate Change.	EIS Section 3.4, *Air Quality*, discusses and quantifies the GHG emission reductions associated with the Project.
1192-0010	Based on these facts the Applicant should do everything possible to lower the GHG. This would mean they would not build on wetlands at Oyster Creek (OC) and take state parkland and down 73 trees on Island Beach State Park (IBSP) and build a facility on natural areas. Instead this would be the worst possible siting presentation.[Underlined: Recommendation:]· Present the carbon budget for the proposals at Oyster Creek and Island Beach State Park.· Explain in detail how this project will contribute to less GHG. Describe the sinks.	The export cable route options on Island Beach State Park were designed to affect previously disturbed areas, such as parking lots, roads, and a maintenance yard, to the extent possible. As stated in Final EIS Section 3.22, *Wetlands*, impacts on wetlands must be avoided, minimized, and then mitigated. Ocean Wind is proposing purchase of wetland bank credits to compensate for wetland impacts.
1192-0025	Climate Change belongs in every renewable energy project - it is not in this DEIS. Are all of the parts to be used recyclable?	EIS Section 3.4, *Air Quality*, discusses and quantifies the GHG emission reductions associated with the Project. Project components would be reused where possible. Much of the remaining material would be recycled. Certain components typically are not recyclable and would be disposed of in an appropriate licensed disposal facility.
1259-0103	3. Large offshore wind farms could have an impact on the regional microclimate and likely impact the marine boundary layer and downstream impacts. [Footnote 74: See S.K. Seidersleben Micrometeorological impacts of offshore wind farms as seen in observations and simulations 13 Enviro. Res. Letters 124012 (2018) https://www.nrel.gov/docs/fy19osti/73183.pdf.]	Wind turbines extract kinetic energy from the atmosphere and thus can reduce wind speeds downwind of the turbine. Wind turbines increase vertical mixing in the atmosphere and thus can increase (or decrease) air temperatures downwind

Comment No.	Comment	Response
		depending on local meteorological conditions. However, these effects dissipate with distance downwind. The referenced paper discusses modeling results indicating that these impacts are only observed in cases of strong stable stratification of the atmosphere at rotor height, allowing the rotor blades to mix warmer air downward. Because of the distance of the Project from land (approximately 15 miles), substantial effects on microclimate are unlikely to occur over land.
1259-0189	Undocumented CO2 Emissions ReductionClean Ocean Action supports responsible and reasonable offshore wind which must include a local pilot-scale project. However the impacts of offshore wind projects or any industrial development in the ocean must be clearly identified and evaluated. Offshore wind energy is not emissions-free. Renewable energy facilities will result in impacts including emissions that contribute to climate change and affect public health in nearby communities.. The emissions from the activities necessary to prepare build operate maintain and decommission offshore wind energy facilities should not be discounted and must be both included and evaluated in the Draft EIS and Final EIS.The Draft EIS claims the benefits of Ocean Wind 1 will be the reduced exposure to and the displacement of fossil fuel-generated power plants. The Draft EIS claims "the Project would provide beneficial impacts on the air quality near the proposed activities and the surrounding region to the extent that energy produced by the Project would displace energy produced by fossil-fueled power plants." [Footnote 193: DEIS at 3.4-10.] How is this assessed by BOEM? Where is the evidence that offshore wind energy facilities will displace fossil fuel facilities and prove a net reduction in air emissions? The Draft EIS provides no evidence that fossil fuel plants will be taken offline anywhere in the geographic analysis area let alone in all of New Jersey or the United States from the completion of the Proposed Action. Further there is no public commitment by the State of New Jersey NJ Governor NJ Department of Environmental Protection ("NJDEP") or the federal government to close or stop building fossil fuel facilities. Without the proof of fossil fuel facilities being displaced by Ocean Wind 1 how are the impacts of the Proposed Action - as outlined in the DEIS and in Clean Ocean Action's comments - justified and acceptable?	EIS Section 3.4, *Air Quality*, discusses and quantifies the air quality and GHG impacts from project construction, operation, and decommissioning, including GHG emission reductions from the Project's displacement of electricity generated by fossil fuel combustion. The price at which the Project would sell electricity to the regional grid is expected to be lower than the prices offered by operators of fossil-fueled power plants. Therefore, market forces would lead to less higher-priced electricity purchased from fossil-fueled power plants in favor of lower-priced electricity purchased from the Project. BOEM used its Wind Tool software to calculate the amount of fossil-fuel emissions the Project would displace. It is unlikely that fossil fuel plants would be taken offline or that no new power plants would be built. Rather, existing fossil-fueled power plants would reduce their output or hours of operation. Wind Tool accounts for these changes in calculating the emissions reductions.

Comment No.	Comment	Response
1259-0190	Also the Draft EIS mentions Europe as a cable staging location for the project but the Draft EIS does not include the impacts of shipping components in the calculations of emissions for the project. Does the Draft EIS include the emissions from the production of turbines and components and the activities associated with extracting and processing materials (e.g. steel rare earth elements) in the life cycle analysis for the Proposed Action? If not the Draft EIS and Final EIS must cover these aspects of Ocean Wind 1's environmental impacts.	The EIS includes the impacts of transporting components between ports, staging areas, and the wind turbine area. The EIS does not include a full life cycle analysis including resource extraction and component manufacturing. Text has been added to the EIS noting this and providing references to recent life cycle analyses of offshore wind.
1259-0191	Despite the unsubstantiated claim of displacing fossil fuel facilities Ocean Wind 1 will still have local adverse impacts. The new local ports required for vessel activity from the project will add construction and traffic both on- and offshore as well their associated emissions plus impacts to water quality and public health in local communities. In addition with twenty-four (24) other projects and leased areas for offshore wind energy in the region the Draft EIS does not address the cumulative impacts of emissions from this widespread offshore wind development. According to the Draft EIS "the largest magnitude air quality impacts and largest spatial extent would result from the overlapping operations activities from the multiple offshore wind projects within the air quality geographic analysis area." [Footnote 194: Id. at 3.4-16.]	Section 3.4.5.1 of the EIS assesses cumulative impacts of offshore wind development based on the predicted emissions from the projects.
1259-0192	To conclude the Draft EIS fails to substantiate the claim that the completion of the Proposed Action will displace and close fossil fuel facilities especially in the geographic analysis area. Additionally the cumulative impacts from the combined offshore wind projects that are in various stages of development off the mid-Atlantic region must be identified considered and mitigated to the fullest extent possible in the Draft EIS and Final DEIS.	EIS Section 3.4, *Air Quality*, discusses and quantifies the air quality and GHG impacts from Project construction, operation, and decommissioning, including GHG emission reductions from the Project's displacement of electricity generated by fossil fuel combustion. The price at which the Project would sell electricity to the regional grid is expected to be lower than the prices offered by operators of fossil-fueled power plants. Therefore, market forces would lead to less higher-priced electricity purchased from fossil-fueled power plants in favor of lower-priced electricity purchased from the Project. BOEM used its Wind Tool software to calculate the amount of fossil-fuel emissions the Project would displace.

Comment No.	Comment	Response
		It is unlikely that fossil fuel plants would be taken offline or that no new power plants would be built. Rather, existing fossil-fueled power plants would reduce their output or hours of operation. Wind Tool accounts for these changes in calculating the emissions reductions. Section 3.4.5.1 of the EIS assesses cumulative impacts of offshore wind development based on the predicted emissions from the projects.
1267-0005	It has been documented that the air temperatures down range of a wind farm are elevated. The ASHRAE Psychometric Chart No 1 notes the additional pounds of water that will be retained by the warmer air. The project design data held as proprietary is the source of how warm the air will be and the frequency that a location is down range during operations. It was asked during the scoping for this EIS to quantify the expected reduction in rainfall. This question remains unanswered.	Wind turbines increase vertical mixing in the atmosphere and thus can affect meteorological conditions downwind. Increased mixing near the ocean surface can take up moisture from the ocean, increasing the humidity and salinity of the air. However, these effects dissipate with distance downwind. Because of the distance of the Project from land (approximately 15 miles), substantial effects on microclimate are unlikely to occur over land.
1275-0003	I wish we could take more time and look closer at the holistic impacts to what we are doing beyond this EIS/COP. When you account for the emissions from the back up generation and marine vessels to build and operate and maintain the WTGs what is the net benefit toward the goal of reducing greenhouse gases and at what financial cost?	EIS Section 3.4, *Air Quality*, accounts for emissions from generators and marine vessels and discusses and quantifies the GHG emission reductions associated with the Project.
1275-0011	[Bold: Emissions]: have you provided an assessment of the emissions associated with marine vessels needed to service this Offshore Wind Farm the emissions created during construction when they are not operating and backup systems used and performed a life cycle analysis which would compare emissions doing the project and not doing the project? What is the net reduction in GHG's after that evaluation?	EIS Section 3.4, *Air Quality*, accounts for emissions from marine vessels and discusses and quantifies the GHG emission reductions associated with the Project.
1278-0017	Regarding pollution there is pollution during construction and after construction. During construction the building of up to 98 WTGs up to 900 feet tall per structure and the associated construction barges and support vessels will lead to	EIS Section 3.4, *Air Quality*, discusses and quantifies the emissions from construction, O&M, and decommissioning.

Comment No.	Comment	Response
	inevitable pollution	
TRANS-0041-0010	Where is the true evidence that offshore wind will take fossil fuel projects offline. This statement is also in the DEIS with no proof of evidence. Offshore wind is touted as an emission free energy where is the evidence that the lifecycle of offshore wind is going to significantly reduce carbon dioxide emissions and at what cost to the ocean	EIS Section 3.4, *Air Quality*, discusses and quantifies the air quality and GHG impacts from project construction, operation, and decommissioning, including GHG emission reductions from the Project's displacement of electricity generated by fossil fuel combustion. The price at which the Project would sell electricity to the regional grid is expected to be lower than the prices offered by operators of fossil-fueled power plants. Therefore, market forces would lead to less higher-priced electricity purchased from fossil-fueled power plants in favor of lower-priced electricity purchased from the Project. BOEM used its Wind Tool software to calculate the amount of fossil-fuel emissions the Project would displace. It is unlikely that fossil fuel plants would be taken offline or that no new power plants would be built. Rather, existing fossil-fueled power plants would reduce their output or hours of operation. Wind Tool accounts for these changes in calculating the emissions reductions.
0941-0001	Climate Change and Sea Level Rise It is unclear if the plan takes sea level rise (SLR) during the proposed lifetime of the project into account for siting landfalls/TJBs. Certain climate change features (i.e. larger and more frequent storms and SLR) have been recognized to have significant impacts to coastal communities and vulnerable infrastructure including utility facilities.	Additional discussion of how the design for onshore facilities accounts for erosion, more frequent high-intensity storm events, tidal surge, and sea level rise associated with climate change has been added to the Final EIS in Chapter 2, *Alternatives*, and in Appendix I.

O.6.4 Bats

Table O.6.4-1 Responses to Comments on Bats

Comment No.	Comment	Response
0984-0012	3.5 BatsBats at the Jersey Shore are one of the most necessary animals that contribute to safe tourism. Zika Virus and the West Nile Virus have both been found in mosquitoes along the Jersey Shore. The applicant has failed to properly conduct an audit of the states bat population along the states salt marshes and how the population frequents areas over water especially during a west wind. The use of NJDEP data on the state bat population was developed to identify land based interactions and never analyzed the populations on the states barrier islands. The feeding patterns of the Jersey Shore bats population is not comparable to the land based bat population. The EIS fails to take into consideration the potential [Bold: Major Impacts] on the shore based bat population and the secondary [Bold: Major Impact] of the speed of viruses to Tourists at New Jersey's Beaches.	BOEM addressed the potential impacts on bats in Draft EIS Section 3.5, including both offshore and onshore impacts. As stated in Section 3.5.1, nine bat species occur in New Jersey and eight may be present in the Project area (offshore and onshore [including barrier islands]), and bat activity is relatively low offshore compared to onshore. As stated in the Draft EIS, onshore activities (land disturbance IPF) would result in limited impacts on bats due to the limited habitat removal and implementation of APMs that would avoid and minimize impacts on bats. BOEM looked at the habitats in the onshore environment, including forested habitats and foraging habitats. EIS Section 3.5 has been revised to provide details on the forested habitat acres that would be permanently and temporarily affected. Draft EIS Section 3.22, *Wetlands*, Table 3.22-3 provides the potential impacts on wetlands, including saline marshes (which could be used for bat foraging). A total of 5.44 acres of saline marsh would have short-term impacts (i.e., the impact would last fewer than 3 years). Other wetland types may have long-term impacts (see Draft EIS Table 3.22-3). The amount of wetland impact compared to all wetlands present within the geographic analysis area is generally less than 1% for the different wetland types (see Draft EIS Table 3.22-3). BOEM does not anticipate

Comment No.	Comment	Response
		whole bat populations to be affected by the Proposed Action. The BA further analyzed impacts on federally listed bats and concluded that the Project *may affect, but is not likely to adversely affect* federally listed bats. Insectivorous bats have often been touted as a biological control from mosquito populations; however, mosquitoes generally represent only a small proportion of bat diet (Gonslaves et al. 2013). In addition, Joe Conlon, an entomologist with the New Jersey-based American Mosquito Control Associations, states that using bats to control mosquitoes is unrealistic because bats are poor predators of mosquitoes, prefer moths and beetles, and expend far more calories trying to catch mosquitoes than they get from eating them; and mosquitoes make up less than 1% of their foodstuffs (Edgar 2016; Hudak 2018). As such, BOEM does not anticipate the Proposed Action's effect on bats would have any notable impact on mosquitos or viruses mosquitos may be carrying.

O.6.5 Benthic Resources

Table O.6.5-1 Responses to Comments on Benthic Resources

Comment No.	Comment	Response
0390-0019	One of the more overlooked issues associated with OW1 is the introduction of non-indigenous and invasive species which presents a threat to biodiversity. Artificial structures (including Ocean Wind Farm's oil rigs breakwaters and ports) are known to promote the spread of no-indigenous species which can disrupt trophic webs and cause shifts in the populations of native species normally with a negative impact on the overall ecosystem.	Text has been added in Sections 3.6.3 through 3.6.7 to address this comment based on reviews of Bray et al. 2017, Wilding et al. 2017, Adams et al. 2014, Causon and Gill 2018, Krone et al. 2017, and Taormina et al. 2018.
0941-0001	Our review of the Draft Environmental Impact Statement (DEIS) was primarily limited to the activities proposed within the BBP's study area namely the northern landfall of the offshore export cable route the inshore export cable route across the Barnegat Bay and the onshore export cable route substation and connection at Oyster Creek. We were disappointed that a project alternative that solely makes use of uplands and avoids any impacts to the bay's aquatic resources (i.e. SAV shellfishes) was not presented. Two living resources impacted by the proposed project (i.e. eelgrass and hard clams) are identified as holistic ecosystem targets in the BBP's 2021 CCMP and will face continuing and increasing threats as the human population and associated development continue to grow.	As described in EIS Appendix C, Section C.2.3 (*SAV Avoidance Alternative E-3*), BOEM did consider an alternative for the export cable route that would have made landfall in Ship Bottom and then utilize a bridge crossing via the Route 72 Bridge and a longer onshore cable route to reach the Oyster Creek Point onshore substation. However, through coordination with the New Jersey Department of Transportation, BOEM found that the proposed export cables could not be attached to the Route 72 Bridge due to issues with weight and integrity. In addition, while Alternative E-3 would have resulted in substantially less SAV impacts compared to the Proposed Action, Alternative E-3 would result in substantial adverse impacts on other resources as described in EIS Section C.2.3.1. Therefore, BOEM determined that the alternative was not feasible and dismissed the alternative from further consideration.
0941-0001	Determination of impacts The export cables crossing beneath Barnegat Bay are identified in various maps throughout the DEIS (i.e. S-1 2-1) as "inshore export cables" but the text and tables throughout the document solely reference "offshore" and "onshore"	Impacts of mapped inshore export cables are assessed as part of the offshore export cable that runs from the Lease Area to the cable landfall.

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	impacts (i.e. Appendix E - Project Design Envelope). The same is true between Volumes 1 and 2 of the COP. It is not clear if disturbances to the environment associated with these routes are included in the discussions of "offshore export cable route" "onshore export cable route" or omitted completely. For example in the "Onshore Export Cable Parameters" section of DEIS Appendix E (PDE) the table appears to show no impacts to "benthic resources" or "finfish invertebrates and EFH" associated with the cables traversing Barnegat Bay even though impacts to these resources are identified in Table 2-4 in the DEIS and in DEIS Chapters 3.6 3.9 and 3.13.	
0941-0001	Recommendations The decreased hard clam population in the Barnegat Bay and the slow trajectory of its recovery have led stakeholders to identify hard clam restoration as a high priority within the BBP's 2021 Comprehensive Conservation and Management Plan. The impacts to high and medium density beds from inshore export cable placement and maintenance would have an appreciable negative effect on the resource and therefore the recreational fishery in the bay. Both impacts should be clearly identified and mitigated. We recommend that a hard clam monitoring and mitigation plan be included in any project approvals. Because of the importance of the blue crab resource to the recreational fishery in Barnegat Bay potential project impacts to blue crabs and its fishery should be determined and a monitoring plan implemented with mitigation thresholds developed.	Shellfish beds will be avoided. These and other fisheries are also addressed in EIS Appendix F (Section F.2.10.2): “Four shellfish leases (37 acres) and one research lease occur in the vicinity of Oyster Creek with the primary shellfish growout of oysters and hard clams; however, these areas would be avoided (Ocean Wind 2023).” Blue crabs and hard clams are included in Section 3.13; status and trends in hard clams (Bricelj et al. 2017) are also reported. The EFH assessment for the Project states that blue and horseshoe crab species are known to occur within the Project area. Adults may use the habitat for spawning. Dredging impacts could include increased local total suspended solids, loss of larvae due to suction dredging, or short-term displacement of individuals. However, these impacts are either short term, limited in spatial extent, or insignificant to the success of the species. Hard clams are mapped and evaluated in the EFH assessment. Commercial fisheries are addressed in Section 3.9.

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	With most of New Jersey's remaining seagrass beds located within the Barnegat Bay there is great scrutiny on any projects that would potentially impact them. To accurately assess the impacts of the proposed inshore export cable placement any project approvals should require that SAV surveys be conducted along the entirety of the proposed route(s) in late spring to ensure that the survey captures the maximum density and extent of the seagrass beds and that any future disturbances within the selected inshore corridor over the life of the project are preceded by an adequate survey. While the applicant has proposed to "restore" any damage to seagrass beds (APM Benth-03) the DEIS does not include any information regarding the means of restoration. Any project approvals should include a detailed restoration/mitigation plan that includes active adaptative management. The variable success rates which have been reported in recent seagrass restoration projects (e.g. NJDOT Route 72 project mitigation) lead us to recommend application of the maximum compensatory mitigation ratio and extension of appropriate monitoring so that maintenance restoration can be extended throughout the projected lifetime of the wind project.	SAV surveys completed for the HDD will be used to avoid SAV where practicable, e.g., Peck Bay and Oyster Creek. Ocean Wind developed a SAV Monitoring Plan (June 2022) and SAV Preliminary Mitigation Plan (December 2022) that includes pre- and post-monitoring of SAV along the inshore cable and restoration for impacts that cannot be minimized or avoided. Restoration is anticipated for portions of the Oyster Creek inshore export cable corridor that transits through Barnegat Bay and adjacent to Island Beach State Park, informed by historic distributions of SAV, sediments, and water quality. The plan includes a 3:1 mitigation ratio consisting of mapping efforts, monitoring activities, restoration of documented impacts at an in-situ 1:1 ratio, and additional research to improve SAV mitigation in the future. No impacts on SAV are anticipated along the Roosevelt Avenue/Peck Bay HDD crossing for the BL England portion of the route; therefore, no restoration there is proposed.
0941-0001	Lastly we note that shorelines and associated intertidal habitats will be adversely impacted. The details of the wetland mitigation plan should also be included in any project approvals. We strongly encourage BOEM to require that wetland mitigation activities occur within the same HUC14 as the disturbance when practicable followed by adjoining HUC14s. This practice is consistent the BBP's CCMP which identifies the maintenance of existing wetland extent and buffers as additional ecosystem targets.	Ocean Wind proposes to purchase wetland credits from the Great Bay Wetland Mitigation Bank through Evergreen Environmental, LLC, the mitigation banker. The proposed wetland impacts are entirely within the Geographic Service Area of the Great Bay Wetland Mitigation Bank. The Great Bay Wetland Mitigation Bank is a federally approved mitigation bank with available credits.
0984-0013	3.6 Benthic Resources This is one of the most agrestic sections of the EIS. The intentional carpet bombing and intentional killing of all marine benthic animals for	Impacts of the Proposed Action on benthic resources (SAV and fauna) are expected

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	a one mile radius around each wind turbine is a [Bold: Major Impact].The elimination of benthic sealife that is yet to be documented as endangered or threatened is comparable to the documentary's on the destruction of the South American Rain Forests. The basis for life in the sea is the food chain that starts with thees tiny animals. Scientists have discovered a potentially catastrophic loss of life in our oceans. An Edinburgh-based research team fears plankton the tiny organisms that sustain life in our seas has all but been wiped out after spending two years collecting water samples from the Atlantic. The landmark research blames chemical pollution from plastics farm fertilizers and pharmaceuticals in the water and now Industrial offshore wind development sites. Previously it was thought the amount of plankton had halved since the 1940s but the evidence gathered by the Scots suggest 90% has now vanished. The sea water samples examined by the team were taken from the equatorial Atlantic. The scientists from the Global Oceanic Environmental Survey Foundation warn there are only a few years left before the consequences become catastrophically clear when fish whales and dolphins become extinct with grave implications for the planet. In the report the researchers state: "An environmental catastrophe is unfolding. We believe humanity could adapt to global warming and extreme weather changes. It is our view that humanity will not survive the extinction of most marine plants and animals." The destruction of a resource that is not fully identified but is known to be the basis for all marine life is a [Bold: Major Impact.]	to result primarily from new cable emplacement, noise from pile driving, anchoring (particularly where it may affect SAV), and the presence of structures. Acres of impacts on benthic habitats are listed in Table 3.6-2 in the EIS. Impacts on benthic resources primarily from anchoring, cable emplacement, and presence of structures (and associated invasive species opportunities) include physical disturbance, injury, mortality, short-term to permanent habitat modification/loss, and behavioral changes. Restoration of SAV for impacts that cannot be avoided would be implemented, per the SAV Monitoring Plan and Preliminary Mitigation Plan. Impacts are not expected at a population level. Adverse impacts are anticipated to range from negligible to moderate and adverse. Plankton are addressed in Section 3.13.
0984-0057	Along the Jersey shore there are a variety of species that rely on the sea breeze sand and the different temperate climate. The "Cold Water Pool" creates this environment and has recently been documented to travel into the applicants industrial energy development site. The blending of different atmospheric stratus by wind turbines in the New York bight will have an affect on the choice of fauna that will survive and die. The Federally endangered species Seabeach Amaranth is one that will be at risk along with the other with the change in salinity moisture and heating degree days. The area known as the mud hole is unique there is no other area like it in the world. It has and will continue to be considered for declaration as a United Nations World Heritage Environmental Sight. For its impacts not only at sea but on land such as the Fauna. The failure to acknowledge the scientifically proven and assessable information on wind waves in the cumulative area of the New York Bight the construction any Industrial energy wind Development zone in the area where the cold water pool exists.	Text has been added in Final EIS Section 3.13.3.2, along with additional citations, to address potential impacts on the cold pool. Potential impacts on seabeach amaranth are addressed in EIS Section 3.8 and Appendix G, and in the BA.

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0984-0072	Also the applicant is failing to discuss the [Bold: major impact] of cable failures from webbing within cables if they are buried too deep. This has become a consistent cause of cable failure around the world because of the intent to mitigate marine life damages by burring the cables deeper than the manufacturer intended. The cost of changing the cable manufacturers designs and splicing them together to account different environments Rivers Streams Estuaries Bays Coastal state territorial and federal waters and the sediments associated with them make the cable more susceptible to failure and massive power outages. The east Coast of the United States and the contour of the continent shelf makes the commutative Development of the east coast significantly higher than around the world and has greater anticipation of failure. The applicants claim that seabed alterations will "be short term and would have little impact" on coastal habitat is as far from accurate representation.	Impacts of dredging due to the Proposed Action are addressed for each identified resource in Sections 3.4 to 3.22. BOEM recognizes the importance of subsea cable infrastructure and the non-destructive (for example, Nicholls-Lee et al. 2022) identification and repair of damaged or degraded cables.
0984-0075	Sediment deposition and burial will have major impacts on coastal habitats and require action. The EIS already sites the decrease in submerged aquatic vegetation (SAV) eel grass populations. Studies have proven at an extreme cost that eelgrass cultivation and relocation has over a ninety percent failure rate. The applicant notes that eelgrass bed will be affected. The eel grass is important too many economically valuable species in the coastal states. Grass shrimp snails and crabs all rely on not just the eel grass but waterfowl rely on the widgeon grass that will also be impacted. The American CanvasBack and muted swan whom rely on the eel grass and widgeon grass for their food source will be adversely affected a [Bold: major impact].	Potential impacts of the Proposed Action on SAV and benthic invertebrates are discussed in Sections 3.6 and 3.13 for each of the Project components (e.g., cable installation, WTG presence). Impacts on benthic habitats are considered to be minor to moderate in the EIS. Impacts on birds are analyzed in Section 3.7.
0984-0080	There has already been [Bold: major impacts] on benthic resources. The secondary impact on a large variety of valuable species during surveys have been adversely affected during spawning. The [Bold: major impacts] of lack of benthic resources have decreased the survival rate of this years classes of mackerel bluefish squid and monkfish. Other species will need to be mitigated as well since BOEM continues to grant permits beyond the scope of work approved.	Potential impacts on benthic invertebrates and fish are analyzed in Section 3.13 (*Finfish, Invertebrates, and Essential Fish Habitat*). Primary factors affecting finfish, invertebrates, and EFH would be noise, cable emplacement, and presence of structures. These are expected to result in short- and long-term, permanent changes to faunal behavior, and habitat modification or loss, but not at the level of population impacts. Adverse impacts would, therefore, range from negligible to moderate on finfish, with the primary impacts on finfish occurring as a result of noise during construction and operation.

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0984-0082 & -0083	The total benthic resource mortality impact is outrageous. Carpet bombing acres by pile driving acres of capping acres of cables acres of lost anchorage acres of cable placement acres of cable maintenance Plus Plus Plus all has a [Bold: major impact] on micro to small organisms. The basis of the seafood industry will be destroyed for decades and will not recover because BOEM admits that the "Benthic communities forming after disturbances will be of different species than disturbance". BOEMs' reference to the commercial fishing industry and its impacts to the benthic resources has no place in any EIS since the applicant is not from a traditional marine industry. The [Bold: major impact] of the EIS in a nascent industry needs to stand on its own merits.	The impacts on benthic resources (SAV and fauna) are expected to result from primarily new cable emplacement, noise from pile driving, anchoring (particularly where it may affect SAV), and the presence of structures. Acres of loss of benthic habitats are listed in Table 3.6-2 in the EIS. Impacts on benthic resources primarily from anchoring, cable emplacement, and presence of structures (and associated invasive species opportunities, scour, and water column mixing) include physical disturbance, injury, mortality, or short-term to permanent habitat modification/loss, and behavioral changes. Restoration of SAV for impacts that cannot be avoided would be implemented per the SAV Monitoring Plan and Preliminary Mitigation Plan. Impacts are not expected at a population level. Adverse impacts are anticipated to range from negligible to moderate and adverse. WTG structures would benefit some benthic fauna by providing new habitat.
0984-0085	The expansion of aquaculture into the oceans industrial energy zones has been part of the plans to offset the food security issues the question is is how much is BOEM going to permit. The long term goals of aquaculture is a [Bold: major impact] and needs to be included in the EIS.	Four shellfish leases (37 acres) and one research lease are near Oyster Creek; the aquaculture lease may be temporarily affected by cable installation and anchor lines. There is potential for more aquaculture gear utilization to meet growing demand for fish as a food source (Costello et al. 2020), as described in the EIS (Section 3.9).
0984-0086	The proposed development will alter the overall character of benthic resource. The action on benthic resources will be a permanent impact; [Bold: major impact]. The EIS fails to address the utilization of ports that will need to be upgraded secondarily creating additional [Bold: major impact] on benthic	Impacts of the Proposed Action on benthic resources are addressed for each IPF in Section 3.6. Impacts on benthic resources are expected primarily from new cable

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	resources in the port areas and having secondary [Bold: major impact] on marine ecosystems in the estuaries. The benthic resource mortality assumed of 9.7 acres around each of stationary turbines is a excessive and permanent impact when done in the short timeframe established by the offshore wind industry as a whole. The impact will be permanent. The impact of invasive species will be moderate to permanent by the cumulative changes in using non-native materials creating habitat for invasive species by the applicant. The co-existence intrusion banter by the partially foreigner country owned companies whom also have financial interest in seafood and aquaculture are misleading. There is no evidence to support the claim by the applicant on the impacts of the commercial fishing industry on benthic resource and the information that does exist should not be part of the EIS. The applicants EIS and the impacts that are documented must stand alone as permanent impacts that are not mitigable by displacement of the commercial fishing industry.	emplacement, noise from pile driving, anchoring (particularly where it may affect SAV), and the presence of structures. Modifications of ports would likely cause temporary and localized impacts on finfish, invertebrates, and EFH, likely resulting in behavioral responses, such as avoiding the area during port modification activities. Presence of WTGs would benefit some benthic invertebrates by providing habitat and would have adverse impacts due to opportunities for invasive species dispersal, scour of benthic habitat, and water column mixing. The impacts of fishing on benthic habitats will continue in the Lease Area; the presence of structures may also attract more fish and result in more fishing. No population-level impacts are anticipated and adverse impacts are anticipated to range from negligible to moderate and adverse.
0984-0088	BOEM has a financial conflict of interest in bringing forward energy options since the individuals whom work there are dependent on funding from lease sites and the creation of work. The [Bold: major impacts] of economically unfeasible stationary wind turbines littering the ocean is a real scenario that was left out of the EIS because it would be in direct violation of the EO. Marine impacts broken down into zones to avoid impacts is a land based equation being implemented in a marine environment. Avoiding a couple area on a chart that humpbacks are know to be does not take into account how the whales get there. They swim! When whales swim to the area of concern they will transit the many areas being leased. The [Bold: major impacts] of interference with migration patterns is speculative and can be easily adopted to a permanent impact when corralling is considered.	All proceeds from lease sales go to the US Treasury. Federal agencies such as BOEM are funded by congressional appropriations. Whales are addressed in Section 3.15 along with other marine mammals. The greatest impacts on marine mammals would occur due to underwater noise from UXO detonations and pile driving, which could cause temporary impacts during WTG construction (98 days over 2 years); and increased vessel traffic, which could lead to injury or mortality from vessel strikes. Impacts would range from negligible to moderate for baleen whales except for the NARW, which would range

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		from negligible to major. Impacts would range from negligible to moderate for odontocetes and pinnipeds and could include beneficial impacts. Beneficial impacts for odontocetes and pinnipeds are expected to result from the presence of structures.
0984-0090	The overall safety of the individual existing ocean users should comparatively equal to the benthic resource mortality rates. There is a calculated mortality rate of ocean users that was omitted from the EIS.	Potential impacts on other ocean users are addressed in Section 3.17, *Other Uses (Marine Minerals, Military Use, Aviation).*
0984-0093	The acknowledgment of invasive species and the creation of nontraditional habitats resulting in the expansion of invasive species in the development area should babe recognized as a [Bold: major impact]. Biologically significant impacts on fin fish invertebrates and EFH have been documented. The impacts of EMFs on a variety of species including spiders is of extreme importance. It is alarming that studies that exist have not been reflected in this EIS. Such as the changes it feeding habitat and range of large coastal sharks. The impacts of burrowing sea life like crabs and the ecosystems dependent horseshoe crabs. The studies also seem to always leave out the EMFs before the cable reaches its burial depth. Especially because the impacts on the habitat creation that the industry claims is so beneficial has an even higher rate of biomass removal than artificial reefs. Unfortunately many of theses studies are considered proprietary by the industry. I would suggest by not releasing the studies that may prove to be in contradiction to the success of the applicants licensing is in violation of the EIS as a whole and that is a criminal offense that the United States Attorney General should be investigating. A good example of why both need to be contained in the EIS is the American Lobster. The applicant highlights habitat creation and has taken the time to look at historic landing but fails to provides the reference to EMF interference with the American Lobsters recruitment. The distance between cables during installation is misrepresented with in the report. Installers try to keep the cables close together and the need for replacement of the cables occurring on the average of two times during the life span of the industrial zone would suggest that need exists. The web of cables hanging from structures and lining the seafloor even a football field apart for acres emitting a EMF and the heat associated with it would have some affect. Such as the benthic resources which is the foundation of the many fish species found in all the oceans including the endangered humpback whale. The corralling of whales into the shipping lanes is a scenario that is relative. As is the noise the EMFs	Text and citations have been added to Sections 3.6 and 3.13 to address potential impacts of invasive species as a result of the Proposed Project. The effects of EMF on invertebrate species have not been extensively studied, and studies have mostly been limited to commercially important species such as lobster and crab. Information available (and reviewed in the EIS) indicates EMF impacts on finfish, invertebrates, and EFH would be biologically insignificant, highly localized, and limited to the immediate vicinity of cables, undetectable beyond a short distance, but persistent as long as cables are in operation. Most exposure is expected to be of short duration, and the affected area would represent an insignificant portion of the available habitat for finfish and mobile invertebrate species; therefore, impacts on finfish, invertebrates, and EFH would be expected to be negligible.

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	omit. We don't hear it but the whales do as many other marine species. It is suspect that the studies on the noise levels generated by EMFs have been removed from this EIS.	
0984-0094	The secondary whale interaction is the reduction of forage. A sizable mortality rate of the squid is not contained in the EIS. The decrease in the squid population will devastate not only the whales but many of the commercially harvested fin fish. The killing area for squid is 2-3 miles from the impact zone. Squid is the most consumed seafood in the world and one of the most economic viable fisheries. During the corona virus squid is one of the fisheries that became extremely important because of the shelf life through freezing processes. Another secondary impact on a multitude of fish that will be effected by noice is the avian population who relies on a large spawning body of fish. There is an overwhelming amount of primary and secondary impacts with the industrial energy construction site and the location to the most fertile reproduction area for over 200 spices of fish. Frankly there is so much information on the impacts on the variety of fish and the mortality rate for each species it is callous of the applicant not to provide the information in the EIS.	The EIS recognizes the potential impacts of the Proposed Action on natural resources. Whales are addressed in Section 3.15 along with other marine mammals. Potential impacts on squid and fish are included in Section 3.13. Impacts on birds are included in Section 3.7.
0984-0095	The cold water pool that so many fish are dependent on will be adversely affected. Wind generated energy will increase the water temperature creating greater hurricane strength when traditionally storms are reduced in strength before hitting the coastal sates. The warming of the surface waters by the applicants industrial energy development is not contained in the EIS and is a [Bold: major impact].	Text has been added in Section 3.13.3.2, along with additional citations, to address potential impacts on the cold pool. Climate change is addressed for all resources in the EIS.
0984-0096	The change in salinity or lack of facilitating the developing of "wind waves' in the cold water pool will affecting tourism agriculture and the ability to see the sun rise; a [Bold: major impact] that the applicant has failed to include in detail in the EIS.	Text has been added in Section 3.13.3.2, along with additional citations, to address potential impacts on the cold pool.
0984-0106	The anticipated change of the ecosystem from a sand bottom to a bottom with structures and compacted non-native sediments with piles of non native rubble are impacts that should be considered permanent and adverse; a [Bold: major impact].	Impacts on benthic resources from the presence of structures, e.g., WTGs and scour protection (analyzed in Sections 3.3 through 3.22), would include scouring around turbine bases that would alter localized seafloor habitats and potentially reduce the extent of soft-bottom habitat; pose a risk of fishing gear entanglement and subsequent disturbance, injury, or mortality of benthic organisms; and provide new hard surface habitat for hard-bottom

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		species and opportunities for invasive species. The adverse impacts of these structures are expected to be minor to moderate; moderate beneficial impacts are also anticipated.
1086-0007	Benthic Habitats and Resources Scallops ocean quahogs surf clams and other shellfish are critical ocean resources for commercial fishing in Cape May County. In addition small surface burrowing fauna small tube-building fauna and clam beds provide important ecosystem functions such as water filtration and nutrient recycling. Increased turbidity and physical damage from anchoring dredging currents cable laying pile driving and other human activities will result in significant changes to the benthic habitats that could smother existing species and potentially result in the relocation or complete loss of thriving benthic habitats. The County is concerned that impacts from construction operation and decommissioning activities could result in permanent ecological changes to the seafloor and benthic habitats that could alter nutrient cycles and disrupt feeding patterns for fish and other species that rely on benthic creatures that exist at the bottom of the food chain.	Potential impacts on benthic habitats and invertebrates from the Proposed Action are analyzed and presented in Sections 3.6 and 3.13. The impacts on benthic resources from the Proposed Action are not anticipated to be permanent or affect benthic resources at a population level. Impacts on benthic resources primarily from anchoring, cable emplacement, and presence of structures include physical disturbance, injury, mortality, short-term to permanent habitat modification/loss, and behavioral changes. Adverse impacts are anticipated to range from negligible to moderate and adverse. WTG structures would benefit some benthic fauna by providing new habitat.
1086-0009	Furthermore BOEM states in the DEIS that impacts from electromagnetic frequencies (EMFs) are not well studied. However studies cited below conclude that EMF has measurable impacts on the development of benthic creatures. Such species are highly sensitive to noise vibration and EMF. There are currently no existing studies that investigate the [Italics: simultaneous] impacts from noise vibration and EMF on benthic species. The developer states that transmission cables may be left in place following decommissioning which runs counter to a public statement made by Orsted which asserted that it will "restore the seabed of the site to the original conditions." [Footnote 17: Summary of Public Comments Green Acres Scoping Meeting Archived online at: [Embedded Hyperlink Text (https://www.waterlog.net/download/6813/)]] The County is concerned that the developer does not plan to leave the ocean in the same way it was found and requests that the developer return the waters off of Cape May County to their original condition following the decommissioning of the project. In addition BOEM should require the developer to hold a bond that guarantees the costs of decommissioning. Electromagnetic Fields (EMF) Generated from	Discussion informed by Hutchison et al. 2020, Harsanyi et al. 2022, and Albert 2020 has been added to the EIS to clarify that impacts on specific organisms are documented under specific conditions. However, the data are inadequate to predict results of EMF.

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	Cables Lobsters and other benthic creatures such as sea scallops ocean quahogs surf clams and blue crabs are the most valuable seafood landings in New Jersey. In fact New Jersey is one of the leading suppliers of surf clams and ocean quahogs to both the nation and the world. [Footnote 18: New Jersey Seafood Harvest [Embedded Hyperlink Text (https://www.nj.gov/seafood/harvest.html)]] A 2022 study found that EMF from offshore wind farms could overlap with the brooding and spawning habitats of lobster and crabs and result in deformities that affect larval mortality recruitment and dispersal. [Footnote 19: Harsanyi P Scott K Easton BAA de la Cruz Ortiz G Chapman ECN Piper AJR Rochas CMV Lyndon AR. The Effects of Anthropogenic Electromagnetic Fields (EMF) on the Early Development of Two Commercially Important Crustaceans European Lobster Homarus gammarus (L.) and Edible Crab Cancer pagurus (L.). Journal of Marine Science and Engineering. 2022; 10(5):564. [Embedded Hyperlink Text (https://doi.org/10.3390/jmse10050564)]] EMF has a measurable impact on the early life history and consequently the population dynamics of lobsters and crabs. The project between interlinking array cables and export cables includes over 284 miles of subsea cables. Cape May County is concerned with the EMF generated from the subsea transmission lines and its impacts to marine life.	
1259-0032	Benthic Resources (3.6) The Draft EIS does not include a full and fair discussion of Ocean Wind 1's impacts on benthic resources. The short intermediate and long term impacts of wind energy turbine installations can be understood only if there is thorough knowledge on bottom sediments habitat types benthic assemblages and fish species. Unfortunately this information is currently lacking in most of the Wind Energy Areas and the proposed project is no exception. If approved Ocean Wind 1 will cause significant harm to the benthic environment both inshore and offshore and also adversely impact Submerged Aquatic Vegetation ("SAV") habitats especially in Barnegat Bay and the Oyster Creek area. Contrary to what the Draft EIS suggests SAV habitats are not extensively studied in the vicinity of Ocean Wind 1 or the infrastructure supporting it.	The potential impacts on benthic and finfish resources from the Proposed Action are presented in the EIS. HDD will be used to avoid SAV beds in coastal waters where possible. Additional text has been added to the EIS to better address potential impacts on SAV, including discussion of carbon sequestration.
1259-0033	General Deficiencies of the Benthic Resources Analysis Ocean Wind 1 is on the Southern Mid-Atlantic Bight shelf with two export cable routes from Lease Site OCS-A 0498 to coastal and back-bay areas. This includes a cable route through the Barnegat Bay Estuary which is impaired and subject to the Barnegat Bay Restoration Plan. The Draft EIS does not fully take into account the serious risk that the export cables will pose to this fragile ecosystem and also wrongly states that (1) the overall impacts on benthic	Impacts on benthic habitats are described as minor to moderate in the EIS. Text and citations have been added to expand the analysis of impacts in the EIS. Benefits to finfish and invertebrates from the Proposed Action include reduced impacts from fishing due to possible

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	communities will be minor and (2) most adverse impacts of benthic mortality and habitat alteration will be temporary or short term. [Footnote 15: DEIS at 3.6-23.] COA disagrees with the assessment that impacts resulting from the Proposed Action would only range from negligible to moderate adverse and also questions the relevant scientific evidence to support the claim that the impact would also range to "moderate beneficial." [Footnote 16: Id.]Separately the Wind Farm Area is predominantly composed of soft sediments especially the finer fraction (0.125-0.25 mm) which are known to accumulate toxic heavy metals and persistent organic pollutants including Polychlorobiphenyls ("PCBs") and Polyaromatic hydrocarbons ("PAHs"). Ocean Wind 1 will result in the resuspension and redistribution of these contaminants thereby adversely affecting the benthic fauna but these impacts have not been discussed in the Draft EIS.	reductions in fishing in the geographic analysis area. The release of contaminants from structures and resuspension from sediments and the potential impacts on benthic resources and fish have been added to the EIS, along with citations, in Section 3.6. These substances are presently considered to have a low environmental impact, but monitoring data are not sufficient to assess the environmental impact of this new source.
1259-0034	2. Invasive Species. The DEIS states "Although the likelihood of invasive species becoming established as a result of offshore wind activities is very low the impacts of invasive species on benthic resources could be strongly adverse widespread and permanent if the species were to become established and out-compete native fauna. Such an outcome however is considered highly unlikely. "COA strongly agrees that invasive species are strongly adverse. However the DEIS fails to provide proof of evidence to support its claim that it would be highly unlikely. In fact the proposed project significantly alters the habitat of the region (structures rocks turbulence turbidity abnormal temperatures and other conditions making it highly susceptible and likely that invasives species will become localized and/or widespread as well as seasonal or permanent with devastating consequences to the region ecology and marine species. For example the Indo Pacific lionfish (Pterois volitans) has become invasive in areas of the US. It is causing devastation in areas where it has become established but has been rarely sighted off New Jersey.. The Proposed project would provide excellent habitat for this reef fish and help establish this invasive species and others. A Belgian study has determined that wind turbine foundations attract non-native species and ten non-native species were observed after one year of construction of WTG. [Footnote 17: See Malin Westerlund Offshore wind farms could become a breeding ground for invasive species ING (Mar. 29 2022) https://ing.dk/artikel/offshore-wind-farms-could-become-a-breeding-ground-invasive-species-255603.] The DEIS fails to consider benthic habitat alterations as a condition for invasive population. This is a potential impact of critical concern and a detailed assessment is needed in order to mitigate risks. To date there is very limited knowledge on this subject area. In addition a detailed review of protections on how this will not result is also required as are plans to respond	Text has been added in Sections 3.6.3 through 3.6.7 to address invasive species based on reviews of Bray et al. 2017, Wilding et al. 2017, Adams et al. 2014, Causon and Gill 2018, Krone et al. 2017, and Taormina et al. 2018.

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	to and eliminate the threat from invasives by the proposed project to facilitate invasive species.	
1259-0039	3. Deficiencies of the Analysis Concerning Sediment Biogeochemistry There is a lack of sediment biogeochemistry data and its impacts in the Draft EIS. This is an important concern which has not been addressed as these impacts would last longer at all stages of the Project. The Draft EIS claims that there will be beneficial impacts from turbine foundations including scouring protection to increase fish populations and variety of species yet fails to describe the likely extent of adverse impacts of the same.Turbine foundation and substructures and scouring protections result in modifications to adjacent fish species. These also result in changes to benthic communities of macrofauna around these human-made structures. These also result in a fining of the sediment and organic matter enrichment which is due to a combination of the deposition of fecal pellets from the fouling fauna and biomass falling from the structures. [Footnote 26: See Emil De Borger et al. Offshore Windfarm Footprint of Sediment Organic Matter Mineralization Processes Frontiers in Marine Science (2021) https://www.frontiersin.org/articles/10.3389/fmars.2021.632243/full.] This increased carbon enrichment causes an increased mineralization activity in the sediments resulting in increased sedimentary oxygen consumption. Consequently this leads to higher levels of carbon dioxide being released from sediments which has far-reaching effects for sediment biogeochemistry with reduced mineralization outside the Ocean Wind 1 site.	Text and citations have been added to the EIS to address the potential for invasive species impacts due to the presence of structures. The release of contaminants from structures and resuspension from sediments and the potential impacts on benthic resources and fish have been added to the EIS, along with citations, in Section 3.6. These substances are presently considered to have a low environmental impact, but monitoring data are not sufficient to assess the environmental impact of this new source.
1259-0040	Altered sediment biogeochemistry including changes in oxygen fluxes due to accumulation of epifauna on turbine structures have been investigated in OSW in the North Sea. The results showed that these affect pelagic primary productivity and ecosystem functioning [Footnote 27: See Kaela Slavik et al. The large scale impact of offshore wind farm structures on pelagic primary productivity in the southern North Sea Univ. Hamburg (2018) https://arxiv.org/pdf/1709.02386.pdf] Results of model simulations showed that potential changes in regional annual primary productivity of up to 8% were likely within the OSW farm area and these are non-negligible.	Discussion of potential impacts on primary productivity due to changes in water column mixing has been added to the EIS based on reviewed material from Tagliabue et al. 2021, Floeter et al. 2022, and Dorrell et al. 2022. Text has been added in Sections 3.6.3 to 3.6.7 to address potential impacts of invasive species based on reviews of Bray et al. 2017, Wilding et al. 2017, Adams et al. 2014, Causon and Gill 2018, Krone et al. 2017, and Taormina et al. 2018.

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1259-0041	Another recently published study on the OSW's footprint on the ocean floor reported the following findings: "The filtering action of OWF biofouling fauna induces a significant increase in TOC deposition within the OWF perimeter that rarely stretches beyond it. Around the turbine (<2 km) the TOC flux to the seabed increases annually on average by 2-15% but this increase may amount to 50% in certain areas. This increase can potentially affect surrounding benthic communities. Beyond 5 km from the monopile the carbon flux decreases compared to the reference situation and reaches its maximum decrease at a distance of 9-13 km then decreases to 0.5% at 30 km. The decrease of the flux does not exceed 2% and hence is tangibly smaller than the increase. Model simulations assess the extension of the impact and clearly highlight that the effect of OWFs on carbon dynamics is not spatially uniform but rather exhibits a high degree of variability in response to the local hydrodynamics and in particular residual and tidal circulation wave- and current induced bottom stress and local gyres. In particular these local gyres act as retention areas inside which the carbon deposition may be enhanced." [Footnote 28: Evgeny Ivanov et al Offshore Wind Farm Footprint on Organic and Mineral Particle Flux to the Bottom Frontiers in Marine Science (2021) https://doi.org/10.3389/fmars.2021.631799.]	This should be added to climate change references or to impacts of WTGs on benthic habitats. Fouling organisms on the WTGs feed on the suspended particulate matter in the water column, which they partially expel in the form of fecal pellets. Fecal pellets contain a large amount of carbon and its influx into the sediment bed may disrupt the carbon balance and affect local ecosystems through changes in sedimentology and oxygen fluxes (Mirto et al. 2000; Christensen et al. 2003; Carlsson et al. 2010). The total organic carbon flux to the sediment is significantly altered inside the wind farm perimeters and total organic carbon deposition is increased up to 50% in an area 5 kilometers around the monopiles. The major changes are found along the direction of the main residual current and tidal ellipse’s major axis. The scenarios show that the number of turbines has only a slight impact on the total organic carbon deposition flux, unlike their positioning that significantly alters the total organic carbon flux to the sediments (gravel beds in this case).
1259-0042	The Draft EIS fails to address these challenges to sediment health and benthic communities while this is being addressed as a significant issue of concern in the offshore wind farms in the North Sea.	See previous comment (1259-0041).
1259-0058	Finally cumulative effects from EMFs are both physical and biological. Physically more numerous cables their orientation and cable type may influence EMFs encountered by marine fauna. Biologically behavioral and physiological effects may interact early life history experiences may influence later life stages and a single encounter may inform the next exposure or not. Further EMFs need to be considered along with OSW-associated infrastructure risks such as entanglement or reef effects. With future plans for more expansive OSW arrays that are located at greater distances offshore and use larger capacity power	BOEM concurs that data gaps in impacts on marine species should be studied and evaluated. Discussion informed by Hutchison et al. 2020, Harsanyi et al. 2022, and Albert 2020, has been added to Section 3.6, *Benthic Resources*, to clarify that impacts on specific organisms are documented under specific conditions;

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	cables a higher encounter rate is certain. A more complete knowledge base and data set concerning EMF interactions with affected species will help reduce the risk of EMF to important resource species (or alternatively retire the risk with more confidence). [Footnote 46: See Zoe L. Hutchinson et al. The Interaction Between Resource Species and Electromagnetic Fields Associated with Electricity Production by Offshore Wind Farms 33:4 Oceanography 96 96-107 (2021) https://tos.org/oceanography/assets/docs/33-4_hutchison2.pdf.] Until consequences of EMF at the individual population or system levels have been addressed data gaps in the fundamental biology of marine species - and the specific question of response to anthropogenic EMFs-make conclusions about potential impacts highly speculative.	however, the data are inadequate to predict the impacts of EMF.
1259-0094	Likewise the Draft EIS does not contain any assessment on coastal acidification and its impacts. Coastal and ocean acidification which refers to the decrease in the pH of coastal and absorb carbon dioxide from the atmosphere is an emerging and serious climate change concern. [Footnote 72: See Barnegat Bay Partnership 2019 Water Quality Network Annual Report (2022) https://www.barnegatbaypartnership.org/wp-content/uploads/2022/03/2019-Water-Quality-Network-Annual- Report.pdf.] Ocean chemistry is being altered by the increasing presence of carbon dioxide and threatening the marine environment. Higher levels of acidification due to anthropogenic inputs of nutrient pollution affect the local waters' buffering capacity and as a result a variety of species including corals clams oysters lobsters etc. to name a few.	Ocean acidification is addressed in Section 3.6.3.1 for benthic resources.

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O.6.6 Birds

Table O.6.6-1 Responses to Comments on Birds

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TRANS-0087-0002	This project is a culmination of exhaustive studies and analysis by scientific experts relevant federal and state agencies and extensive public consultation in collaboration with local communities. The majority of the impacts of Ocean Wind 1 is highlighted in the draft environmental impact statement is determined to have negligible to moderate adverse environmental impacts on birds bats coastal habitat farm marine life and water quality. Siting these turbines 15 miles from shore will minimize the potential bird impacts research has shown that wind turbines structures have beneficial impacts on the sea floor and communities by creating artificial reefs as already previously mentioned. NJEC understands the environmental concerns of offshore wind on our natural resources both in and out of the ocean. Ongoing engagement education outreach combined with plans to avoid and mitigate any disturbances are part of the process and we have full confidence in the plan set forth.	Comment noted.
0950-0001	Despite the significant advantages outlined above scientists have not been able to determine exactly how offshore wind turbines will affect migrating birds and marine animals. We ask that every effort be made to study the possible effect on wildlife and explore ways to lessen any negative impact. For example wildlife monitoring and impact minimization should continue for the life of the project not just for a few years and best practices (e.g. lighting marking noise abatement brief shut down periods and other measures to protect wildlife) should be routinely reassessed and updated.	BOEM has used the best available information on bird presence in the Project area and will continue to collect information on bird presence in the offshore environment to help inform the assessment of potential impacts on birds from construction and operation offshore wind farms. Based on current information, bird presence in the offshore environment is relatively low (as described in Draft EIS Section 3.7). To support the advancement of the understanding of bird interactions with offshore wind farms, Ocean Wind has proposed an Avian and Bat Post-Constructing Monitoring Framework (COP Appendix AB and BA Appendix B) that outlines an approach to post-construction monitoring. The scope of monitoring is designed to meet federal requirements (30 CFR 585.626(b)(15) and 585.622(b)) and is scaled to the size and risk profile of the Ocean Wind Project with a focus on species of conservation

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		concern. Furthermore, BOEM anticipates the bird and bat mitigation/adaptive management for Ocean Wind to be similar to the Vineyard Wind COP approval conditions for birds and bats (found here: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/VW1-COP-Project-Easement-Approval-Letter_0.pdf). The Avian and Bat Protection Conditions (Condition Section 5.2.3) include an avian and bat monitoring plan for construction and operations. As part of the monitoring plan, new mitigation measures and monitoring may be imposed by BOEM if impacts deviate substantially from the impact analysis in the EIS. If deemed necessary, BOEM could require a longer monitoring period to assess the potential effects of the wind farm on avian species.
0984-0014	3.7 BirdsThe irreversible killing of threatened and endangered bird species like the American Grebe is a [Bold: Major Impact]. The scientifically listed birds known to transit at sea within the applicants development site are razorbills Black Capped Petrels terns seagulls eagles osprey pelicans mallards black ducks eiders coot snow geese golden eye widgeon teal American Goldfinch American Tree Sparrow Baltimore Oriole Black- capped Chickadee Blue Grosbeak Blue Jay Brown Thresher Chipping Sparrow Common Redpoll Dark-eyed Junco Eastern Bluebird Eastern Meadow Lark Eastern Towhee Evening Grosbeak Field Sparrow Hermit Thrush House Finch Northern Flicker Orchard Oriole Pine Grosbeak Pine Siskin Pine Warbler Purple Finch Red-breasted Nuthatch Red-winged Blackbird Ruby-crowned Kinglet Ruby-Throated Hummingbird Song Sparrow White-throated Sparrow Yellow-throated Warbler pintail canvasback wood duck snipe yellow legs shoveler gadwall bufflehead ring-neck scup redhead merganser scooter eider harlequin and broadbills. The applicants failure to disclose the [Bold: major impact] on birds or suggest any mitigation on the non-threatened or endangered species within the EIS is reason to reject the application.The Atlantic is the most densely populated of the four flyways and many waterfowl habitats in this region are already threatened by development. The applicants EIS fails to recognize all the individual impacted species. Each individual bird species needs to	The bird assessment in Draft EIS Section 3.7 is based, in part, on a Project-specific bird exposure assessment that estimated risk of various offshore bird species that could encounter the Wind Farm Area. The full assessment can be found in COP Volume III, Appendix H. As stated in the exposure assessment and in Draft EIS Section 3.7, approximately 159 bird species have been identified as potentially occurring in the Offshore Project area through public databases and baseline studies (see Table 3-1 in COP Volume III Appendix H for the full list of bird species). The 159 bird species are part of the various species groups that the exposure assessment analyzed. The exposure risk conclusions are summarized in Draft EIS Section 3.7.5, *Presence of Structures*, where it states that most of the bird species have minimal to low overall exposure. A few species have low to medium. Overall, the results of the exposure assessment would not warrant a “major” impact because the exposure assessment indicates that population-level impacts would not occur. Given the detailed analysis

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	be listed and a mortality rate needs to be provided. The applicants industrial energy development site adds to the list of lost habitat for the East Coast states permanent and transit bird population. The EIS fails to meet the basic requirements of an EIS and has purposely avoided declaration of the major impacts to the birds.	of all bird species in the bird exposure assessment, providing an impact assessment for each individual bird species is not warranted given the assessment conclusions. As summarized in Draft EIS Section, 3.7, impacts on bird habitat in the onshore environment are anticipated to be limited given the nature of the existing habitat, abundance on the landscape, limited removal of habitat, temporary nature of construction, and implementation of avoidance and minimization measures proposed by Ocean Wind.
0984-0078	The land based coastal habitat for many seabirds are dependent on the cold water pool area for food. The bird studies from satellites are filled with incomplete data. The proposed vibration sensory will not be adequate for the smaller bids that frequent the area. If the Cold water pool inclusive of the applicant accountants for 50 % of all fish harvested on the east coast of the United States; where do you think the seabird population gets it food? The suggestion of having limited sensory on each wind turbine is also unacceptable. The bird follow the tide lines when feeding that run through the applicants leased area. So one turbine might have 10 bird strikes one day and none the next. I also take exception to the premise that the birds relocate after a few die. That is the same theory the applicant and BOEM have with the fishers. The fact is after a few die the count goes down because there are fewer to kill. The land based calculations of bird strikes will not work in the applicants developing site. The bird population in transient. A [Bold: major impact] and requirement to shut down the entire industrial zone during heavy migration periods should be mandatory. When birds are feeding that is when they are most vulnerable to predation and wind turbine accidents. The proximity of the applicants lease from Long Island and New Jersey is where many birds fly and feed. The two bodies of land provide the avian population the opportunity to fly back and forth to feed and roost. The [Bold: major impact] on the avian population contained in the EIS is inadequate. The EIS should be rejected as incomplete.	The Draft EIS addresses potential bird collision with offshore wind structures. As stated in the Draft EIS, the predicted activity of bird populations that have a higher sensitivity to collision is relatively low in the outer coastal shelf during all seasons of the year (see Draft EIS Figure 3.7-3). In addition, as stated in the response to comment 0984-0014, most bird species have minimal to low overall exposure to the offshore wind turbines. The land-based calculations for bird strikes are different than what would be anticipated offshore because the presence of birds offshore is much lower than on land. BOEM would anticipate a much lower number of strikes for offshore wind farms based on the current understanding of birds' use on the outer continental shelf.
1048-0002 and 1112-0002	Your own report show this will have a adverse affect on fisheries migratory birds. This project is in close sensitive areas to several wild life refuges including the "Edwin B. Forsythe National Wildlife Refuge	BOEM acknowledges the importance and sensitivity of the Edwin B. Forsythe National Wildlife Refuge to birds and bird migration. However, no part of the

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	protects more than 48000 acres of southern New Jersey coastal habitats. More than 82 percent of Forsythe refuge is wetlands of which 78 percent is salt marsh interspersed with shallow coves and bays. The refuge's location in one of the Atlantic Flyway's most active flight paths makes it an important link in seasonal bird migration." The Audobon society clearly points out in their literature that wind turbines must always be placed in areas that are not sensitive! Lib to cape May ni is a highly sensitive area. The red knot for one is of crucial concern. Millions of birds are killed yearly due to these turbines snd your proposing placing this in high migratory areas? This is detrimental!	onshore Project would directly affect the refuge, and the offshore wind farm area is greater than 15 miles from the nearest point to Edwin B. Forsythe National Wildlife Refuge. Draft EIS Section 3.7.5, *Presence of Structures*, addresses potential bird collision with the Project wind turbines.
1086-0010	Birds The County is concerned about the impacts to migrating avian species through and around offshore windfarms as this area of study is not well understood. Conservative estimates project that at least 681000 birds are killed by collisions with wind turbine blades each year with an emphasis on smaller birds. [Footnote 20: How Many Birds Are Killed by Wind Turbines [Embedded Hyperlink Text (https://abcbirds.org/blog21/wind-turbine-mortality/)] On land wind farms are responsible for the death of over 150 bald and golden eagles due to blunt force trauma from turbine blades. [Footnote 21: As wind-power grows across America and into open-water areas that are used for migration these numbers are likely to be severely underestimated based on both the lack of current information available on bird-deaths and the rapid increase of the number of turbines in operation.]A 2020 study of tagged Piping Plovers showed evidence that the migratory path of this species is directly through as many as 12 of BOEM's wind-energy lease areas.[Footnote 22: Loring Pamela & Mclaren James & Goyert Holly & Paton Peter & Loring Pamela & Mclaren J & Goyert H & Paton P. (2020). Supportive wind conditions influence offshore movements of Atlantic Coast Piping Plovers during fall migration 2 Piping Plover migration. The Condor. 122. 1-16. 10.1093/condor/duaa028.] These migratory paths are part of the Atlantic Flyway and are shown in Figure 2. Various stopover areas along the Atlantic Flyway such as Cape May Meadows Stone Harbor Point and the Forsythe National Wildlife Refuge are recognized as critical points for migratory birds. As avian species migrate over water at night as the 2020 study showed most piping plovers do they may be attracted to lighting components of the wind farms that could result in blind collisions with turbines due to poor nighttime visibility haze fog or	Impacts on bird migration and collisions are addressed in Draft EIS Section 3.7. Bird kills based on collisions in the onshore environment are well documented and USFWS has estimated bird kills from wind turbines onshore (see Draft EIS Section 3.7.3.2). Based the current understanding of bird presence in the offshore environment, as documented in Draft EIS Section 3.7, BOEM anticipates that bird collisions with offshore wind infrastructure will be lower than onshore wind infrastructure because bird presence in the offshore environment is much lower than onshore. As stated in Draft EIS Section 3.7, within the Atlantic Flyway along the North American Atlantic Coast, much of the bird activity is concentrated along the coastline. Waterbirds use a corridor between the coast and several kilometers out onto the OCS, while land birds tend to use a wider corridor extending from the coastline to tens of kilometers inland. While both groups may occur over land or water within the flyway and may extend considerable distances from shore, the highest diversity and density are centered on the shoreline (see Draft EIS Figures 3.7-2 and 3.7-3 and Table 3.7-3). BOEM addresses piping plover and other federally listed birds in detail in the BA that BOEM developed for ESA Section 7 compliance.

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	other weather conditions that reduce visibility. Such collisions would go undetected and would occur far from shore where their deaths would be unable to be recorded and monitored. BOEM suggests that this impact would be localized. However the County is concerned that BOEM is substantially underestimating the adverse impact posed to avian species. Ocean Wind 1 spans 68450 acres and is just one of 25 planned wind farms along the Eastern Seaboard many of which cover substantially larger acreage than Ocean Wind 1. To categorize the impact of one wind farm that spans nearly 70000 acres as 'localized' is a failure to consider the cumulative impacts of multiple wind farm arrays that will exist adjacent to one another and is a violation of NEPA guidelines for cumulative impacts.BOEM also states that wind farms may have a beneficial impact on bird populations due to the artificial reef effect which may create greater foraging opportunities. While this may be true it places birds at greater risk of colliding with turbine blades. Research has shown as birds seek prey they tend not to look in the direction of travel which makes them effectively blind in the direction of travel greatly increasing their risk of collision with a turbine blade. [Footnote 23: Understanding bird collisions with man-made objects: a sensory ecology approach [Embedded Hyperlink Text (https://onlinelibrary.wiley.com/doi/10.1111/j.1474-919X.2011.01117.x)]] [Footnote 24: Windmill Hits Eagle [Embedded Hyperlink Text (https://www.youtube.com/watch?v=rrB0NPNNllc)]] [See original comment for Figure 2: Migratory path of Piping Plovers. Source: Loring Pamela & McLaren (14)]	Regarding potential lighting impacts, as stated in Draft EIS Section 3.7, Ocean Wind proposes to use ADLS, which would dramatically reduce the amount of time obstruction lights are on, significantly reducing the potential impacts on birds. It is estimated that lights would be activated on offshore structures for only 1 hour 19 minutes and 17 seconds over a full 1-year period. When the lights are activated they will be flashing, which minimizes attraction to birds. The Draft EIS addresses the effects of future offshore wind activities (not including the Proposed Action) on birds in Draft EIS Section 3.7.3.2. However, to make it clearer that this is a cumulative analysis, the Draft EIS outline has been revised and now includes clarity on the cumulative analysis section (see Final EIS Section 3.7.3.2, *Cumulative Impacts of the No Action Alternative*). In addition, to support the advancement of the understanding of bird interactions with offshore wind farms, Ocean Wind has proposed an Avian and Bat Post-Constructing Monitoring Framework (COP Appendix AB and BA Appendix B) that outlines an approach to post-construction monitoring. The scope of monitoring is designed to meet federal requirements (30 CFR 585.626(b)(15) and 585.622(b)) and is scaled to the size and risk profile of the Ocean Wind project with a focus on species of conservation concern. Furthermore, BOEM anticipates the bird mitigation/adaptive management for Ocean Wind to be similar to the Vineyard Wind COP approval conditions for birds (found here: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/VW1-COP-Project-Easement-Approval-Letter_0.pdf). The Avian and Bat Protection Conditions (Condition Section 5.2.3) include an avian monitoring plan for construction and operations. As

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		part of the monitoring plan, new mitigation measures and monitoring may be imposed by BOEM if impacts deviate substantially from the impact analysis in the EIS. If deemed necessary, BOEM could require a longer monitoring period to assess the potential effects of the wind farm on avian species.
1116-0004	The DEIS has failed to take a hard look on the Ocean Wind project's and other offshore wind projects' adverse impact on migratory bird species protected by the Migratory Bird Treaty Act some of which are also protected under the Endangered Species Act. 30 CFR 585.102(b) provides that "BOEM will require compliance with all applicable laws [and] regulations." BOEM has failed to take a hard look at required compliance with all applicable laws and regulations because the Ocean Wind project is likely and practically certain to kill migratory birds which is a strict liability crime.	The bird assessment in Draft EIS Section 3.7 is based, in part, on a Project-specific bird exposure assessment that estimated risk of various offshore bird species (including migratory birds protected under the Migratory Bird Treaty Act) that could encounter the Wind Farm Area. The full assessment can be found in COP Volume III, Appendix H. As stated in the exposure assessment and in Draft EIS Section 3.7., approximately 159 bird species have been identified as potentially occurring in the Offshore Project area through public databases and baseline studies (see Table 3-1 in COP Volume III Appendix H for the full list of bird species). The 159 bird species are part of the various species groups that the exposure assessment analyzed. The exposure risk conclusions are summarized in Draft EIS Section 3.7.5, *Presence of Structures*, where it states that most of the bird species have minimal to low overall exposure. A few species have low to medium exposure. Ocean Wind will be required to comply with the Migratory Bird Treaty Act should BOEM approve the Project and Ocean Wind decide to construct the Project. BOEM understands that the Migratory Bird Treaty Act is a strict liability statute that Ocean Wind (and any other offshore wind project applicant) must comply with. Ocean Wind would be required to work with the USFWS and follow the Migratory Bird Treaty Act regulations (whatever those may be at the time of construction). The Draft EIS also addressed federally listed bird species and provides a high-level summary of the

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		more detailed BA that addresses all federally listed species that could be affected by the Project.
1259-0107	New locations for birds are also emerging including one area that is already "one of the most critically important areas for birds in the State of New Jersey." [Footnote 80: Frank Kummer A new island emerges at the Jersey Shore and boaters are angry it's been closed to protect birds Philadelphia Inquirer (May 13 2022) https://www.inquirer.com/news/brigantine-new-jersey-horseshoe-island- conservation-migrating-birds-20220513.html.] Named "Horseshoe Island" this new location that has attracted "more than 1360 coastal birds for nesting foraging and roosting" is located south of Little Egg Inlet by Little Beach Islands off Brigantine NJ (see map; credit John Duchneskie The Philadelphia Inquirer). The island is a feature that is not found anywhere else in the state. It has been found that Horseshoe Island:provides habitat for a number of species including 470 endangered least terns making it the largest colony of the species in the state. It also provides roosting habitat for 80 red knots which are federally threatened and state endangered. It also provides nesting or roosting habitat for other state endangered or species of special concern including six pairs of breeding American oystercatchers 380 black skimmers 50 common terns 24 royal terns 10 piping plovers and other species including brown pelicans whimbrels and ruddy turnstones. [Footnote 81: Id.]	BOEM has reviewed the article and the embedded map showing the location of Horseshoe Island. While BOEM acknowledges the existence of this new island and potential importance for birds, no part of the Ocean Wind Project would affect the island, and the nearest Project component (offshore cable route to the Oyster Creek landing) is over 6 miles away (farther offshore).
1259-0108	With regard to Ocean Wind 1 the risks to bird species are many: mortality risk from encounter with blades habitat conditions offshore and onshore habitat loss and alteration displacement of food sources avoidance of areas for foraging & nesting noise vibrations vessel traffic spills new lighting and reduced fitness and "energetic costs of longer flight paths (especially for migrating shorebirds and ducks)." [Footnote 82: Charles H. Peterson Risks to Birds and Wildlife from Offshore Wind Farms: BOEMRE NC Task Force Univ. N. Car. (2011) https://www.boem.gov/sites/default/files/renewable-energy-program/State- Activities/RiskBirdsWildlifeOffshore.pdf.] The species of birds at Horseshoe Island and in the geographic analysis area - including Brigantine and Atlantic City as well as inland - will be adversely impacted by the onshore and offshore development associated with the Proposed Action. In fact the Draft EIS identifies birds as experiencing "potential unavoidable impacts" specifically due	Draft EIS Section 3.7.5 analyzes the impacts of the Proposed Action on various IPFs, including IPFs related to collisions, habitat loss, altered flight patterns, and vessel spills. Impact categories for birds are defined in Draft EIS Table 3.7-2. These are all potential unavoidable impacts, but they describe varying degrees of the potential impact. As such, an impact that is an unavoidable impact does not equate to a major impact (or any of the other impact categories). Each IPF analysis provides a summary of the impact level, and the conclusion section (Draft EIS Section 3.7.5.1) provides an overall summary, including in the context of other reasonably foreseeable environmental trends and ongoing and future planned activities.

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	to the "displacement and avoidance behavior due to habitat loss/alteration equipment noise and vessel traffic." [Footnote 83: DEIS at L-1.] Yet BOEM assesses the impacts to birds as "moderate." In the Draft EIS BOEM fails to provide important information about how the agency assesses the impacts to birds as "moderate" when also stating birds will experience "unavoidable impacts." These determinations are inconsistent with each other.	See response to comment 1259-0107 regarding Horseshoe Island.
1259-0109	Regarding additional risks and impacts to birds the brief reference to the use of European studies about birds affected by offshore wind projects does not reveal how birds were impacted. Also other estimates of birds killed by wind turbines show that approximately 538000 birds are killed each year by wind turbines in the U.S. not the 320000 annual average that the Draft EIS suggests. [Footnote 84: Joel Merriman How Many Birds Are Killed by Wind Turbines? American Bird Conservancy (Jan. 26 2021) https://abcbirds.org/blog21/wind-turbine-mortality/.] Also the Draft EIS does not explain how BOEM lighting guidelines will help minimize impacts on birds. [Footnote 85: DEIS at 3.7-9.] This underscores the lack of studies about the impacts to birds and the potential risks to birds from the Proposed Action.	How birds are affected by the Proposed Action is disclosed in Draft EIS Section 3.7.5. BOEM used the latest information posted by USFWS regarding bird kills throughout the United States, including by wind turbines. The data are referenced in Draft EIS Section 3.7.3.2, *Presence of Structures*. Even if BOEM were to cite the 538,000 kill number from the American Bird Conservancy, this would still amount to less than 0.1 percent of all annual bird kills in the context of all bird kill causes across the United States (see Draft EIS Section 3.7.3.2 for other causes and associated kill numbers). In addition, data on bird kills from wind turbine collisions are for the onshore environment, where bird occurrence is much higher than the offshore environment. Based on current information and as cited in multiple areas of Draft EIS Section 3.7, bird occurrence on the OCS is low. Therefore, any potential bird kills from turbines in the offshore environment would likely be lower than the turbine kill numbers reported for the onshore environment. BOEM lighting guidelines specifically do not minimize impacts on birds. Draft EIS Section 3.7.3.2, *Lighting*, has been revised to provide further detail on how lighting impacts on birds are anticipated to be reduced.
1259-0110	Also the Draft EIS notes if new structures in the ocean attract increased prey for some birds then surely there will be more birds around the wind turbines therefore increasing the amount of birds at risk of colliding with turbines. [Footnote 86: Id. at 3.7-9.] As such the construction and placement of thousands of offshore wind turbines	Draft EIS Section 3.7 addresses bird impacts related to collisions with offshore structures for both the Proposed Action and future offshore wind (not including the Proposed Action) on the Atlantic OCS.

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	(cumulatively speaking) will impact the bird populations in and outside of the geographic analysis area of the Proposed Action.	
1259-0111	Regarding impacts to birds from potential spills in the ocean and coastal areas from the supporting vessels during construction operations and maintenance as well as the materials expected to be stored and used at substations and turbines "Ocean Wind committed to preparing and implementing waste management plans and hazardous materials plans which would minimize the potential for spills and identify procedures in the event of a spill." [Footnote 87: Id. at 3.7-16.] Ocean Wind is set to "prepare waste management plans and hazardous materials plans as appropriate for the project" [Footnote 88: Id. at H-3.] and claims that plan would minimize potential for spills but there is no plan in place. When is that plan expected for public review? It would seem to be appropriate for inclusion in the Draft EIS or Final EIS. Also cumulatively speaking the quantity of these stored materials and the impacts from them are much higher as is the case with the thousands of gallons expected to be onsite for the multiple offshore wind projects in the region. [Footnote 89: Id. at Table F2-4.] Nevertheless the Draft EIS fails to consider the cumulative impact of such spills on birds.	The voluntary plans would be developed if BOEM approves the COP and if Ocean Wind decides to construct the Project. The potential impact of accidental release on birds for future offshore wind projects is addressed in Draft EIS Section 3.7.3.2.
1259-0112	The Draft EIS's analysis is similarly errant with respect to the impacts of onshore development associated with the Proposed Action on bird species. For example the document does not specify or estimate how many trees (or acreage of trees) the Applicant plans to cut down for the building of onshore substations. [Footnote 90: Id. at 3.7-15.] However these actions will not only have an impact on local erosion and flooding but will also impact the birds that use the trees for habitat nesting safety from predators and food.	Several IPFs are addressed for birds, including land disturbance, which addresses onshore habitat impacts. During the comment process with USFWS on the BA (after the Draft EIS was issued), BOEM obtained more information on forests and forest removal for the onshore Project components. The Oyster Creek substation area is previously disturbed and sparsely vegetated, and characterized as upland meadow early-successional forest with some patches of emergent wetlands and small, scattered trees. The Oyster Creek onshore cable route does include tree clearing in some forested areas characterized as mixed Pine Barrens/oak-dominated forest. An estimated 7 acres of forested areas will be cleared for construction; approximately 2 acres of forested area will be permanently cleared and maintained as a utility easement. These forested areas were predominantly previously disturbed

Comment No.	Comment	Response
		farmland and are composed primarily of successional stage pitch pine and small mixed oaks typical of coastal New Jersey, with most trees fewer than 3 inches in diameter. The BL England substation site is predominantly upland meadow, as it occupies much of a former golf course that continues to be mowed regularly, but there are areas of upland forest with a moderate to dense tree canopy with a mix of pines and hardwoods. Forested areas within the substation parcel feature a moderate to dense tree canopy with a mix of coniferous and deciduous species, and an open shrub and sapling layer. Trees are generally small (6 to 10 inches in diameter) with the exception of a few larger pitch pines and red maples. Dominant tree species are red maple, pitch pine, Eastern red cedar, black tupelo, sweetgum, and white pine. An estimated 6 acres of forested areas would be permanently cleared. The BL England onshore export cable route is within paved roadways and would not disturb habitat. Forested areas within the Island Beach State Park area are dense upland maritime forest dominated by red cedar and American holly. An estimated 1 acre of forested areas would be temporarily cleared for construction.
1259-0113	Also the DEIS acknowledges uncertainties too often in the section making Clean Ocean Action challenge the finding of "moderate" impacts to birds. The DEIS admits to uncertainty due to "habitat use and distribution that varies for seasons species and years" as well as offshore wind "being in its infancy." [Footnote 91: Id. at D-2.] Specifically the DEIS states "there will alway be some level of uncertainty regarding the potential for collision risk and avoidance behaviors for some of the bird species that may be present within the offshore portions of the geographic analysis area." Further uncertainties were also cited due to BOEM's use of data mortality rates from onshore wind farms.	Impact and uncertainty (due to knowledge gaps) are two different issues. Uncertainty does not necessarily mean an impact level should be adjusted upward. It is known that bird activity is relatively low offshore compared to onshore (see Draft EIS Section 3.7). BOEM does acknowledge the uncertainty of bird use of the OCS and that there will always be a level of incomplete information (as stated in Section D.1.4). However, as stated in Section D.1.4, BOEM believes that sufficient information does exist to inform the decision-making process.

Comment No.	Comment	Response
		See response to comment 1259-0109 regarding data mortality rates from onshore wind farms and how they compare to anticipated mortality in the offshore environment.
1259-0114	With all the deficiencies and inconsistencies presented in the discussion to the impacts on bird species Clean Ocean Action challenges BOEM's designation of "moderate" impacts on bird species and maintains BOEM failed to complete a comprehensive analysis of the impacts to birds onshore and offshore from the Proposed Action. A pilot-scale project would allow for studies to be performed to evaluate the true potential impacts of a full-scale industrial project especially for endangered birds.	BOEM has responded to previous Clean Ocean Action comments on the “moderate” rating for birds and the specific comments on the bird analysis. BOEM has reviewed bird data from existing wind turbines on the Atlantic OCS and has taken those data into consideration in the Draft EIS. In addition, to support the advancement of the understanding of bird interactions with offshore wind farms, Ocean Wind has proposed an Avian and Bat Post-Constructing Monitoring Framework (COP Appendix AB and BA Appendix B) that outlines an approach to post-construction monitoring. The scope of monitoring is designed to meet federal requirements (30 CFR 585.626(b)(15) and 585.622(b)) and is scaled to the size and risk profile of the Ocean Wind Project with a focus on species of conservation concern. Furthermore, BOEM anticipates the bird and bat mitigation/adaptive management for Ocean Wind to be similar to the Vineyard Wind COP approval conditions for birds and bats (found here: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/VW1-COP-Project-Easement-Approval-Letter_0.pdf). The Avian and Bat Protection Conditions (Condition Section 5.2.3) include an avian and bat monitoring plan for construction and operations. As part of the monitoring plan, new mitigation measures and monitoring may be imposed by BOEM if impacts deviate substantially from the impact analysis in the EIS. BOEM also notes that there are currently two pilot offshore wind projects on the Atlantic OCS where impacts on birds and other resources are being

Comment No.	Comment	Response
		studied: Block Island offshore wind and Coastal Virginia Offshore Wind.
1194-0002c	The FEIS should consider the full scope of impacts to federally and state protected birds and bird species that trigger conservation obligations and address collision risk for species most at risk of collision. In addition it must include habitat loss that birds may experience beyond the footprint of project construction and operation.? BOEM should require Ocean Wind to pursue studies to further strike avoidance mitigation methods to ensure that migratory species like bats birds and other offshore wildlife are protected especially as technologies advance.?	Ocean Wind and BOEM recognize that active monitoring may be necessary after construction. The Avian and Bat Post-Construction Monitoring Framework developed by Ocean Wind states that, “Over the course of monitoring, Ocean Wind will work with BOEM, USFWS, and other relevant regulatory agencies, to determine the need for adjustments to monitoring approaches, consideration of new monitoring technologies, and/or additional periods of monitoring, based on an ongoing assessment of monitoring results.” In addition, similar to previously approved COPs (e.g., South Fork and Vineyard Wind), BOEM anticipates that BOEM’s COP approval conditions for avian and bat protection conditions will include an avian and bat monitoring plan for construction and operations. As part of the monitoring plan, adaptive management may be required (i.e., new mitigation measures and monitoring may be required by BOEM if impacts deviate substantially from the impact analysis in the EIS).

O.6.7 Coastal Habitat and Fauna

Table O.6.7-1 Responses to Comments on Coastal Habitat

Comment No.	Comment	Response
0984-0056	Coastal Fauna- No matter how many scenarios are written there is always something that slips through the cracks such as the Seabeach Amaranth repopulation along the Jersey Shore after the Army Corps. Of Engineers' Beach replenishment project. Between 2018-2019 the federal protected species Sea Amaranth increased 600% due to the o?shore sand dredging taking materials below the worm line and removing some archipelagic islands that pre-dated Christ. The removal of some of the islands stopped when an ancient intact cedar forest was encountered releasing the old seeds. It should be anticipated that events like this can happen again. The disturbance of the seafloor by the developer can have significant impacts. The additional flotsam can result in miles of recreational beaches removed from recreation to protect the residents and visitors from increased amounts of fecal coliform. Increased testing along New Jersey beaches during any sediment disturbance scenario should be required. The applicants' failure to site upwelling and the movement of water west towards the beaches is an example where there is lack of financial commitment to produce a valid EIS. The EIS should be rejected as incomplete.	The federally listed seabeach amaranth is addressed in Draft EIS Section 3.8 and in the BA. Seafloor disturbance is addressed in Draft EIS Section 3.6 and Section 3.13, and water quality is addressed in Draft EIS Section 3.21.
0984-0059	The cumulative impact of oil spills on the beaches and a?ecting coastal fauna is also amiss. Although mitigation response plans will be implemented there is a scientifically proven statistical calculation that can be attributed to the impacts on the coastal communities based on wind tide the amount of oil contained by each vessel. This information is available by the applicants partners at Rutgers and Monmouth Universities. Compiling the information and providing the scenario within the EIS is not an economic consideration but of intentional falsification of the EIS application. The applicant and BOEM are fully aware of the information on oil spills from the wind turbine industry and the potential impacts on the fauna. The omission of such information of this application by the applicant and BOEM should result in the immediate denial of the application and the United States Attorney General should be brought in to investigate the actions by BOEM for violation of public trust.	As stated in Draft EIS Section 3.21, *Water Quality*, BOEM has conducted extensive modeling to determine the likelihood and effects of chemicals (including oil and petrochemicals) from construction and operations of offshore wind facilities along the Atlantic Coast. The report is titled *Environmental Risks, Fate, and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf* and is cited as Bejarano et al. 2013 in the Draft EIS. If BOEM approves the Project, spill avoidance and minimization measures would be conditions of BOEM's approval.

Comment No.	Comment	Response
0984-0060	There is president set in the judicial system where courts have found that paving a beach is not an environmental mitigation solution since many of the sealife vegetation and land (beach) animals have to transit said paths. There is the ongoing cost of sand drift that requires creative beach fencing maintenance corridors and public or private funds to maintain them. Moderate impacts from increased GHG on a level to climate change is so significant that the application should be rejected on this premise alone.	The proposed Project does not include the paving of beaches. Beach habitat would be avoided via the use of HDD. GHG and climate change are addressed throughout the Draft EIS.
0984-0071	The depth of the cable has significant affects on coastal habitat. It is scientifically known and proven that the increased sediment temperature around the cables has significant impacts on the invertebrates that affect the feeding habits and distribution of marine resources that rely on them. The omission of the cumulative impact of the individual species that will be affected and secondarily is an act of non-compliance within the application process. There is scientific information that is proprietary held by other cable development companies that should be part of the EIS. The applicant and BOEM look to use this application to address impacts on other applications. The relative information needs to be provided in this application. The applicant needs to purchase or collaborate with other industry representatives and submit an appropriate application before this EIS is approved. The applicant continues to refer as the shoreline being developed and that the impacts will be negligible. The fact is that the areas where there is no development like state parks are the areas that the different developers are looking to make land fall. This is a farce by the applicant not to address the EIS on open space and the rules that pertain to their use. For example a president has been set in New Jersey for every acre of dedicated open space disturbed a seven acres of comparable space must be secured. As the applicant has noted most of the coastal communities are already built out and the cost of close to fifty acres will run into the millions of dollars making the entire application non-compliant with the EO.	Cable installation and associated impacts, including effects on invertebrates and other benthic organisms, are addressed in Draft EIS Section 3.6. BOEM has addressed potential future offshore wind in the onshore and offshore environment along the Atlantic OCS in the Draft EIS. For any resource where the established geographic analysis area overlaps with another potential future offshore wind project, those impacts are discussed. As stated in Draft EIS Section 3.8.3.2*, Offshore Wind Activities (Without the Proposed Action)*, there are currently no planned future offshore or onshore wind project that overlap with Ocean Wind's coastal habitat and fauna geographic analysis area. The potential impacts of the Proposed Action on coastal habitats and fauna are disclosed in Draft EIS Section 3.8.5.
1192-0028	Island Beach State Park is one of the longest barrier island natural dune structures left in the US. There has been no impact study/ drawings/ research dealing with the cable coming into the beach and exiting on the west side. IBSP is the largest protection from rising oceans and hurricanes for a huge population living around the bay.	All beach habitats will be avoided at landings and at Island Beach State Park through the use of trenchless technology (HDD). Indicative HDD layouts, configurations, cross sections, and operating rigs can be found in COP figures 6.2.1-3, 6.2.2-1, 6.2.2-2, 6.2.2-3, and 6.2.2-4. Drawings of the specific Island Beach State Park crossing are shown in Draft EIS Figure 2-1.

Comment No.	Comment	Response
1259-0115	vi. Coastal Habitat and Fauna (3.8)Activities related to Ocean Wind 1 will negatively impact the wildlife and fauna that can be found within the acres facing disturbance. To this end the Draft EIS identifies five (5) species that are classified as endangered or threatened and can be found within the overall onshore project area:· the American chaffseed;· the Knieskern's beaked-rush;· the seabeach amaranth;· the sensitive joint-vetch; and· the swamp pink. [Footnote 92: Id. at 3.8-3.] The document goes on to explain that while a sixth species-the State-list Bobcast-is unlikely to be present within the onshore project area due to existing development individuals among the species may experience stress and negative physiological effects. Nevertheless the Draft EIS dismisses any potential impacts to the species on the basis that "the species can habituate to human presence" [Footnote 93: Id. at 3.8-11.] a conclusion we reject due to the lack of any scientific support. Not only is the Draft EIS lacking a comprehensive analysis regarding the foreseeable impacts of onshore development from Ocean Wind 1 on these species but it is also largely silent with respect to the impact of Ocean Wind 1 on the monarch butterfly as well. The monarch butterfly is an iconic and easily recognizable insect for which New Jersey including its coast provides a crucial migratory route between Canada and Mexico. [Footnote 94: Monarch Migration Made Easy Cherry Hill Township (Spring 2019) https://www.chnj.gov/1138/Monarch- Migration-Made-Easy.] Although the monarch butterfly was not listed as "endangered" or "threatened" under the Endangered Species Act at the time of the Draft EIS's publication the International Union for the Conservation of Nature ("IUCN") has since designated the species as "endangered." [Footnote 95: Migratory monarch butterfly now Endangered - IUCN Red List Intl. Union for the Conservation of Nature (July 21 2022) https://www.iucn.org/press-release/202207/migratory-monarch-butterfly-now-endangered-iucn-red-list.] As such the Draft EIS's analysis concerning monarch butterflies-which is largely limited to acknowledging that the species may use open fields near construction and operations activities where milkweed can be found-is woefully inadequate. BOEM cannot allow Ocean Wind 1 to move forward as proposed without a full accounting of the extensive steps that will need to be taken to avoid reduce and mitigate impacts on monarch butterfly habitat.	The Draft EIS does not state the bobcat is not present, but that it is unlikely to be present given the habitat conditions. Even though the species is unlikely to be present, BOEM still indicates that noise could affect the species in the unlikely event one is present. The species habituating to human presence statement is based on the cited reference in the Draft EIS (Carroll 2019). Federally listed threatened, endangered, and candidate species are addressed in more detail in the BOEM’s BA to USFWS. As stated in Draft EIS Section 3.8, monarch butterflies are candidate species. Candidate species have no statutory protection under the ESA, but BOEM has still addressed the species in the BA in case the species is listed as threatened or endangered in the future. The IPFs and impact analysis in the Draft EIS address all wildlife and plant species, whether they are protected (e.g., endangered) or have no protective status because the IPFs apply to all wildlife regardless of status. Protected species may be more sensitive to the IPFs than species with no special status.

Comment No.	Comment	Response
1259-0116	Next with respect to Ocean Wind 1's eventual decommissioning the Draft EIS indicates that Ocean Wind intends to abandon the onshores cables from the project in place. [Footnote 96: DEIS at 3.8-13.] Despite this plan however the document presumes that these cables will not have any impacts on the wetlands where they will be abandoned or on the species that reside therein including the protected species identified above. The Draft EIS never analyzes potential environmental effects-either negative or positive-of abandoning the onshore cables associated with Ocean Wind 1 at the end of the project's life-cycle. The cables' continued presence may have profound effects on local ecosystems and communities particularly due to interactions with electromagnetic forces ("EMF") from the cables.	Underground cables that are abandoned would no longer be in use, and no EMF would be generated. Therefore, there would be no impact from EMF on habitat or wildlife.
1259-0117	Furthermore the Draft EIS's analysis relies on flawed logic that ultimately prevents the document from fulfilling its purpose. More specifically the Draft EIS provides "In context of reasonably foreseeable environmental trends [Ocean Wind 1] would contribute an undetectable increment to the combined noise impacts on coastal fauna from ongoing and planned activities including offshore wind which would likely be minor." [Footnote 97: DEIS at 3.8-11.] However federal courts have rejected this line of reasoning when relied upon by an agency during environmental reviews in the past. Most recently the United States Court of Appeals for the Ninth Circuit decided in 2021 that the U.S. Army Corps of Engineers ("USACE") could not conclude that aquaculture activities' effects on the environment were insignificant or minimal on the basis that "other sources caused even greater harm to the aquatic environment than aquaculture [...]." [Footnote 98: Coal. to Prot. Puget Sound Habitat v. U.S. Army Corps of Eng'rs D.C. No. 2:16-cv-00950-RSL at 4 https://www.centerforfoodsafety.org/files/2021-02-11-ecf-71-1--memorandum_71986.pdf.] The same principle must apply here. Until it includes a complete analysis of the impacts that Ocean Wind 1 will have on coastal fauna as opposed to summarily describing them as negligible against the baseline of impacts from other activities expected to occur the EIS for this project is deficient and cannot support the decision to move ahead with the industrial-scale development proposed for Lease Area OCS-A 0498.	The Draft EIS analyzed the No Action Alternative, consisting of the current baseline conditions as influenced by past and ongoing activities and trends, which serves as the baseline against which all action alternatives are evaluated. The Draft EIS analyzed the impacts of the Proposed Action both alone and in combination with other past, present, and reasonably foreseeable future actions (i.e., cumulative impacts). In Chapter 3 of the Final EIS, the heading structure in each resource section (including Section 3.8, *Coastal Habitat and Fauna*) has been reorganized to improve the presentation of the analyses.

Comment No.	Comment	Response
1259-0118	Finally in spite of the variety of risks and harms identified above the Draft EIS concludes that the overall impact of Ocean Wind 1 on coastal habitat and fauna will be minor and does not propose any measures to mitigate Ocean Wind 1's anticipated impacts on thereupon. [Footnote 99: DEIS at 3.8-14.] This is plainly unacceptable. BOEM must exercise its authority and discretion to protect precious coastal resources from irreversible harm by not allowing Ocean Wind 1 to proceed until specific and binding mitigation measures for coastal habitat and fauna are identified for this development. Again a pilot-scale project here would allow for studies to be conducted to evaluate the true potential impacts of a full-scale industrial project especially for endangered species.	BOEM has not proposed any specific measures, but Ocean Wind has proposed many measures that would avoid and reduce impacts on coastal resources. Those measures, or APMs, are cited throughout the Proposed Action analysis in Draft EIS Section 3.8. If BOEM decides to approve the Project, BOEM may include additional measures that would be conditions of the Project approval. The coastal habitat and fauna section focuses more on the onshore environment, so without a specific suggestion or details on a “pilot-scale project,” it is unclear what this would look like and the value it would have on the impact analysis for the onshore environment. BOEM also notes that there are currently two pilot offshore wind projects on the Atlantic OCS where impacts on birds and other resources are being studied: Block Island offshore wind and Coastal Virginia Offshore Wind.
TRANS-0068-0001	Next I'd like to point out that Clean Ocean Action is concerned by Ocean Wind's comments in section 3.8 of the draft EIS where it says that Ocean Wind will abandon the buried cables that are left in place after the expected lifetime of the project which is anticipated at least by the DEIS to be 35 years. What will the long term consequences of these abandoned cables be for the health of the local community and the ecosystems around them. And what happens if an abandon cable becomes exposed. None of these concerns are addressed by the EIS in its draft form and ought to be before the final - before the final EIS is published.	Onshore cables will be abandoned and remain buried and will no be longer used. Onshore cables would be buried at least 4 feet below the surface and no exposure is anticipated. As stated in COP Section 6.3.2, any cable ends will be buried if the cables are to be abandoned in situ to ensure that the ends are not exposed or have the potential to become exposed post-decommissioning.

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O.6.8 Commercial Fisheries and For-Hire Recreational Fishing

Table O.6.8-1 Responses to Comments on Commercial Fisheries and For-Hire Recreational Fishing

Comment No.	Comment	Response
1259-0133	The presence of OSW structures will also result in "navigational complexity…disturbance of customary routes and fishing locations and the presence of scour protection and cable hardcover leading to possible equipment loss and limiting certain commercial fishing methods." [Footnote 120: Id.at 3.12-20.] The Draft EIS admits that if specific fishing operations are unable to find alternative locations "they could experience long-term major disruptions." This is unacceptable. Mitigation measures - acceptable to the industries adversely affected - must be proposed and strictly implemented as conditions of the COP and Final EIS.	The EIS considers mitigation measures for gear loss and damage, as well as compensation for lost fishing income, that can be found at the end of Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*. These proposed mitigation measures are consistent with BOEM's draft guidance for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585.
0175-0004	Section 3.9 COMMERCIAL FISHERIES - Page 178 (During Construction Phase approximately 2 years with no interruptions) "When safety zones are in effect fishing vessels could either forfeit fishing revenue or relocate vessels that chose to relocate could incur increased operating costs "Developers have stated that the grounds would be open to commerical fishing during operation. The same was stated for Vineyard. However In Responding to BOEM's Record of Decision on Vineyard Wind 1 The Army Corps of Engineers issued the following statement: "While Vineyard Wind is not authorized to prevent free access to the entire wind development area due to the placement of the turbines it is likely that the entire 75614 acre area will be abandoned by commercial fisheries due to difficulties with navigation."	Impacts on commercial fisheries from the Proposed Action are expected to be minor to major, depending on the fishery. Impacts would result primarily from reduced access to traditional fishing grounds and increased risk of fishing gear damage or loss. Although the Lease Area would not be closed to fishing, fishers may choose to avoid the Lease Area due to the potential for gear loss/damage and safety. The majority of vessels would only have to adjust somewhat to account for disruptions. In addition, the impacts of the Proposed Action could include long-term, minor beneficial impacts for some for-hire recreational fishing operations due to the artificial reef effect. Cumulative impacts on commercial (and for-hire recreational) fishing due to the Proposed Action and planned activities including offshore wind would be major because some commercial and for-hire recreational fisheries and fishing operations

Comment No.	Comment	Response
		would experience substantial disruptions indefinitely and because of the ongoing impacts of offshore structures, climate change, and regulated fishing effort.
0488-0002	We are certainly grateful that the lease holders and BOEM have developed outreach programs and appointed fishing liaisons but the final approvals must clearly protect the rights of recreational anglers and boaters to access fishing grounds that may be within the project area. Only a definitive statement of policy supporting recreational fishing rights in the lease area will relieve the concerns of the thousands of anglers and the multi-billion dollar industry they support. Preserving the right to fish is a commitment made frequently in the hearings in the reports and in comments from the lease holder. Cementing it as a part of the final approval should be a decision that is easy to reach together.	Approval of the Proposed Action would not restrict the legal rights of recreational fishers to fish in the Lease Area except during construction, when fishing may be excluded in safety zones.
0837-0006	For instance according to the National Ocean and Atmospheric Administration (NOAA) the amount of revenue from New Jersey commercial fishing has increased each year from 2017 through 2021 with total earnings ranging from $169701007 to $258657952. [Footnote 7: National Oceanic and Atmospheric Administration (NOAA) accessed August 2022 https://www.fisheries.noaa.gov/foss/f?p=215:200:10060836853169:Mail:NO:::.] The commercial fishing industry in Cape May County is one of the largest employers and revenue producers in the County and one of the largest on the East Coast. [Footnote 8: Cape May Chamber of Commerce accessed August 2022 https://www.capemaycountychamber.com/commercialfishing/commercial-fishing-industry-in-cape-may-county/] Government data supports the current condition of the commercial fishing industries in the State of New Jersey and accordingly should be considered a baseline in the DEIS for the Commercial Fisheries and For-Hire Recreational Fishing category. In the Alternative A through E proposals in the AI category BOEM indicates that the Project will result in a lesser (AI) impact that the No Action Alternative. Therefore BOEM presents the conclusion that the commercial fishing industry will improve. Considering the current state of the industry and its economic importance to the State of New Jersey BOEM needs to present tangible evidence to support the finding that the instant Project of ninety-eight WTGS to be followed with the future projects with an additional 1337 WTGs will improve New Jersey's commercial fishing industry.	For the No Action Alternative analysis in the Chapter 3 resource sections, the Final EIS was updated to present the analysis of the ongoing non-offshore wind and ongoing offshore wind activities under a separate sub-heading from the planned non-offshore wind and offshore wind activities. The Proposed Action and action alternative discussions were also updated to present the cumulative impact analysis under a separate subheading. As a result of this organizational adjustment, the impact conclusions have been made clear in that the Proposed Action has a standalone impact on the commercial fishing industry, and then has an incremental impact on the overall cumulative impact of all offshore wind activities.

Comment No.	Comment	Response
0837-0007	In addition BOEM's model indicates that a No Action Alternative creates a moderate to major impact on the Resource of Commercial Fisheries and For-Hire Recreation Fishing while Alternatives A through E create a minor to major [Italics: depending on the fishery]. BOEM changed the language in Alternatives A through E to deviate from that used in the No Action Alternative. This alteration compromised the Table because a direct comparison was eliminated. With this caveat BOEM has concluded that [Italics: some] commercial fisheries will be impacted based on their research. BOEM will need to provide fisheries with the details of those specific findings. Furthermore the alteration within the Table undermines public trust and suggests that findings were contrived to support a foregone conclusion.	Impacts of the No Action Alternative are considered moderate to major, as described in the EIS. Impacts are expected to primarily result from reduced access to traditional fishing grounds and increased risk of fishing gear damage or loss, and effects of climate change. The potential benefits of WTGs as hard-bottom habitat and contributing to a reef effect, more so related to for-hire recreational fishing, are described for both the No Action Alternative and Proposed Action in the EIS. Under the Proposed Action, impacts would range from minor to major, depending on the fishery. Impacts would be minor for vessels that derive a small portion of their total revenue in wind farm areas or are willing to seek and able to find suitable alternative fishing locations. For fishing vessels that choose to avoid the Wind Farm Area, have historically derived a large percentage of their total revenue from the area, and are unable to find suitable alternative fishing locations, the adverse impacts would be major. In general, fisheries impacts would be lower in offshore wind lease areas (compared with other locations) because offshore wind lease areas are selected to reduce potential use conflicts between the wind energy industry and fishers. In addition, the amount of fishing activity that could be affected within the Lease Area is a small fraction of the amount of fishing activity in the New England and Mid-Atlantic regions as a whole. For example, NMFS found that from 2008–2019, only 0.9 percent of the vessels in the offshore wind lease areas generated

Comment No.	Comment	Response
		more than 50 percent of their total fishing revenue for the year from one or more of the areas; 75 percent of the vessels fishing in any given offshore wind lease area derived less than 0.9 percent of their total revenue from the area (NMFS 2021).
0941-0001	The DEIS identifies areas of moderate and high densities of hard clams (Mercenaria mercenaria) within the Oyster Creek export cable route and notes that "recreational fishing effort in New Jersey is greater for blue crab than any other single species" (Section 3.9 Commercial Fisheries and For-Hire Recreational Fisheries). The DEIS also states that blue crabs (Callinectes sapidus) and hard clams are recreationally and commercially harvested species within Barnegat Bay (Section 3.13. Finfish Invertebrates and Essential Fish Habitat) but then fails to mention how these valuable resources or the fisheries will be impacted how the impacts will be minimized or mitigated for and how the impacts will be monitored and assessed.	NOAA works with state and local partners to monitor the recreational fishery catch and effort through the Marine Recreational Information Program (NOAA Fisheries n.d.). Because blue crabs are not monitored, data are not available to evaluate potential impacts on this species; this information has been added to the Final EIS to explain the absence. Both species are discussed briefly in Section 3.6, *Benthic Resources*, and Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*, and in the EFH assessment. Blue crabs are referenced in the EFH assessment and text has been added to Final EIS Section 3.9.5. Adult blue crabs may use benthic habitat for spawning, and dredging impacts could include increased local TSS, loss of larvae due to suction dredging, or short-term displacement of individual crabs; however, these impacts are either short term, limited in spatial extent, or insignificant to the success of the species. Hard clams are referenced in the EFH assessment and text has been added to Final EIS Section 3.9.5 to address potential impacts. “Impacts from installation of the export cable would result from direct disturbance of benthic habitats, the resuspension and nearby deposition of sediments, and emplacement of cable

Comment No.	Comment	Response
		protection resulting in habitat conversion. Direct disturbance could result in the injury or mortality of organisms within the footprint of the export cable, primarily sessile or slow-moving benthic invertebrates such as hard clam…”
0967-0001	Broadly we would like to reiterate our strong recommendation also expressed in our comments on the NOI that impacts to the charter/for-hire sector and private recreational anglers be considered or at least presented jointly rather than separately under the "3.9: Commercial Fisheries and For-Hire Recreational Fishing" and "3.18: Recreation and Tourism" sections of the DEIS respectively. Charter/for-hire and private recreational anglers fish similar areas target the same species use the same gear and are subject to management under the same authorities. For fishermen fishery managers and other interested parties struggling to provide constructive feedback on a document of this magnitude separating the expected impacts of alternatives to these two groups by over 200 pages in the document only further complicates the process.	Reference to each of the other sections were added to these sections to support cross-referencing by the reader. However, the sections will remain separated for analysis in the different EIS sections.
1086-0013	Commercial fishing is an essential part of Cape May County providing jobs and food locally and across the Nation. The most valuable fisheries in New Jersey include sea scallops ocean quahogs surf clams and blue crabs. Fishermen in New Jersey contribute to the local economy by providing jobs to seafood processors wholesalers distributors and retailers as well as jobs created from the repair and operation of fishing vessels and fishing gear. The loss of the seafood and fishing industries would have severe economic and cultural impacts for the County. Concerns regarding commercial fisheries include increased vessel traffic and congestion navigational safety gear loss loss of revenues and the disruption of the Cold Pool and ecologically important component of Mid-Atlantic fisheries. In addition the most recent Fisheries Mitigation Guidance session hosted this year by BOEM on July 11th left many questions unanswered for fishermen who are impacted by offshore wind farms such has how mitigation payments would be structured how claims for lost gear would be processed and the process in which fishermen could work together with BOEM to reconcile the issues raised by the fishing industry.	The Draft EIS recognizes the importance of commercial fishing to New Jersey and Cape May, which as the combined port of Cape May/Wildwood is among the top 25 producing commercial fishing ports in the country and the largest commercial fishing port in New Jersey. Impacts of the Proposed Action on commercial fisheries would range from minor to major, depending on the fishery and fishing operation; combined with impacts from ongoing and planned activities, impacts would be major because some commercial and for-hire recreational fisheries and fishing operations would experience substantial disruptions indefinitely, even with Applicant-proposed mitigation. Construction, O&M, and decommissioning activities may affect the ability to fish certain areas or may affect

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		fishing (negative or positive), including fishing for shellfish, as well as shore-based support services for these fisheries. As described in the EIS and the COP (Volume II, Section 2.3), each of the fisheries revenue values derived from the New Jersey WEA represented less than 1 percent of their respective total average annual revenue, with the exception of clams, which made up 4.7 percent of the revenue. Based on the vessel monitoring data, most of the commercial fishing activity, including the scallop fishery, is outside the Ocean Wind 1 Lease Area. The annual average revenue (2013 to 2017) sourced from within the Wind Farm Area for all fisheries combined ($209,927 in 2019 dollars) was 0.02 percent of the total fishery. This average annual value is down from 1.1 percent of the total fishery estimated for the years 2007 to 2012. Ocean Wind has committed to maintaining a strong working relationship with all commercial and recreational fishers who may be affected by the Project and has developed a Fisheries Communication and Outreach Plan (Appendix O of the COP) in accordance with BOEM guidelines. This plan outlines key strategies to communicate with fishers and fishing industry representatives associated with the Project. Proposed mitigation relevant to the comment are provided in Appendix H of the EIS and include: • CFHFISH-02: Develop and implement a Fisheries Communication and Outreach Plan (COP Appendix O). The plan includes the appointment of a dedicated

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		fisheries liaison as well as fisheries representatives who will serve as conduits for providing information to, and gathering feedback from, the fishing industry, as well as Project-specific details on fisheries engagements. • CFHFISH-03: Implement Ørsted's corporate policy and procedure to compensate commercial/recreational fishing entities for gear loss as a result of Project activities.
1086-0017	Gear Loss Fishermen in Cape May County are concerned about the process in which they would recover losses from gear that becomes entangled or damaged by wind farm equipment. Fishermen have stated that they will likely abandon any fishing grounds within the wind farm areas. However if the species that fishermen are trying to catch migrate into the wind farm area the captain may risk entanglement while trying to follow their catch. In addition subsea cables create concerns for fishermen who drag equipment behind their boats. According to MIT several fishermen have lost or damaged dragnets around Block Island where subsea cables lay exposed. [Footnote 26: Trouble in the wind: Offshore turbine farms complicate fishing shrimping [Embedded Hyperlink Text (https://climate.mit.edu/posts/trouble-wind-offshore-turbine-farms-complicate-fishing-shrimping)]] Orsted has said that the cables at Block Island are covered with rocks and mattresses yet several fishermen have nevertheless reported lost or damaged gear which requires days of downtime to repair and is costly to the vessel operator. Loss of Fishing Revenues In every single impact category included in the DEIS BOEM classifies the impacts to fishing as [Italics: major]. As a County that prides itself on its historic fishing culture and relies on fishing revenues for its economy Cape May County has significant concerns about lost revenues for fishermen as a result of Ocean Wind 1 as well as other planned wind farms that will continue to restrict access to various parts of the ocean. There are reasons for both increased costs and loss of revenue. Fishermen may have to take longer routes to reach their destination or travel at slower speeds while transiting wind farms. Fishermen may lose access to fishing grounds that were once relied on forcing them to relocate and risk fishing in unfamiliar areas. In addition as certain areas become off limits the relocation of vessels to other	BOEM recognizes that the presence of structures can lead to entanglement or gear loss/damage due to buoys, meteorological towers, foundations, scour/cable protection, and transmission cable infrastructure. Ocean Wind is committed to maintaining a strong working relationship with all commercial and recreational fishers who may be affected by the Project and has developed a Fisheries Communication and Outreach Plan (COP Appendix O) in accordance with BOEM guidelines. This plan outlines key strategies to communicate with fishers and fishing industry representatives associated with the Project. Appendix H details mitigation measures proposed for the Project. BOEM has proposed guidance to lessees for mitigating impacts on commercial and recreational fisheries (see https://www.boem.gov/renewable-energy/request-information-reducing-or-avoiding-impacts-offshore-wind-energy-fisheries). BOEM will consider requiring mitigation measures in addition to those proposed in the COP. These measures may change as a result of

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	known fishing areas could result in overfishing of those areas and the depletion of resources.The Cold Pool The Mid-Atlantic exhibits a unique seasonal phenomenon referred to as the Cold Pool in which warm and cold-water temperatures are horizontally stratified along the continental shelf. This drastic difference between cold and warm water drives a thriving ecosystem that supports diverse and abundant species. Fisherman can catch both warm and cold-water fish and shellfish simply by adjusting the depth of their gear. A Rutgers study in 2021 writes that "the scale of these wind farms has the potential to alter the unique and delicate oceanographic conditions along the expansive Atlantic continental shelf a region characterized by a strong seasonal thermocline that overlies cold bottom water known as the "Cold Pool." The seasonal characteristics of the Cold Pool are "associated with and drivers of important biological and ecological processes that support key species of commercial and recreational importance." [Footnote 27: Offshore Wind Energy and the Mid-Atlantic Cold Pool: A Review of Potential Interactions [Embedded Hyperlink Text (https://scemfis.org/wp-content/uploads/2021/11/Miles_2021.pdf)]] The County is concerned that the vertical mixing caused by thousands of wind turbines will disrupt the natural processes of the cold pool which is necessary to our local ecosystem and economy.	comments on the guidance document or in response to comments on the Draft EIS. With respect to this comment, measures may include: • Compensation for Gear Loss and Damage and Mobile Gear–Friendly Cable Protection Measures
1125-0006	There is one area of analysis where some expansion of the categories is warranted. The current outline combines "Commercial Fisheries and For-Hire Recreational Fisheries". Based on the extensive analyses compiled to date and the extensive comments provided by certain commercial fishing interests and recreational fishing advocates and charter boat captains it is very clear that these two groups have decidedly different views of OSW. The commercial interests express a wide range of concerns and trepidations while the recreational fishing interests are generally very positive particularly on the prospect of new productive "mini reef" environments at each WTG monopole/scour pad. Lumping the two together makes for a muddled analysis in my opinion.	Comment noted. The commenter is correct that Section 3.9 concludes distinct adverse and beneficial effects of the proposed Project for commercial fisheries and for-hire recreational fishing. However, BOEM does not concur that this is cause for separating the analysis into different EIS sections.
1125-0007	The Commercial/Recreational Fishing Assessment (Section 3.9) spans some 54 pages of dense text in DEIS Volume 1. The writeup is very thorough but forces the reader to search for specific data and perspective on the 75500 acre project lease area. For example on page 3.9-7 the reader learns that "The commercial fisheries active in the Lease Area encompass a wide range of FMP fisheries gear and landing ports although NMFS VMS data indicate that most FMP fisheries with in the Lease Area do not have a high level of	This information has been added to Final EIS Section 3.9.1 to follow the listing of fisheries species and general gear types: “For example, dredging gear targets seafloor organisms such as surfclam, ocean quahog, and scallops; bottom trawl for monkfish and summer flounder; trawlers

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	fishing effort compared to surrounding areas". This is followed by a lengthy reference to supporting data from the Ocean Wind COP Volume I. The point is driven home by Table 3.9-5 which indicates that the average annual revenue generated by FPV in the Lease Area was $326333 or less than $5 per acre (2008-2019 data). Seventy five percent of the reported revenue is attributed to just two species sea scallop and surfclam/ocean quahog. Both of these fisheries involve dragging/dredging of the ocean bottom a fact which is conveniently ignored.	and purse seines for herring; and traps and pots for lobster and Jonah crab.” In addition, within Section 3.9.5, under the presence of structures IPF, estimated revenue exposure for fisheries is discussed and also presented within Table 3.9-21, which acknowledges both sea scallop and surfclam/ocean quahog. It also states within the text that the “largest impacts in terms of exposed revenue as a percentage of total revenue in the Mid-Atlantic and New England regions would be in the Surfclam/ Ocean Quahog FMP fishery.”
1125-0009, -0010, & -0011	Notwithstanding these numbers BOEM rates the Proposed Action impact of fisheries as "Minor to major depending on the fishery". Oddly the No Action alternative is rated as Moderate to Major. Given the Project's demonstrably minor impact of potentially foregone commercial fisheries revenue a closer reading reveals a strained logic for assigning a minor to major impact rating to the Project (and its alternatives). The Project (and its alternatives) in combination with "other foreseeable impacts" is rated as a Major impact to commercial/recreational fisheries across the board. The "other foreseeable impacts" includes the entirety of OW projects expected in the New England/Mid Atlantic lease areas. The discussion concludes by stating "the reduction in GHG emissions per kilowatt of electricity produced from offshore wind projects ...would result in long-term beneficial impacts of fishing operations". Surprisingly the analysis then concludes that "the benefits would be negligible". By dismissing the project's primary benefit this presumably allows BOEM to support its MAJOR impact conclusion.	Under the No Action Alternative, ongoing activities would have continuing impacts on commercial fisheries and for-hire recreational fishing, primarily through port use, vessel activity, other offshore development, climate change, and fisheries use and management. BOEM concurs that there will be benefits to some fisheries due to reduced GHG, as described in Section 3.9.3. However, fish and shellfish species are expected to exhibit variation in their responses to climate change, with some species benefiting from climate change and others being adversely affected (Hare et al. 2016). To the extent that impacts of climate change on targeted species result in a decrease in catch or increase in fishing costs, the profitability of businesses engaged in commercial fisheries and for-hire recreational fishing would be adversely affected, while reductions in GHG due to reduced reliance on fossil fuels would benefit some fisheries.

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		Overall, BOEM anticipates that the impacts of ongoing activities on commercial fisheries and for-hire recreational fishing would be moderate to major. The major impact rating for some fisheries and fishing operations is primarily driven by regulated fishing effort and climate change associated with ongoing activities.
1150-0001	The following comments are being submitted on behalf of the Marine Trades Association of New Jersey (MTA/NJ) regarding the Draft Environmental Impact Statement for Ocean Wind LLC's Proposed Wind Energy Facility Offshore New Jersey. The MTA/NJ established in 1972 is a non-profit trade organization comprised of over 300 marine related businesses dedicated to advancing promoting and protecting the recreational boating industry and waterways in the State of New Jersey. In New Jersey the recreational boating industry generates $6.6 billion in annual economic impact supporting more than 1100 businesses and 28000 jobs. Additionally more than 70% of all boat outings involve fishing making recreational fishing a key asset to the recreational boating industry. To ensure continued industry growth recreational boaters and anglers rely on abundant access and healthy ecosystems. The size and scope of this proposed offshore wind facility has the potential to greatly impact the boating and fishing industries in New Jersey. As advocates for the marine industry it is our responsibility to ensure that the interests of our members are protected and that their customers can continue to fully enjoy the use of the coastal waters in and around New Jersey. We know that the development of wind turbines off the coast of New Jersey could also have positive benefits for fisheries and thus for recreational fishing. Bottom structure can serve as artificial reefs that attract fish and serve as breeding grounds. While we realize that there may need to be limits on access to waters near the wind farm during construction we want to ensure that recreational boats will have access to the waters in the wind farm and in proximity to the wind turbines once construction is completed. It is imperative that BOEM the lease holders and the Coast Guard allow continued access to transit navigate through and fish these areas and that these assurances are written into any approval by BOEM. We also want to ensure that any disruptions to our waters and to recreational boating while the wind farm is constructed and the transmission lines are laid are kept to a minimum. We would suggest that any work in Barnegat Bay or in	Boaters will not be excluded from the Wind Farm Area except during construction. Ocean Wind has committed to measures to minimize impacts of onshore construction activities during the peak summer recreation and tourism season. Relevant APMs are included in Appendix H of the EIS and listed below. • GEN-15: Develop and implement an Onshore Maintenance of Traffic Plan to minimize vehicular traffic impacts during construction. Ocean Wind would designate and utilize onshore construction vehicle traffic routes, construction parking areas, and carpool/bus plans to minimize potential impacts. • GEN-18: No permanent exclusion zones during operation. • FISH-02: Ocean Wind will coordinate with NJDEP, NMFS, and USACE regarding time-of-year restrictions for winter flounder and river herring, as well as summer flounder HAPC. • REC-01: Develop a construction schedule to minimize activities in the onshore export cable route during the peak summer recreation and tourism season, where practicable.

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	any other coastal waters be done in non-boating seasons and be accomplished as quickly as possible to allow the continued enjoyment of these waters. Barnegat Bay has a significant amount of boat usage in the areas off Island Beach State Park and near the transmission connection point at the former Oyster Creek Nuclear Generating Facility. Tices Shoal is in this area and is highly used especially in the summer months and on weekends. Dredging or any construction related activities in these areas from April to November and especially in the summer months will have significant negative consequences to the recreational boating community and to the local economy. We strongly suggest that these conflicts be avoided as much as possible and written in the final approval. We also question whether the chosen depth to bury transmission cables in Barnegat Bay is sufficient to ensure it does not become exposed and interfere with fishing or anchoring activities. We would encourage BOEM to further consult with experts on the Bay its sediment and its movement to ensure that both the transmission infrastructure and boaters are protected.	• REC-02: Coordinate with local municipalities to minimize impacts on popular events in the area during construction, to the extent practicable. For Barnegat Bay, specific proposed time-of-year restrictions include avoiding construction activities in Barnegat Bay during winter flounder seasonal spawning activity from January 1 through May 31 and during anadromous fish migration and spawning activity from March 1 through June 30. These are noted in Appendix H, Table H-1 (FISH-02) as well as in Table H-2 under “EFH Conservation Recommendations - USACE jurisdiction” and Table H-3, “NMFS-proposed Measures,” respectively.
1188-0001	Bold: General Comments] Given the current pace of offshore wind energy development in this region we are unable to provide a thorough and detailed review of each individual project. For example this comment period overlapped with four other wind energy comment periods of interest to our Councils. The analysis in the DEIS has important ramifications for terms and conditions which may be implemented through final project approval including fisheries mitigation and compensation measures. However at 1408 pages (including appendices) we were unable to review the DEIS in detail given other priorities and constraints on staff time. With this in mind we strongly encourage BOEM to consider the recommendations listed in the wind energy policies adopted by both Councils which apply across all projects.[Footnote 2: Available at https://www.mafmc.org/s/MAFMC_wind_policy_Dec2021.pdf] Our two Councils worked together on these policies and adopted the same policy language. We also urge BOEM to adopt the recommendations provided by NOAA Fisheries for this project including recommendations regarding data considerations impacts analysis and ways to minimize the negative impacts of this project on marine habitats commercial and recreational fisheries and fishery species.	BOEM continues to work with NOAA to support additional scientific research and surveys to assess uncertainties in scientific data collection and implement any changes to surveys. BOEM has reviewed the MAFMC wind policy referenced and concurs with the content of the document. BOEM also finds that the document is consistent with the approach of the EIS with respect to stakeholder engagement, BMPs, and environmental review considerations (e.g., navigation and safety, evaluation of impacts on fisheries). Therefore, no changes to the EIS are needed.
1234-0005	[Bold: Transit Safety Concerns] The GSSA has always supported the need for transit lanes proposed in the lease area. Sadly Orsted and BOEM erroneously reported that the commercial	BOEM evaluated a 2-nm by 2-nm wind turbine layout and found that this spacing would only provide for 30 wind turbine

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	fishing industry impacted and supported the design of the array now being considered. Based on our experience transit corridors of a minimum of 2nm are necessary in order to keep our state's fishermen safe at sea and to lessen the economic impact. It is also worth noting that without transit corridors there is a significant impact to fishermen who operate under a day's at sea quota. Specifically in the case of Scallop fishery identified a lack of a transit corridor would have direct impact on the time constrained permit of the industry with a limited number of days at sea and running 24-hour clocks. Therefore we strongly support the inclusion of an alternative with transit lanes from Atlantic City and Barnegat Ligtht NJ.	positions in the Lease Area (see Section C.2.1 in Appendix C of the EIS). A 2-nm by 2-nm layout would significantly reduce annual energy production, resulting in failure to meet the required 1,100 MW of wind energy. Use of a 12-MW or 14-MW WTG for the 30 WTGs would result in a Project capacity of 360 and 420 MW, respectively. The reduced capacity and annual energy production would fail to fulfill BPU's solicitation award for 1,100 MW of offshore wind and would not meet the purpose of and need for action. Therefore, this alternative was dismissed from further consideration.
1241-0002	1. [Italics: A minimum spacing of 2 nm between turbines and interarray and export cables buried to 8-10 feet in order for the dominant fisheries (Atlantic surfclam and ocean quahog) to operate after construction.] Atlantic surfclam and ocean quahog are the dominant species fished with mobile gear in the Ocean Wind lease area. For these fisheries to operate after construction a project would need to maintain a minimum spacing of 2 nm between turbines due to the specific way gear is deployed and hauled back chain lengths vessel maneuverability and other conditions [Footnote 4: This does not mean that spacing of 2 nm would result in no impacts from the project to clam fisheries but that gear cannot effectively operate at all in denser layouts.]. Turbine spacing less than 2 nm will impose a complete closure for this fishery including for purposes of determining compensatory mitigation. Despite this clear access consideration the DEIS does not analyze an alternative wind turbine layout of 2 nm spacing between turbines rationalizing in Appendix C ("Additional Analysis for Alternatives Dismissed") that such an alternative would reduce the number of turbines to an extent "resulting in failure to meet the required 1100 MW of wind energy."[Footnote 5: See https://www.boem.gov/sites/default/files/documents//Ocean-Wind1-DEIS-App-C-Alternatives-Dismissed.pdf.] As discussed in multiple RODA comment letters including Ocean Wind scoping comments and reiterated below the agency should approach National Environmental Policy Act (NEPA) analyses to fulfill its own purpose and in stewardship of the needs of the U.S. public. It	BOEM evaluated a 2-nm by 2-nm wind turbine layout and found that this spacing would only provide for 30 wind turbine positions in the Lease Area (see EIS Section 2.1.7 and Table 2-3 and Section C.2.1 in Appendix C). A 2-nm by 2-nm layout would significantly reduce annual energy production, resulting in failure to meet the required 1,100 MW of wind energy. Use of a 12-MW or 14-MW WTG for the 30 WTGs would result in a Project capacity of 360 and 420 MW, respectively. The reduced capacity and annual energy production would fail to fulfill BPU's solicitation award for 1,100 MW of offshore wind and would not meet the purpose of and need for action. Therefore, this alternative was dismissed from further consideration due to technical infeasibility.

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	should not base its actions purely on achieving states' OSW goals which may be driven by politics rather than science or primarily to satisfy the terms of private contracts (in this case New Jersey Board of Public Utilities' solicitation for 1100 MW of OSW capacity). All alternatives in the DEIS only analyze target burial depths for interarray and export cables of up to 4 to 6 feet which is shallow enough to potentially interact with surfclam and ocean quahog gear. As clam dredges are substrate penetrating gear and the substrate in this area consists of high- energy sand it is extremely important that interarray and export cables are buried to sufficient depths to reduce the risk of fishing gear interactions. Fishermen's knowledge suggests this to be a minimum of 8-10 feet to avoid interactions; if a shallower depth is permitted it must at a minimum be paired with remote monitoring to ensure the cable remains adequately buried at all times. BOEM must provide clear standards as to what this depth is how it is determined and monitoring protocols to ensure there are no future interactions. Moreover the project layout should be designed to minimize instances where cables transect fishing tow areas.	
1241-0002	2. [Italics: A transit corridor of no less than two nautical miles between the two leases would be needed to safely preserve traditional transit paths with four nautical miles being more appropriate.] Fishermen have requested directly to Ocean Wind and Atlantic Shores since the earliest stages of project development-and prior to the execution of any procurement contracts-to incorporate a reasonable turbine-free corridor between the two lease areas. Directly at the projects' shared lease boundary is an area heavily transited by multiple vessels primarily from Atlantic City and Cape May. The need for a transit lane in this location is supported by several analyses and documents submitted to Ocean Wind and BOEM: the "Fishing Route Analytics Reports" produced by Last Tow LLC the New York Bight Transit Lanes Surveys Workshop and Outreach Summary prepared by NYSERDA NY State Department of Environmental Conservation and RODA (2020) and summaries of the January 2020 RODA/Ocean Wind workshops. Despite these timely and evidence-based requests neither developer has included such a setback in its Construction and Operations Plan. Alternative C in the DEIS [Underlined: incorrectly] suggests RODA proposed a 0.81-1.08 nm buffer between turbines in these different leases. Simply put at no point did RODA propose or support a "buffer" of no surface occupancy between lease areas of 1.08 nm or less. The DEIS misleads the reviewers stating its consideration of a roughly one mile setback between wind projects	The Draft EIS summarizes the concerns raised by USCG, RODA, and commercial fishermen during scoping regarding the layout of the Ocean Wind 1 and Atlantic Shores South projects and the proximity of the two projects in the adjacent lease areas. The Draft EIS explains that Alternative C was developed by BOEM in coordination with USCG to address these concerns. BOEM coordinated with USCG regarding an appropriate buffer distance, and that buffer distance (0.81 nm to 1.08 nm) is analyzed in the Ocean Wind 1 Draft EIS as Alternative C. The Draft EIS does not state or imply that USCG, RODA, or commercial fishermen proposed or support Alternative C. Nevertheless, revisions have been made to the Final EIS to further clarify that BOEM developed Alternative C in coordination with USCG.

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	is responsive to public comment from "RODA and commercial fishermen concerning the different layouts between the Ocean Wind 1 and Atlantic Shores South projects and the need for a buffer between the two projects in the adjacent lease areas." [Underlined: This alternative is not responsive to nor consistent with any requests from our organization nor any known commercial fishing operators.] Indeed it appears to be simply equivalent to standard turbine spacing and is not readily distinguishable from the proposed action of no buffer at all. Upon publication of the DEIS RODA immediately contacted BOEM about this clear error and provided documentation of consistent requests for a 2-4 nm buffer between leases in our EIS scoping comments and summaries of meetings with Ørsted. BOEM responded that this alternative was a combination of RODA's suggestion and internal discussions with the U.S. Coast Guard (USCG) and stated it was unable to correct copy errors until publication of the Final EIS. BOEM subsequently reissued this DEIS on July 22 2022 with updated cable route options provided by Ørsted but without including a correction of this statement regarding RODA's position or request. Unfortunately there are increasing instances of BOEM and developers mischaracterizing and mismanaging recommendations from and information about the commercial fishing industry. [Underlined: The absence of a process for ensuring the accuracy of fisheries-related information in project documents is a persistent problem we request BOEM to solve immediately.][Footnote 6: See RODA's Ocean Wind 1 scoping comments for a full description of a nearly identical problem in BOEM's scoping hearings for this project where Ørsted asserted its preferred layout was developed with input from RODA and New Jersey fishermen. This statement was provided without explanation and directly contradicted the industry's experience including well-documented layout recommendations provided by dozens of fishermen that were not incorporated into the proposed layout. Despite formally raising this to BOEM and Ørsted similar statements remain in the Ocean Wind COP issued with this DEIS.] Fishing industry associations have repeatedly requested record corrections to no effect. [Footnote 7: In another example Vineyard Wind's recent Construction and Operations Plans and corporate website lists RODA as a partner although there is no relationship between the organizations whatsoever following the dissolution of the Joint Industry Task Force in January 2020. Multiple requests to remove this language including to BOEM have been futile. This is not specific to RODA nor to that developer; many of our fishing association members regularly report similar mischaracterizations	

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	from various parties.] This seemingly avoidable pattern has led to considerable distrust in BOEM developers and the current leasing process as a whole and has grown to become a significant barrier to effective problem solving. While BOEM cannot control the actions of private citizens it is responsible for the accuracy and veracity of its own materials. Thus BOEM in working with the fishing sector to reduce impacts from OSW must communicate directly with community members and representatives accurately portray their feedback in public documents and give this information equal scrutiny and deference to that provided by the OSW community. BOEM appears to have determined through the inclusion of Alternative C that a buffer zone between the leases is a reasonable Alternative in the DEIS. It is therefore unclear why it would analyze only a nominal setback of 1.08 nm between lease boundaries but not ones of 2 and 4 nm that may actually mitigate some impacts to transiting. [Footnote 8: It should be noted that for the most recent lease auction in the NY Bight BOEM established 2.44 nm spacing between select leases [Italics: specifically] in response to comments requesting transit corridors and measures for maritime safety. See https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/ATLW- 8%20NY%20Bight%20Response%20to%20Comments.pdf.] The DEIS simply refers to "public comments from the USCG" in establishing the width analyzed in Alternative C but provides no explanation rationale or analysis of why a 1.08 nm or smaller buffer between two huge lease areas (each with two likely projects within them) would be sufficient to ensure transiting safety. This contrasts with the material analysis and ecological knowledge provided by RODA and the fishing industry to the contrary. D. [Bold: Alternatives Analyzed] The DEIS alternatives and impacts analyses are somewhat consistent with past BOEM documents related to OSW which RODA and others have previously commented lack clear structure and are difficult to evaluate. [Footnote 20: Previous comments to that end such as on the Vineyard Wind South Fork and other Southern New England and Mid-Atlantic OSW projects are incorporated herein by reference.] The purpose of a DEIS is to inform public comment and a lack of clarity in presentation confounds that ability.	
1241-0002	The No Action alternative is difficult to follow as it conflates no action with a cumulative effects analysis. The No Action alternative seems to propose the logic that the impacts of any individual project do not matter since a large number of other OSW projects will proceed anyway. This is problematic for multiple reasons is inconsistent with NEPA analysis methodology and	For the No Action Alternative analysis in the Chapter 3 resource sections, the Final EIS was updated to present the analysis of the ongoing non-offshore wind and ongoing offshore wind activities under a separate

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	predetermines outcomes arguably negating the need for any analysis at all. This approach unintentionally emphasizes the need for a proper cumulative effects analysis and a programmatic EIS prior to lease agreements being put in place so that the true impacts of new large-scale regional OSW development can be analyzed presented and understood.	sub-heading from the planned non-offshore wind and offshore wind activities. The Proposed Action Alternative and action alternative discussions were also updated to present the cumulative impact analysis under a separate subheading.
1241-0002	Finally overall net impacts on each resource area are largely absent. Acknowledging that impact- producing factors can have complicated interactions with resource areas is important to highlight however the public is left to come to their own conclusions regarding whether the positive will outweigh the negative or vice versa.	The overall impact level is presented in the conclusion section of each Chapter 3 resource section and also in the *Executive Summary*, Table S-1.
1243-0003	The clam industry which operates mobile bottom-tending hydraulic dredges insisted that co-existence depended on the requirement that wind turbines in WEAs must be a minimum distance of 2 nm apart. The clam industry along with several other commercial fisheries that operate mobile bottom tending gear voiced this minimum spacing of turbines requirement at every outreach meeting and recommended other spacing requirements and cable burial recommendations as well only to be summarily dismissed within this DEIS into the alternatives section considered but not presented as a viable option for this WEA. Essentially all participation in outreach meetings by several major commercial fisheries for continued safe fishing were simply ignored. Evidently the participation of commercial fisheries at outreach meetings on WEAs has proved to be a complete waste of our time since BOEM saw fit to list our recommendations for co-existence on the water in the category of [Bold: Table 2-3 Alternatives Considered but Dismissed] as not worthy of being analyzed in detail (see Vol. 1 p. 2-28 Wind Turbine Array and Spacing). [Bold: Essentially BOEM is stating that the needs of the clam industry and many other important commercial fisheries don't meet BOEM's purpose and need in advancing Ocean Wind 1 (boldface is my emphasis)]. So let's examine the purpose and needs of BOEM in the proposed action of Ocean Wind 1 to understand how the commercial fisheries that have existed for many decades suddenly interfere with development of offshore wind energy fail to co-exist with WEAs and must make adjustments request mitigation and compensation and may ultimately go out of business because their continued clamming is a nuisance and impediment to the industrialization of the East coast of the US from ME through NC through many WEAs.	BOEM evaluated a 2-nm by 2-nm wind turbine layout and found that this spacing would only provide for 30 wind turbine positions in the Lease Area (see EIS Section 2.1.7 and Table 2-3 and Section C.2.1 in Appendix C). A 2-nm by 2-nm layout would significantly reduce annual energy production, resulting in failure to meet the required 1,100 MW of wind energy. Use of a 12-MW or 14-MW WTG for the 30 WTGs would result in a Project capacity of 360 and 420 MW, respectively. The reduced capacity and annual energy production would fail to fulfill BPU's solicitation award for 1,100 MW of offshore wind and would not meet the purpose of and need for action. Therefore, this alternative was dismissed from further consideration due to technical infeasibility.
1243-0003	The Ocean Wind 1 lease site proposes to space 98 wind turbines in rows and columns that are less than or equal to 1 nm. apart. This cluster of structures	BOEM recognizes the challenges identified by the clamming industry due to the

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	will prevent the clam industry and some other commercial fisheries from operating within the lease area and a de facto marine protected area will be created where no clamming can safely occur regardless of whether clamming occurred within the lease site in the past. Since surfclam beds are moving in northerly and easterly directions to lower ocean bottom temperatures in response to climate change surfclam beds may settle within a lease site produce good recruitment to the stock but because wind turbines are spaced so closely together there can be no safe access for surfclam vessels to harvest those clams.	selected WTG spacing and acknowledges these challenges in Sections 3.9.3 and 3.9.5 in the EIS. However, BOEM evaluated a 2-nm by 2-nm wind turbine layout and found that the number of turbine positions result in failure to meet the required 1,100 MW of wind energy. The reduced capacity and annual energy production would fail to fulfill BPU’s solicitation award for 1,100 MW of offshore wind and would not meet the purpose of and need for action. Therefore, this alternative was dismissed from further consideration, as described in EIS Section 2.1.7 and Table 2-3 and Section C.2.1 in Appendix C.
1243-0003	So if BOEM is trying to produce renewable energy economically and with minimal environmental impacts the clam industry would give BOEM a failing grade on many fronts. The wind energy companies are only concerned with the economical scale of the COP and the potential profits and BOEM doesn't seem to weigh those earnings against the lost income and fishing grounds of the clam industry. Nor does BOEM seem to have an answer to how they are minimizing the cumulative impacts on marine fisheries resources in the foreseeable future marine habitats essential fish habitat and federal independent fisheries surveys either. Let's consider the economic impacts on commercial fisheries first and then deal with all the other impacts on the ecosystem. The DEIS relies on NMFS values from VMS for fishing activity and landings for the monetary evaluation of fisheries impacted by the WEA. The calculus of financial impact on fisheries is grossly underestimated when using number of trips and ex-vessel value of landings. The ex-vessel value of the clam industry which is vertically integrated through processing plants and distribution networks of products is grossly underestimated. For example in the Science Center for Marine Fisheries (SCEMFIS) funded project "Economic Activity Associated with SCEMFIS Supported Fishery Products by T. J. Murray - June 2016 the combined value for surfclam and ocean quahog fisheries the initial harvest value (ex-vessel times landings) amounts to $54873000 but the total value of the fisheries through all their value-added steps that reach final retail food service is valued	By providing revenue exposure within the EIS analysis, not impacts, BOEM is already providing a very conservative estimate of potential revenue losses and potential impacts for different fisheries, which include sea scallops and surfclam/ocean quahog. Surfclam/ocean quahog is also acknowledged as the highest-revenue exposed fishery in the affected environment and Proposed Action. By providing this over-estimation of revenue exposure, the analysis provides a buffer to cover other potential operating expenses. BOEM acknowledges the importance of the commercial fishing industry, as well as the variety of ports and shoreside businesses related to and within this area. To that end, it has included extensive analysis of commercial fishing revenue exposure within the Ocean Wind Lease Area. As the comment mentions, Section 3.9.9, *Proposed Mitigation Measures*, accurately

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	at $1308331000. Ex-vessel value as currently computed by NMFS represents only a fraction of the value of such vertically integrated fisheries. NMFS estimates in the DEIS at Table 3.9-1 page 3.9-4 for the clam industry an annual amount of only $28290400/year during the period 2008-2019. While BOEM recognizes the commercially important invertebrates such as surfclams and ocean quahogs in the geographic analysis area they do little to mitigate the loss of such an important industry. BOEM makes sure to avoid artificial reefs in WEAs that are enjoyed by recreational fishermen yet doesn't extend the same consideration to productive clam beds. Other economic data presented in the DEIS (see Vol. 1 Table 3.9-5 and 3.9-6) document the presence of significant clam industry earnings from the WEA the clam industry is second in economic value only to the sea scallop fishery. Under Vol 1. [Bold: Section 3.9.9 Proposed Mitigation Measures] in the DEIS Sub-section [Bold: Compensation for Lost Fishing Income] it states that "Ocean Wind would implement a compensation program for lost income for commercial and recreational fishermen and other eligible fishing interests for construction and operations consistent with BOEM's draft guidelines for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585 or as modified in response to public comment. The clam industry takes little solace in the mention of a compensation program that currently doesn't exist but must rely on BOEM to develop such a program in future years. The clam industry is also disheartened to read that the compensation fund will include "Levels of funding required by Ocean Wind to be set aside for fulfilling verified claims (and) would be commensurate with those in Vol. 1 Table 3.9-21. Compensation funds to be determined in the future would certainly not be as credible as lost fishing opportunities currently being documented by the clam industry in an independent Knowledge Trust Program.	captures the categories for intended mitigation or compensation.
1272-0002	BOEM on every occasion has said that their desire is to have the wind development and the fishing industry coexist. However the developers have said that the lease areas are theirs to do with as they please and the other users must go elsewhere to catch their fish. The clam fishery suggested that the turbines be placed 2 x 2 NM apart with this design would allowing fishing with in the wind array in good weather. That idea was opposed by the developers and BOEM then approves the turbine spacing at whatever the developers wanted. The European manages of the U.S. wind farms made it clear that they want the other users of the ocean to stay out of their wind farms. So it appears that if the developers get their way and American	BOEM recognizes the challenges identified by the clamming industry due to the selected WTG spacing and acknowledges these challenges in Sections 3.9.3 and 3.9.5 in the EIS. However, BOEM evaluated a 2-nm by 2-nm wind turbine layout and found that the number of turbine positions result in failure to meet the required 1,100 MW of wind energy. The reduced capacity and annual

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	fishermen will be denied access to their fishing grounds which amounts to closure of thousands of square miles to U.S. fishermen.	energy production would fail to fulfill BPU's solicitation award for 1,100 MW of offshore wind and would not meet the purpose of and need for action. Therefore, this alternative was dismissed from further consideration, as described in EIS Section 2.1.7 and Table 2-3 and Section C.2.1 in Appendix C, due to technical infeasibility.
1272-0007	There is serious injustice that is about to happen to the fishing industry in the next decade which is the loss of access to fishing grounds. With thousands of large turbines in Southern New England and the Mid Atlantic taking up thousands of square miles because of the types of bottom necessary to install these turbines. Prime fishing grounds are about to become wind farms which are going to be defacto Marine Protected Areas. Because the turbines are going to be so close together is it going to be difficult if not impossible to use bottom tending model fishing gear in the wind farms. The wind farm developers have also made it clear that they do not want and will attempt to keep all non-wind farm vessels out of their arrays. At this point BOEM seems to agree because they are approving COPs that allow the turbines to e place as close as 1 X .6 NM apart. And the developers are work to find a way to keep all other out of the leases. BOEM could have taken the fishing industries advise and only approve COPs with the turbines 2 X 2 NM apart which would have allowed bottom tend fishing gear to operating within the farms in good weather. But that has not happened. In the foreseeable future the negative effect on the fishing industry is going to become clear. The fishing industry will be harmed and most developers states grid operators and BOEM appear not to care.	BOEM recognizes the challenges identified by the clamming industry due to the selected WTG spacing and acknowledges these challenges in Sections 3.9.3 and 3.9.5 in the EIS. BOEM evaluated a 2-nm by 2-nm wind turbine layout and found that the number of turbine positions result in failure to meet the required 1,100 MW of wind energy. The reduced capacity and annual energy production would fail to fulfill BPU's solicitation award for 1,100 MW of offshore wind and would not meet the purpose of and need for action. Therefore, this alternative was dismissed from further consideration, as described in EIS Section 2.1.7 and Table 2-3 and Section C.2.1 in Appendix C, due to technical infeasibility. Approval of the Proposed Action would not restrict legal fishing in the Lease Area except during construction, when fishing may be excluded in safety zones.
1278-0016	The Oyster Creek export cable is a bad idea since it travels a long distance (143 miles p S-6) and mostly parallel to the shore. In a sense it creates a grid with other export cables that would run directly inshore making it next to impossible for commercial fishermen to avoid should it ever partially uncover. Especially commercial fishermen will need to know the exact coordinates of any export cable. A target depth of 4 feet for the export cable is much too shallow and will lead to almost certain uncovering. Also I could not find any reference to how wide the surveyed corridor was for the export cables. Hiding	BOEM recognizes the potential effects of cables, including potential entanglement and damage or loss of commercial and recreational fishing gear. However, these impacts are unlikely. Ocean Wind proposes to bury all cables to a target depth of 4 to 6 feet (1.2 to 1.8

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	relevant information on marine surveys so that the public cannot know if a thorough survey was conducted contradicts the intent of the DEIS.	meters). Cable-laying activities would directly disrupt commercial and for-hire recreational fishing activities only during construction. Existing aquaculture leases would be avoided to the extent practicable; however, the aquaculture lease near the Oyster Creek marina landfall option may be temporarily affected by cable installation and anchor lines for installation vessels. Hydraulic dredges at 6.3 inches penetrate the ocean floor the deepest of any bottom-trawl gear (Hiddink et al. 2017); therefore, it is unlikely that fishing gear would penetrate deep enough to snag or become tangled in the cable. BOEM assumes less than 10 percent of the cables may not achieve the target burial depth and would require cable protection in the form of rock placement, concrete mattresses, or half-shell (BOEM 2021). As described in Chapter 2 of the EIS, there are numerous active and inactive cables along the New Jersey shore and throughout the Mid-Atlantic areas dating back hundreds of years, and well-established BMPs and laws have allowed for the mutual coexistence of submarine cables with vessel operations. This is expected to continue.
1278-0022	The commercial fishermen want those cables buried 8-10 feet not four feet in both the WTG area and the export cables. The suggestion on page 3.9-30 that after WTG completion commercial fishermen will avoid the area because many recreational fishermen will be attracted to the WTG is not the reason commercial fishermen will avoid it. Commercial fishermen are afraid of the danger of uncovered inter-array cables and limited maneuverability with the WTGs. Commercial fishermen are also afraid of entanglement and gear loss due to pulling the gear over the bottom and snagging either the WTG concrete mattresses cables or other infrastructure. Large construction vessel movement	BOEM recognizes the potential effects of cables, including entanglement or gear loss/damage and navigational hazards, as described throughout Section 3.9. Ocean Wind proposes to bury all cables to a target depth of 4 to 6 feet. Hydraulic dredges at 6.3 inches penetrate the ocean floor the deepest of any bottom-trawl gear (Hiddink et al. 2017); therefore, it is unlikely that

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	and anchoring during construction is another navigation hazard for commercial and recreational vessels alike.	fishing gear would penetrate deep enough to snag or become tangled in the cable. BOEM assumes less than 10 percent of the cables may not achieve the target burial depth and would require cable protection in the form of rock placement, concrete mattresses, or half-shell (BOEM 2021).
0984-0016	3.9 Commercial Fisheries and For-Hire Recreational Fishing. The commercial fishing industry is extremely complex and should not be commingled with the scientific information of the recreational For-Hire Recreational Fishing Industry. BOEM's claim that it has a working relationship with The Department of Commerce is a farce. The science and policies that can be provided by the other four United States Agencies that deal with fisheries exists and undermines the rapid expansion of wind energy industrialization of the sea. This section is notably incomplete and is an example of why a relatively new government agency (BOEM) should not be imposing their taxpayer funded will on producing fishery information. BOEM's conflict of interest as the lessor and willingness to produce supporting claims to rush this EIS is an act with criminal intent and should be investigated by the United States Attorney General. The EIS should show hundreds of [Bold: Major Impacts] to Commercial fishing. The applicants development site has over 200 different fish species that frequent or transit through the area. Endangered and threatened marine species will be affected [Bold: a Major Impact]. The EIS notably only uses information from federally permitted vessels. There are many fishers who will be affected by the Industrial energy development zone whom did not file VTRs in the questionable time frame chosen to collect use data. The EIS should be rejected and found incomplete.	Comment noted. Data available from numerous sources—such as federal, state, and local agencies, academia, and collected by Ocean Wind—were used to develop the EIS. Analyses presented in the EIS are based on available scientific information and sources of data are cited. In addition, the Draft EIS was prepared in accordance with the requirements of NEPA (42 USC 4321–4370f) and implementing regulations of CEQ and the Department of the Interior.
0984-0070	The failure to quantify the amount of bottom that will be hardened and changed permanently without any bonded removal requirements is a misrepresentation of the true costs to the environment. The EIS should have a complete application and the fact that the applicant fails to provide such available calculation the application should be denied.	The amount of (ocean) bottom expected to be hardened as a result of the Proposed Action is presented in Appendix E, Table E-2, of the EIS. Extents of hard protection for inter-array cables and offshore export cables are 77 acres and 94 acres, respectively; WTG foundation and scour protection would total 84 acres.
0984-0073	The multiple [Bold: major impacts] of the EIS will create significant impacts on coastal habitats and change the overall character of the coastal habitat within the geographical analysis area. Sound waves will have noticeable [Bold: major	BOEM expects the Proposed Action to lead to unavoidable, short- to long-term impacts on benthic resources due to sediment

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	impact] from the repetitive work being conducted. A base stock of marine life capable of reproduction will be so adversely affected that it will take a century before the slower growing invertebrates are to recover from the pre-offshore wind energy industrialization zone. The introduction of non-native sediment cap on top of the cable will create native marine life displacement and create new habituate for non-native species like the Chinese green mussel and Chinese mitten crab. The applicants recognition of a permanent [Bold: major impact] is significant; but the applicant has failed to talk about the impact of having the compacted non-native soils replicated side by side for miles repeated multiple times during the life span of the project. This will change the eco-systems and the available food source for the most valuable fin fish in the Northeast. The applicants EIS is a [Bold: major impact] noted to be for cables. The [Bold: major impact] should also be considered for the import cable to the transfer stations that will be hotels at sea for the crews. The effects of the EMFs will be significant on a variety of marine life. There is enough scientific evidence that would suggest that the impacts will change the feeding habits of large sharks and push them closer to the beaches.	disturbance and the addition of cable and WTG protections. These structures and associated fauna would provide opportunities (i.e., “stepping stones”) for the establishment and spread of nonnative and invasive species but would also provide a “reef effect” that would support benthic organisms that are a food source to many fish species (described in Section 3.6, *Benthic Resources*). BOEM has considered the possibility of a significant impact resulting from invasive species and considers it unlikely; this level of impact could occur if an invasive species were to adversely affect benthic ecosystem health or habitat quality at a regional scale. While it is an impact that should be considered, it is also unlikely to occur and the incremental increase in this risk due to the Proposed Action is negligible. Information available (and reviewed in the EIS, e.g., Section 3.6, *Benthic Resources*) indicates EMF impacts on marine resources would be biologically insignificant, highly localized, and limited to the immediate vicinity of cables, undetectable beyond a short distance, but persistent as long as cables are in operation. Most exposure is expected to be of short duration, and the affected area would represent an insignificant portion of the available habitat; therefore, impacts would be expected to be negligible.
0984-0074	If that is the case and fishers choose to fish in the zone (because that is where the fish are before the wind turbine installation) there will be a [Bold: major impact] of noise from the turbines on the individuals fishing in the area. There are plenty of studies that the applicant has failed to include in the EIS on the medical impacts in regards to hearing loss. If the ocean users who choose not	The amount of fishing activity that could be affected within the Lease Area is a small fraction of the amount of fishing activity in the New England and Mid-Atlantic regions as a whole.

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	to risk being affected are now displaced the [Bold: major impact] is the removal of over a thousand square miles of the North Easts' most productive fishing grounds accounting for nearly three quarters of all fish caught. The [Bold: major impact] to the nations food Security international trade coastal economy the over two hundred year old supply chain will all be lost and the amount of people food insecure will see double digit growth. The applicant has an obligation to comply with current social justice requirements and include the impact of noice on other sea users in the EIS.	Noise from the proposed Project would result in a localized, short-term, negligible impact on jobs supported by local businesses as well as on subsistence fishing, and these impacts are considered in Section 3.12, *Environmental Justice*.
0984-0089	The suggestion that the recreational fishing industry will benefit from the additional artificial sites is one of the systemic raciest components contained in the application and within BOEM as a whole. The sites will have a negative biological inventory affect. The new environmental justice regulations should be enacted with regards to the EIS. Challenges to the recreational fishing section of the EIS that supports inequality needs to be addressed as a bias. The removal of a source a cheap protein "seafood" for the food insecure for recreationists is criminal as is the EIS who promotes such an act. The increased cost of seafood with a simple supply and demand chart will show the additional costs to the consumers. The USDA has the calculations on the price increase / decrease ratio on a ten cent basis on how many people can afford a nutritional meal. The applicant and BOEM have refused to address the cost of seafood and the impacts to the countries people whom are already in need. The comments that only the wealthy can afford fish was not true in the coastal communities but will be with the lack of inclusion and understanding of the [Bold: major impact] that have been omitted from the EIS. This EIS is incomplete and should be rejected.	Impacts on for-hire recreational fishing due to the Proposed Action and planned activities would be minor to major depending on the fishery, as described in Section 3.12, *Environmental Justice*. The EIS presents both beneficial and adverse impacts of the Proposed Action on the recreational fishing industry. Beneficial impacts would be generated by the reef effect of offshore structures, providing additional opportunity for tour boats and for-hire recreational fishing businesses. Adverse impacts would result from navigational complexity within the Wind Farm Area, disturbance of customary routes and fishing locations, and the presence of scour protection and cable hardcover, leading to possible equipment loss and limiting certain commercial fishing methods.
0984-0099	The ongoing and future surveys of the potential impacts of offshore wind on finish invertebrates and EFH will have to continue before this and any of the permits are granted. The EIS is incomplete and should be rejected.	BOEM continues to work with NOAA to support additional scientific research and surveys to assess uncertainties in scientific data collection and implement any changes to surveys. As part of the Proposed Action, Ocean Wind has committed to conducting several pre-, during, and post-construction monitoring surveys.

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0984-0100	The reference to endangered species the American sturgeon and the seasonal migration habits is a good example why this EIS should be rejected for being incomplete. The American Sturgeon migrants North in the spring across the cumulative lease sites. The applicant continues to falsely portray impacts within the EIS and has not invested the time or money ignorer to complete the EIS properly. The application should be rejected	Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*, has been expanded to include discussion of potential impacts on the Atlantic sturgeon for each IPF. In addition, the Atlantic sturgeon is addressed in the NMFS BA, which is included in the Final EIS.
0984-0101	The changing of an ecosystem by adding structures where none existed before is a permanent [Bold: major impact] and should not be considered a moderate beneficial impact. There will be significant [Bold: major impacts] to the fishing industry with the loss of miles of the most diverse fishing grounds on the east coast. The applicant has been misled by the fishing liaison as to the willingness of fishers to fish in shipping lanes. Plus it should be anticipated that with the reduction of open waters to transit that vessel traffic in the shipping lanes will place vessel at closer proximity especially during the construction phase of any of the development sites. This reduction in fishing grounds and the increased vessel traffic will have a direct negative [Bold: major impact] on fishing effort.	Impacts on commercial fisheries from the Proposed Action are expected to be minor to major, depending on the fishery, as described in Section 3.6.5 of the EIS. The Wind Farm Area will not be closed to fishing during operation of the wind farm, although some fishers may choose to avoid the lease area due to the potential for gear loss/damage and safety. Impacts on the industry would result primarily from reduced access to traditional fishing grounds and increased risk of fishing gear damage or loss.
TRANS-0081-0002	Additionally we do believe this document has been rushed in its development. Specifically we are concerned with commercial fishing portions of the document and we have been combined with the four higher recreational fishing in your analysis we believe this undermines the real impact on commercial fishing directly as you look at the no action alternatives and the other alternatives when it comes to impacts on commercial fishing. Specifically to identify that are moderate to major impact that will occur with no action seems irresponsible to the commercial fisherman. We even go so far as to look at table 3.9-4 which is a table that identifies commercial fishing revenue of federally permitted vessels in the Mid-Atlantic and New England fisheries and the level of fishing dependence by port. This table lacks specifically the ports of Atlantic City of Barnegat Light and of Sea Isle City in the state of New Jersey. We don't understand by BOEM has not included these major ports commercial fishing ports in this analysis.	Impacts on commercial and for-hire recreational fisheries are expected to be minor to major depending on the fishery. Commercial and for-hire recreational fisheries are presented together in Section 3.9 and a change is not considered warranted. Under the Proposed Action, impacts on these resources would range from minor to major, depending on the fishery. Impacts would be minor for vessels that derive a small portion of their total revenue in wind farm areas or are willing to seek and able to find suitable alternative fishing locations. For fishing vessels that choose to avoid the Wind Farm Area, have historically derived a large percentage of their total revenue from the area, and are unable to find suitable

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		alternative fishing locations, the adverse impacts would be major. With respect to additional ports, Table 3.9-4 in Section 3.9 has been revised to include Atlantic City, Barnegat Light. Sea Isle is included in Tables 3.9-9, 3.9-10, 3.9-14, and 3.9-15.
TRANS-0089-0001	Some commercial fisherman also stand to have their usual operations altered Orsted will help ease any transition strain by implementing a navigational safety fund and a gear loss program. I urge BOEM to create a loss mitigation strategy that accounts for any harm to our historical South Jersey fishing fleet.	Proposed mitigation for fisheries impacts are provided in Appendix H of the EIS and include: • CFHFISH-02: Develop and implement a Fisheries Communication and Outreach Plan (COP Appendix O). The plan includes the appointment of a dedicated fisheries liaison as well as fisheries representatives who will serve as conduits for providing information to, and gathering feedback from, the fishing industry, as well as Project-specific details on fisheries engagements. • CFHFISH-03: Implement Ørsted's corporate policy and procedure to compensate commercial/recreational fishing entities for gear loss as a result of Project activities.
TRANS-0092-0001	We do however have concerns about the impacts to the commercial fishing industry. Commercial fishing is vital to New Jersey's economy and to our way of life as a coastal state. The DEIS notes that there will be material impacts to this industry. It also notes that some project design changes have already been made and that mitigation can be effective in offsetting those impacts. More must be done to ensure that mitigation takes place. For this reason New Jersey BIA believes that the Federal Government must continue working with both the commercial and fishing industries to ensure that the mitigation nplan to compensate the commercial fishing industry is in place.	Proposed mitigation for fisheries impacts are provided in Appendix H of the EIS and include: • CFHFISH-02: Develop and implement a Fisheries Communication and Outreach Plan (COP Appendix O). The plan includes the appointment of a dedicated fisheries liaison as well as fisheries representatives who will serve as conduits for providing information to, and gathering feedback from, the

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		fishing industry, as well as Project-specific details on fisheries engagements. • CFHFISH-03: Implement Ørsted's corporate policy and procedure to compensate commercial/recreational fishing entities for gear loss as a result of Project activities.

O.6.9 Cultural Resources

Table O.6.9-1 Responses to Comments on Cultural Resources

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0321-0001	My name is Nancy Solomon and I am the director of Long Island Traditions a regional nonprofit organization that documents presents and advocates for the preservation of local traditional culture including our maritime culture. I have worked with local regional bodies including the South Shore Estuary the National park Service and other agencies. In reviewing the NHPA compliance documents prepared by the project team I come to the conclusion that there needs to be an impact study for impacts to offshore fishermen baymen and shellfish beds. One way to do this would be through a traditional NEPA or NHPA study using the criteria established by the Traditional Cultural Properties assessment designed by the NPS and the National Register. Intangible cultural resources are critical to our regional identity. The current evaluation documents prepared for historic resources do not include any analysis of intangible cultural resources. Should the EIS deem there will be an impact we ask that Shell New Energies US LLC and EDF Renewables North America establish a mitigation fund for the impacted fishermen.	Impacts from the Project on offshore fishers, bay farmers, and shellfish beds are addressed in Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*. BOEM appreciates and will consider the issue of offshore fishing areas as a TCP raised by the comment. Long Island Traditions will be invited to be a Section 106 consulting party. Identification of offshore fishing areas as a potential historic property through implementation of a TCP assessment will be completed pursuant to the Phased Identification Plan stipulated in the Section 106 Memorandum of Agreement. If the phased identification process finds fishing areas to be TCPs and assessment of effects consistent with the process identified in the Memorandum of Agreement finds the historic property to be adversely affected, BOEM will consult with Section 106 consulting parties to resolve adverse effects, including consideration of a mitigation fund.
0487-0002	I have been diving the hundreds of historic shipwrecks off our coast for 40 years. Many of these historic wrecks lie within the areas designated for turbine construction. Disturbing these sites cannot be allowed and must be thoroughly addressed along with maintaining unfettered access. This issue must be seriously researched and considered.	BOEM has identified 19 submerged archaeological resources within the marine APE (Targets 1–19). The Draft EIS previously indicated the Project would encroach into the recommended 50-foot buffers around two of these resources (one shipwreck within the Oyster Creek offshore export cable route and one shipwreck within the BL England offshore export cable route). However, BOEM has reviewed the revised Marine Archaeological Resource Assessment (COP Volume III, Appendix F-1, September 2022) prepared by Ocean Wind. Based on the revised assessment, BOEM has revised the Final EIS to specify the Project will avoid the 50-meter buffer around all 19 submerged archaeological resources and thus avoid impacts on those cultural resources under NEPA and avoid adverse effects on those historic properties under Section 106.

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0487-0008	BOEM needs to insure through detailed siting information and firm policies that preservation and access to shipwrecks in the area is not compromised.	Information related to wind turbine siting is provided in COP Volume III, Appendix G, Locations for Offshore Turbines and Substations. Regarding public access to shipwrecks, please see response to comment 0487-0002.
0984-0112	Individual turbines to the offshore substations substation interconnector cables linking the substations to each other offshore, export cables and onshore export cable system two onshore substations and connections to the existing electrical grid in New Jersey (underground cables or overhead transmission lines would be required to connect each onshore substation to the existing grid). The WTGs and offshore substations array cables and substation interconnector cables will be located in Federal waters approximately 13 nautical miles (nm 15 statute miles) southeast of Atlantic City. The offshore export cables will be buried below the seabed surface within Federal and State waters. The onshore export cables substations and grid connections are intended to be located in Ocean and Cape May Counties New Jersey. The Project location is depicted in [Error! Reference source not found]. The Project will be installed beginning in 2023 and operational in 2024. Section 106 of the National Historic Preservation Act (Section 106 54 USC 306108) requires federal agencies to take into account the effects of an undertaking on historic properties listed in or eligible for the National Register of Historic Places (NRHP). As the lead federal agency for this undertaking BOEM has the responsibility for compliance with the NHPA and other federal statutes regulations and guidance relating to the protection of historic properties. Similarly the State of New Jersey has promulgated regulations and guidance related to the protection of historic properties including the properties listed in the State Register of Historic Places (SRHP). Ocean Wind is out of compliance. If Ocean Wind was committed to the protection of historic properties in accordance with federal and state statues regulations and appropriate guidance they would be using the appropriate resources to document the sites at sea and within the sites they intend on disturbing before construction. BOEM's conflict of interest is evident in this section as the lessor. Identifying historic properties within the Project's Area of Potential	The Marine Archaeological Resource Assessment (COP Volume III, Appendix F-1) prepared by Ocean Wind represents a good-faith effort to identify historic properties with the Project's marine APE. Ocean Wind has revised this report in response to consulting party comments on the initial version. These revisions were incorporated into the Final EIS. Additionally, if Alternative B-1, B-2, C-1, C-2, or D is selected, Ocean Wind has committed to conducting phased identification to further delineate and evaluate submerged archaeological resources within the marine APE that cannot be avoided. The Terrestrial Archaeological Resource Assessment (COP Volume III, Appendix F-2) prepared by Ocean Wind represents a good-faith effort to identify historic properties within the Project's terrestrial APE. The terrestrial APE includes the footprint of the proposed onshore facilities associated with construction, O&M including the onshore substation and onshore export cable routes, as well as temporary work areas including staging and laydown areas. In addition to identifying known archaeological resources in the terrestrial APE, the Terrestrial Archaeological Resource Assessment includes information about archaeological sensitivity. Given there are areas identified as being archaeologically sensitive and areas that are previously undisturbed, the Post-Review Discoveries Plan for Terrestrial Resources includes language that requires "[Secretary of the Interior] qualified professional archaeologist [to] initially monitor all construction activities that could potentially impact archaeological deposits. Monitoring will be discontinued as soon as the archaeologist is satisfied that final construction will not disturb important deposits."

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	Effects (APE) at sea by Ocean Wind has been purposely omitted. Cultural resources studies to identify historic properties that may be affected by construction and operation of the Project should be conducted beforehand. Archaeological properties listed in eligible for or recommended as eligible for inclusion in the NRHP or SRHP should be identified within the APE for terrestrial archaeological resources since a majority of the APE has been not been previously disturbed by prior anthropogenic activity. Ocean Wind recognizes that there is possible significant archaeological resources and/or human remains will be discovered during construction of onshore facilities primarily during excavation. Ocean Wind also recognizes the importance of complying with federal state and municipal laws and regulations regarding the treatment of human remains and should have started the compliance process before submission of an EIS. The Terrestrial Discoveries Plan (UDP) is inadequate in outlining the protocol / steps for dealing with discoveries of cultural resources including human remains during the construction of the proposed Project.	In addition to the Post-Review Discoveries Plan for Terrestrial Resources, a Post-Review Discovery Plan for Submerged Resources has been prepared for the Project. Both documents were included in the Draft EIS Appendix N as attachments to the Memorandum of Agreement. Input provided during the public comment period pertaining to specific revision requests on these documents were considered. In addition, during Consultation Meeting #3 on November 30, 2022, BOEM sought input from consulting parties on adverse effect findings and on resolution measures for adverse effects. This discussion requested input on the post-review discovery plans. If needed, this discussion will be continued in subsequent consulting party meetings. Final versions of these plans are included in the Final EIS.
1202-0004	Cape May County's goal in consultation with BOEM is to ensure that BOEM's permitting process follows the law and that BOEM selects an alternative that preserves the integrity of the project's surrounding area to the greatest extent possible including the County's ocean-facing historic properties. Cape May County insists that BOEM comply with the requirements of the National Environmental Policy Act (NEPA) and Section 106 and 110(f) of the National Historic Preservation Act (NHPA) so that Ocean Wind 1 and nearby windfarms are developed responsibly. Our comments address five major deficiencies: (1) the DEIS is inadequate because it fails to assess cultural and historic resources in the Project area; (2) the DEIS is inadequate because it mischaracterizes impacts to Cape May County and other cultural and historic resources; (3) the DEIS fails to consider cumulative effects of Ocean Wind 2 and other reasonably foreseeable wind farms; (4) the DEIS is incomplete because it does not provide adequate measures to resolve adverse effects; and (5) BOEM has violated the letter and spirit of NEPA and the NHPA by refusing to subject its permitting review to public scrutiny. If BOEM or any other cooperating agency such as the U.S. Army Corps of	The Marine Archaeological Resource Assessment, Terrestrial Archaeological Resource Assessment, and Historical Resource Visual Effects Assessment (COP Volume III, Appendices F-1, F-2, and F-3, respectively) prepared by Ocean Wind represent a good-faith effort to identify historic properties with the Project’s marine, terrestrial, and visual APEs. These technical reports were distributed for Section 106 consulting party review and comment on March 21, 2022. In addition, Ocean Wind prepared a supplemental architectural intensive-level survey report to characterize the full population of properties inventoried in support of Historical Resource Visual Effects Assessment preparation. This document was shared with Section 106 consulting parties for comment on April 1, 2022. Ocean Wind has revised these reports in response to consulting parties’ comments on the initial versions. These revisions were incorporated into the Final EIS and inform the identification and evaluation of historic

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	Engineers relies on the DEIS in its current form any decision the agency makes will be arbitrary capricious and contrary to law.I. The DEIS is inadequate because it fails to assess cultural and historic resources inthe Project area. BOEM must uphold its consultation obligations under NEPA and Section 106 ofthe NHPA to assess impacts to historic properties. BOEM has failed to uphold its obligations to properly consult under both NEPA and the NHPA.NEPA is designed to ensure that the public and decision-makers are provided with the information they need to make a considered decision about the best path forward. The statute is also designed to ensure that federal agencies have carefully and fully contemplated the environmental effects of a proposed action.[Footnote 1: 40 C.F.R. § 1502.1; N.C. Wildlife Fed'n v. N.C. Dep't of Transp. 677 F.3d 596 601 (4th Cir. 2012) (quoting Robertson v. Methow Valley Citizens Council 490 U.S. 332 350 (1989)).] In addition to considering impacts on the natural environment NEPA requires federal agencies to consider impacts on historic and cultural resources.[Footnote 2: 40 C.F.R. §1508.27(b)(3); 40 C.F.R. § 1508.27(b)(8).] By focusing the permitting agency's attention on the environmental consequences of its proposed action NEPA "ensures that important effects will not be overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast."[Footnote 3: Robertson 490 U.S. at 349.] In other words NEPA requires that federal agencies take a "hard look" at the environmental consequences of a proposed action.[Footnote 4:Citizens Against Burlington v. Busey 938 F.2d 190 (D.C. Cir. 1991) cert. denied 502 U.S. 994 (1992).]	properties and BOEM's assessment of these properties within the Project's APE. BOEM has considered the above-referenced technical reports and Section 106 consulting parties' comments on the reports, including those specific to identification and characterization of historic properties within the APE that are in Cape May County. BOEM finds the technical reports listed above represent a good-faith effort to identify historic properties with the Project's visual APE. Cumulative effects of Ocean Wind 2 and other reasonably foreseeable wind farms are addressed in Section 3.10, which considers the impacts on cultural resources resulting from the Proposed Action, action alternatives, and the No Action Alternative. Additionally, the Cumulative Historic Resources Visual Effect Assessment specifically addresses anticipated cumulative visual effects on onshore historic properties accruing from the Project, Ocean Wind 2, and other foreseeable wind farms. Consulting parties' comments on the Cumulative Historic Resources Visual Effect Assessment were incorporated into the Final EIS. Adverse effects on historic properties will be resolved through avoidance, minimization, and mitigation measures for historic properties to be stipulated in a Memorandum of Agreement, which will include treatment plans. Consulting parties were provided an overview of the Memorandum of Agreement and an opportunity to provide comments and questions during Consultation Meeting #3 and Consultation Meeting #4. BOEM has provided multiple opportunities for Section 106 consulting parties to review information about the Project and provide their comments on the Project and shared information. This includes the distribution of the complete terrestrial archaeological resources report, complete marine archaeological resources report, complete historic resources visual effects assessment, complete cumulative visual effects assessment report, and a technical memorandum detailing the delineation of

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		the APE for the Project on March 21, 2022; and the supplemental architectural intensive-level survey report on April 1, 2022. Ocean Wind revised the distributed technical reports for BOEM based on consulting party comments, and information from the revised versions of these reports are included in the Final EIS. On June 24, 2022, BOEM distributed the Draft EIS to consulting parties for review and comment. On November 11, 2022, BOEM distributed revised technical reports, the revised draft Finding of Adverse Effect, and the revised draft Memorandum of Agreement to consulting parties. BOEM will distribute the Final EIS to consulting parties concurrent with publication of the Notice of Availability in the *Federal Register*. To date, BOEM has held five Consultation Meetings (March 8, 2022, May 4, 2022, November 30, 2022, February 10, 2023, and April 24, 2023) to discuss the Project and materials previously distributed to consulting parties. Additionally, the general public was notified of the release of the Draft EIS on June 14, 2022, and provided a 45-day period to review and comment on the Draft EIS. The comment period was extended by an additional 15 days to August 23, 2022. The general public will be notified of the release of the Final EIS on May 26, 2023. BOEM has met and will continue to meet the requirements of both NEPA and the NHPA regarding the public sharing of information about its permitting process and consulting with and receiving comments from consulting parties and the public.
1202-0005	In addition to assessing all impacts to the natural environment BOEM must fully assess and consider all direct and indirect impacts on cultural and historic resources. The DEIS purports to incorporate the standards for identifying assessing and mitigating effects under Section 106 within its NEPA review. [Footnote 5: Bureau of Ocean Energy Management Ocean Wind Farm Project Draft Environmental Impact Statement (hereinafter "DEIS") 2-1 (2022). See also DEIS at 3.10-22.] But the DEIS falls short of NEPA and NHPA mandates that require consideration of all adverse effects because BOEM has failed to integrate properly its	BOEM has met and will continue to meet the requirements of NEPA and the NHPA through the NEPA Substitution for Section 106 process as outlined by the Section 106 regulations and the ACHP's and CEQ's Handbook on NEPA and Section 106 Coordination and Substitution. BOEM has provided multiple opportunities for Section 106 consulting parties to review information about the Project, the identification of historic properties, the assessment of effect, and resolution of adverse effects, and to provide their comments on the Project and

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	NEPA and NHPA reviews preferring instead to integrate in name only but not in substance.[Footnote 6:See NEPA and NHPA: A Handbook for Integrating NEPA and Section 106 Synopsis Advisory Council Hist. Preservation https://www.achp.gov/digital-library-section-106-landing/nepa-andnhpa-handbook-integrating-nepa-and-section-106.] BOEM must carry out proper consultation under Section 106 of the NHPA if it intends to use the DEIS to assess impacts to historic properties for NEPA as well as the NHPA a standard it has not reached. To assess adverse effects under Section 106 agencies must properly consult with all relevant parties.[Footnote 7: See e.g. Advisory Council on Historic Preservation Section 106 Toolkit available athttps://www.achp.gov/digital-library-section-106-landing/section-106-applicant-toolkit.] However BOEM is not even close to have completed Section 106 consultation much less any steps within the Section 106 process that would allow BOEM and the public to understand the full extent of adverse effects on historic properties or how to resolve those effects. BOEM has not responded to or considered comments from consulting parties regarding historic and cultural resources. BOEM has also failed to adequately consult with required parties including local governments and the SHPO. Therefore the DEIS is incomplete and inaccurate because it purports to assess impacts on historic resources without having adequately followed the requisite requirements pursuant to Section 106. BOEM should ensure it has properly carried out its full obligations under NEPA and NHPA before the finalization of the EIS. Failure to do so will result in a Final EIS that is arbitrary, capricious, and contrary to law. The DEIS does not adequately consider all possible planning to minimize harm to the Cape May NHL. BOEM has ignored its Section 110(f) obligations to Cape May Historic District NHL by completely ignoring it in the identification of properties and concluding incorrectly that it will not experience adverse effects. Not only does Cape May County object to BOEM's determination that Cape May Historic District will not experience adverse effects from Ocean Wind 1 but also BOEM has failed to consider the cumulative impacts of reasonably foreseeable cumulative effects from Ocean Wind 2 which will be several miles closer to Cape May Historic District.[Footnote 8: 40 C.F.R. § 1508.1(g).] To fulfill its legal obligations for permitting	shared information. This includes the distribution of the complete terrestrial archaeological resources report, complete marine archaeological resources report, complete historic resources visual effects assessment, complete cumulative visual effects assessment report, and a technical memorandum detailing the delineation of the APE for the Project on March 21, 2022; and the supplemental architectural intensive-level survey report on April 1, 2022. Ocean Wind revised the distributed technical reports for BOEM based on consulting party comments, and information from the revised versions of these reports was included in the Final EIS. On June 24, 2022, BOEM distributed the Draft EIS to consulting parties for review and comment. BOEM will distribute the Final EIS to consulting parties concurrent with publication of the Notice of Availability in the *Federal Register*. To date, BOEM has held five Consultation Meetings (March 8, 2022, May 4, 2022, November 30, 2022, February 10, 2023, and April 24 2023) to discuss the Project and materials previously distributed to consulting parties. Additionally, the general public was notified of the release of the Draft EIS on June 14, 2022, and provided a 45-day period to review and comment on the Draft EIS. The comment period was extended by an additional 15 days to August 23, 2022. The general public will be notified of the release of the Final EIS on May 26, 2023. As noted, BOEM has provided consulting parties multiple opportunities to comment on Ocean Wind 1 and the agency's efforts to identify and evaluate historic properties within the Project APE and BOEM's assessment of effects on these properties resulting from the Project. BOEM will continue to consult with consulting parties on these topics, specifically in upcoming Consultation Meetings. BOEM invited 205 local, state, and federal government agencies and organizations to be consulting parties and 20 local, state, and federal government agencies and organizations elected to participate as consulting parties

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	BOEM must undertake all possible planning to minimize harm to Cape May Historic District pursuant to Section 110(f) of the NHPA.[Footnote 9: 54 U.S.C. § 306107.] Section 110(f) provides: Prior to the approval of any Federal undertaking which may directly and adversely affect any [NHL] the head of the responsible Federal agency shall to the maximum extent possible undertake such planning and actions as may be necessary to minimize harm to such landmark and shall afford the Advisory Council a reasonable opportunity to comment on the undertaking.[Footnote 10: Id.] The DEIS does not make clear whether BOEM has initiated the Section 110(f) process or whether and how BOEM has undertaken such planning and actions as would be necessary to minimize harm to Cape May County. In fact the DEIS does not contain any information at all about how BOEM intends to demonstrate compliance with Section 110(f) of the NHPA. BOEM must address impacts to the Cape May Historic District differently than it addresses impacts to other historic properties in the Project area for Section 110(f) purposes and revise the DEIS accordingly.c. The DEIS fails to assess the Project's specific impacts on the unique history and history-related tourism and property values of Cape May County. The DEIS does not properly contemplate the effect of the wind turbine generators (WTGs) on tourism from visual impacts. Under NEPA BOEM must consider a wide range of effects specifically including impacts that are "historic cultural [and] economic."[Footnote 11: 40 C.F.R. § 1508.1(g)(1).] Yet the DEIS does not consider how the changed viewshed could negatively impact tourism to Cape May County. Tourism revenue and property values are vital to Cape May County's economy. Tourism alone is a $7 billion industry in Cape May County supporting over 50000 jobs every year. Spoliation of Cape May County's historic landscape increases the risk of lost tourism revenue and property taxes which are expected to decrease after Ocean Wind 1 industrializes the ocean landscape with visual clutter and light. Impacts to the County's tourism economy would be devastating to the economic health of the area and would put tens of thousands of jobs at risk. Despite this risk the DEIS' discussion of tourism blithely dismisses potential impacts without sufficient discussion or research. BOEM must carefully consider the impacts on the Cape May County's unique	under Section 106. The New Jersey Historic Preservation Office was invited to be a consulting party and elected to participate as a consulting party under Section 106. BOEM has followed the requirements of Section 110(f) and is consulting with the National Park Service, New Jersey SHPO, and ACHP to assess, and if necessary mitigate, effects on NHLs within the APE. This process and finding is addressed in Appendix N, Section N.6, *National Historic Landmarks and the NHPA Section 106 Process*. Language in this section of the Final EIS has been supplemented to provide additional details regarding BOEM's compliance with Section 110(f). Based on visualizations described in the VIA and referenced in the Historical Resource Visual Effects Assessment, visibility of the Project's offshore infrastructure beyond 25 miles is unlikely. The Cape May Historic District NHL is beyond this threshold distance, which represents the limits of potential for adverse visual effect. Therefore, Cape May Historic District NHL is not within the APE. As such, the Cape May Historic District NHL is not included in the assessment of effects found in Appendix N of the EIS, is not addressed in Section 3.10, and is also not included in BOEM's consideration of cumulative effects from Ocean Wind 1, Ocean Wind 2, and other foreseeable wind farm projects, as analyzed in the Cumulative Historic Resources Visual Effects Assessment. Section 3.10 discusses potential impacts on cultural resources and states that the cultural resources geographic analysis area for NEPA is the Section 106 APE. As such, Cape May County's cultural resources are considered under NEPA if those resources are in the geographic analysis area. Impacts on tourism from the Project are not a consideration under Section 106. However, the EIS does address these impacts under NEPA in Section 3.18, *Recreation and Tourism*.

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	character and historic properties which qualifies as a "resource" both to the area's economy and under NEPA's definition. Negative impacts on tourism revenues and tax revenues due to the WTGs are expected be quite significant and these potential adverse effects must be further analyzed and quantified as BOEM develops the Final EIS.II. The DEIS is inadequate because it mischaracterizes impacts to Cape May County's cultural and historic resources. The DEIS fails to address adequately visual impacts to Cape May County. The DEIS's conclusion that only a single building in Cape May County-the Ocean City Music Pier-will be adversely affected by Ocean Wind 1 defies common sense and amounts to legal error. Cape May County has a thirty-mile coastline well within Ocean Wind 1's Area of Potential Effect with hundreds of buildings properties or districts listed or eligible for listing in the National Register of Historic Places. Despite this fact BOEM has failed in both its identification and assessment of historic properties. As described in detail in our May 2022 comments on the historic resource reports BOEM's process for identifying historic properties and assessing impacts to those properties is woefully inadequate. In addition to ignoring known historic properties listed in the New Jersey and National Registers of Historic Places BOEM has ignored other potentially eligible properties including historic boardwalks lighthouses lifesaving stations hotels and even historic beach houses that may qualify as traditional cultural properties and/or recognition for eligibility as a multiple property designation. All of these historic properties were purpose-built to take advantage of pristine uninterrupted ocean views-an inseparable part of their historic context-and maintain connections to living communities who have come to Cape May County since its development for recreation and associated with other broad patterns of our history. Because BOEM has yet to respond to those comments or address them in any substantive way and ignored how New Jersey's coastal historic properties and associated ocean landscape could be eligible for listing in theNational Register we incorporate them herein by reference in particular the County's concerns about unnecessary limitations on the APE and BOEM's gross mischaracterization that Cape May County's historic properties (other than the Ocean City Music Pier) do not have a connection to a maritime or oceanfront setting.	In addition, economic impacts from the Project are not considered under Section 106. However, the EIS does address these impacts under NEPA in Section 3.11, *Demographics, Employment, and Economics*. BOEM finds characterization of visual impacts on Cape May County cultural resources and historic properties to be accurate. BOEM reviewed comments submitted by Cape May County in response to BOEM’s distribution of the Historical Resource Visual Effects Assessment to consulting parties on March 21, 2022. On November 11, 2022, BOEM provided response to consulting party comments and distributed a revised Historical Resource Visual Effects Assessment for consulting party review. BOEM has considered information from the revised versions of these reports, including the revised description of approach to visual Preliminary APE delineation; methodology for differentiating seaside setting versus uninterrupted ocean views as character-defining features of historic properties; revised characterization of properties including Riviera Apartments, Vassar Square Condominiums, the House at 114 South Harvard Avenue, and Ocean City Music Pier; and updated affects recommendations. These revisions have provided sufficient substantial evidence such that BOEM has revised the Final EIS to find the following additional properties adversely affected: Brigantine Hotel, Absecon Lighthouse, Atlantic City Boardwalk, Atlantic City Convention Hall, Ritz-Carlton Hotel, Haddon Hall/Resort Casino Hotel, Lucy the Margate Elephant, Great Egg Coast Guard Station, Ocean City Boardwalk, Hereford Lighthouse, North Wildwood Life Saving Station, U.S. Lifesaving Station #35, Flanders Hotel, and Little Egg Harbor U.S. Life Saving Station #23 (U.S. Coast Guard Station #119). In addition, Charles Fischer House is no longer found adversely affected, given it was demolished.

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1202-0006	The DEIS's Visual Impact Assessment and Visual Simulations are far too limited in scope and do not provide enough information for consulting parties to adequately assess potential impacts to Cape May County as well adjacent counties. BOEM has failed in its consultation obligations as well as its obligations under the NHPA and NEPA and as a result neither the consulting parties nor the general public can understand the full extent of visual impacts to all of Cape May County's historic properties. Visual assessments that are this limited in nature are not only unreasonable but also arbitrary capricious and contrary to federal law.	Based on BOEM's SLVIA methodology (2021), EIS Section 3.20 and Appendix M consider the offshore and onshore facilities' effects on scenic resources and viewers and include analyses of scenic and visual resources from 32 KOPs between Barnegat Light near the Oyster Creek Point of Interconnection and Cape May. The NEPA geographic analysis area, which is consistent with the NHPA Section 106 APE, for this undertaking is delineated by BOEM. The visual Preliminary APE in the Historical Resource Visual Effects Assessment was identified by Ocean Wind using a methodology approved by BOEM. This methodology includes consideration of the viewshed analysis prepared for the VIA. Viewshed modeling was conducted for a 40-mile study area. Forty miles is set as the threshold of maximum theoretical visibility from the wind turbines because the EC prevents visibility beyond that distance. Viewshed modeling was applied to test the potential for visibility of the wind turbines by using USGS Light Detection and Ranging data to identify where views would be obstructed by natural features or the built environment. The viewshed analysis applies a Digital Terrain Model, which shows potential areas of visibility for offshore turbine blade tips, relying on the screening effects of topography alone (without accounting for vegetation and structures). Viewshed analysis also considers Digital Terrain Model plus Digital Surface Model, which shows potential areas of visibility for offshore turbine blade tips, including the screening effects of both topography and surface data (accounting for vegetation and structures such as buildings). Additional data to inform where there is true potential for visibility (i.e., visual impact) include consideration of visual simulations from the VIA because they demonstrate potential visibility from KOPs. In the case of this Project, the VIA simulations indicate that views over 25 miles away were indistinct or not obvious within the

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		view and, therefore, too faint to represent a potential for adverse effect. Much of Cape May County’s coastline is more than 25 miles from the Ocean Wind 1. As such, only a portion of Cape May County’s coastline is within the APE. BOEM disagrees with the comment regarding the inadequacy of the VIA and visual simulations as the basis upon which to assess potential impacts under NEPA and potential adverse effects under Section 106 of the NHPA. The current analysis and simulations represent a good-faith effort to analyze the visibility of the Project from affected historic properties under the VIA requirements of a “typical day.” While all photographic visualizations were taken during summer, they were taken under different lighting conditions and at different times of day. Current KOP coverage is sufficient to represent visibility along the shoreline for historic properties in the APE.
1202-0007	In addition BOEM must include construction impacts in its final analysis of impacts to historic properties. Proposed construction is expected to cause significant adverse effects to historic properties within the Project Area and Area of Potential Effect something the DEIS does not address with any substance. Prolonged constant and bright lights will be required to construct the WTGs and this lighting will cause major impacts to Cape May County's views for a significant period of time. The DEIS does not discuss fully how Ocean Wind 1 will address potential lighting impacts including during the construction phase. The County is especially concerned about lighting impacts to the dark night sky both during and after construction and urges BOEM to take a hard look at these impacts and mandate ADLS. In addition BOEM should also consider visual impacts of lighting at each proposed turbine's base reflections caused by weather conditions and reflections on the ocean's surface.	EIS Section 3.10, Section 3.20, and Appendix M consider the visual impacts of lighting including light from vessels, use of lighting during construction and decommissioning, and use of lighting on WTGs and OSS during operations. The EIS discloses that the visibility of the wind turbines will be variable depending on current meteorological, moonlight, and sunlight conditions. In Section 3.10, language has been updated to acknowledge nighttime lighting impacts would be restricted to cultural resources for which a dark nighttime sky is a contributing element to their historic integrity, and the National Park Service has indicated during consultation for offshore wind projects that a dark nighttime sky should be assumed to be a character-defining feature of certain resource types such as lighthouses or resources associated with historic events that may have occurred at night, such as battlefields. Given this assumption, of the nine historic districts and 40 individual properties reviewed in the offshore visual APE, a dark nighttime sky is considered a character-

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		defining feature of Absecon Light House and Hereford Inlet Lighthouse. However, in both cases, there is a limited view of the Proposed Action and the impact from lighting would be negligible. In addition, the Cumulative Historic Resources Visual Effect Assessment has been revised to address cumulative visual effects on historic properties from lighting during construction. Of the 10 historic properties assessed in the Cumulative Historic Resources Visual Effect Assessment, none were resource types that met the conditions specified above. In addition, visual simulations of nighttime lighting from the Project and other offshore wind energy development activity WTGs are included in the Cumulative Historic Resources Visual Effect Assessment, Appendix C.
1202-0008	Due to the high potential for Ocean Wind 1 to adversely impact cultural sites historic properties the viewshed property values and tourism BOEM must revise the DEIS to properly address all consulting party concerns and provide consulting parties and the public with adequate and easily accessible information that informs all parties of potential impacts. Such revisions should include a historic resource report that properly identifies all historic properties in area takes into account SHPO input and adequately assesses impacts to the sites. In addition ADLS and paint colorshould be required by BOEM.	In response to previous consulting party comments on the technical reports, the Marine Archaeological Resource Assessment, Terrestrial Archaeological Resource Assessment, and Historical Resource Visual Effects Assessment (COP Volume III, Appendices F-1, F-2, and F-3, respectively) have been revised by Ocean Wind to better identify all historic properties within the marine, terrestrial, and visual APEs. Additionally consulting party comments made during previous Consultation Meetings (March 8, 2022, May 4, 2022, November 30, 2022, February 10, 2023, and April 24, 2023) have been considered by BOEM and are reflected in the Final EIS. In response to SHPO and consulting party comments regarding visual effects, 13 additional properties were identified as being adversely affected by the Proposed Action: Brigantine Hotel, Absecon Lighthouse, Atlantic City Boardwalk, Atlantic City Convention Hall, Ritz-Carlton Hotel, Haddon Hall/Resorts Casino Hotel, Lucy the Margate Elephant, Great Egg Coast Guard Station, Ocean City Boardwalk, the Flanders Hotel, Hereford Inlet Lighthouse, North Wildwood Lifesaving Station, U.S. Lifesaving Station #35, and Little Egg Harbor U.S.

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		Lifesaving Station #23 (U.S. Coast Guard Station #119). One historic property (Charles Fischer House) was removed from the population of adversely affected properties because it has been demolished. The following properties were identified as being adversely affected by the Proposed Action in the Draft EIS and remain adversely affected in the Final EIS: Riviera Apartments, Vassar Square Condominiums, the House at 114 South Harvard Avenue, and Ocean City Music Pier.
1202-0012	It is concerning then to see the lack of minimum guidelines and best practice standards established for offshore wind projects in the United States especially as they relate to adverse visual impacts upon National Historic Landmarks and historic properties sites and districts listed or eligible for listing in the National Register of Historic Places. It is essential to apply consistent criteria to this project and subsequent future sites. Due to the high cultural and historic sensitivity of Cape May County's hundreds of ocean-facing historic properties Cape May County insists that best practice criteria be applied. Minimum standards should include:o Requiring the least impactful nighttime lighting such as ADLS;o Requiring all windfarms in a specific region to use the same non-reflective paint color determined to be most effective in minimizing the visual impacts per specificatmospheric/geographical conditions of the lease sites;o Establishing minimum set-back standards from land with specific considerations forhistoric landmarks and areas with tourism-driven economies;o For communities with historical significance BOEM should help ensure that localstakeholders receive fair and direct access to any state and federal agencies or resources which may provide critical regulatory guidance on how best to avoid minimize and mitigate the local impacts of offshore windfarms. This support would be provided independent of the Section 106 process and would for example identify and encourage dialogue between communities with their State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP); ando Requiring-to the extent to which harm to historic and cultural resources cannot be avoided or minimized-appropriate project	BOEM has established *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* (BOEM 2020), which was applied in analysis associated with this Project as presented in the Marine Archaeological Resource Assessment, Terrestrial Archaeological Resource Assessment, Historical Resource Visual Effects Assessment, and Cumulative Historic Resources Visual Effect Assessment documents and EIS Appendix N, *Finding of Adverse Effects*. In addition, BOEM Section 106 subject matter experts work across offshore wind projects under the Office of Renewable Energy Programs to ensure consistent application of cultural resources impact assessment under NEPA and effects analysis for historic properties, including NHLs, under Section 106 and Section 110(f) of the NHPA. Measures to avoid, minimize, and mitigate for adverse effects on historic properties for this Project include but are not limited to: • Ocean Wind would apply a paint color to the WTGs no lighter than RAL 9010 pure white and no darker than RAL 7035 light gray to help reduce potential visibility of the turbines against the horizon during daylight hours. • Ocean Wind would implement an ADLS to automatically activate lights when aircraft approach. The WTGs and OSS would be lit and marked in

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	mitigation measures to offset the impacts to communities such as community benefit agreements offshore wind mitigation trust funds or other economic development arrangements as are standard in the offshore wind industry globally. At this critical juncture in the development of the U.S. offshore wind industry stakeholders are open minded if not supportive of a successful industry that shares benefits with local communities who will bear the brunt of adverse impacts and certain risk of loss to their economies. IV. The DEIS fails to provide adequate measures to resolve adverse effects. It is inconceivable that BOEM has identified only one historic property along Cape May County's coastline that will be adversely affected by Ocean Wind 1-Ocean City Music Pier-even though this same coastline contains hundreds of properties listed or eligible for listing in the National Register of Historic Places.[Footnote 13: See Section II.A. supra.] It is likewise inconceivable that the DEIS proposes to resolve adverse effects to Ocean City Music Pier by allowing Ørsted to get away with preparing a historic structure report building documentation or a nomination form for the National Register of Historic Places as purported mitigation. [Footnote 14:DEIS App. N Sec. N.4 at N-26.] Cape May County objects to this determination and reminds BOEM of its obligation to identify all historic properties affected and resolve all adverse effects including cumulative effects. Mitigation must be proportionate to the degree of harm caused yet Ocean Wind 1's proposal is meaningless.Furthermore any proposal of mitigation at this stage-before BOEM or Ørsted has addressed comments on the historic resource reports and before proper consultation with the NJSHPO-is inappropriate and contrary to the NHPA. BOEM's decision to include a proposed Memorandum of Agreement [Footnote 15: DEIS App. N Attachment A.] before consulting parties have even met with BOEM to discuss resolving adverse effects is evidence that BOEM does not take its Section 106 responsibilities seriously. Failure to amend the DEIS to provide for a thorough and lawful Section 106 process will result in a Final EIS and Record of Decision that is arbitrary capricious and contrary to law.	accordance with FAA and USCG lighting standards and consistent with BOEM best practices. No minimum setbacks are established for wind farm areas offshore from areas with historic landmarks or areas with tourism-driven economies. As part of the NEPA process, the public is offered the opportunity to review and comment on the Draft EIS. Independent of the Section 106 process, the NEPA process does not require BOEM to facilitate access for the public to state agencies or other federal agencies (such as the New Jersey SHPO or ACHP). However, as part of the NEPA scoping public meetings, BOEM did provide the *National Environmental Policy Act (NEPA) Substitution for Section 106 Consulting Party Guide Updated March 10, 2021,* which provides a links to ACHP documents—*A Citizen's Guide to Section 106 Review* and *Integrating NEPA and Section 106*—via its Ocean Wind Scoping Virtual Meetings website (www.boem.gov/Ocean-Wind-Scoping-Virtual-Meetings). Mitigation proposals submitted by Ocean Wind to BOEM were reviewed for sufficiency and appropriateness in terms of proportionate scale and nexus with adverse effect, and mitigation measures developed through that review process were presented in the draft Memorandum of Agreement included as Attachment A to EIS Appendix N, *Finding of Adverse Effect*. BOEM provided a draft Memorandum of Agreement as part of the Draft EIS to offer consulting parties the opportunity to review proposed stipulations, including mitigation measures, and provide input. While the first opportunity to provide input on resolution of adverse effects stipulated in the Memorandum of Agreement was through the public comment period for the Draft EIS, BOEM's consultation also included distribution of revised cultural resources technical reports, revised Cumulative Historic Resources Visual Effect Assessment, revised draft Finding of Adverse Effect, and revised draft

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		Memorandum of Agreement to consulting parties on November 11, 2022. BOEM has revised its Finding of Adverse Effect in EIS Appendix N to include visual adverse effect findings for the following properties: Brigantine Hotel, Brigantine City; Absecon Lighthouse, Atlantic City; Atlantic City Boardwalk, Atlantic City; Atlantic City Convention Hall, Atlantic City; Ritz-Carlton Hotel, Atlantic City; Riviera Apartments, Atlantic City; Vassar Square Condominiums, Ventnor City; House at 114 South Harvard Avenue, Ventnor City; Lucy the Margate Elephant, Margate City; Ocean City Boardwalk, Ocean City; Ocean City Music Pier, Ocean City; Hereford Lighthouse, North Wildwood; North Wildwood Life Saving Station, North Wildwood; U.S. Lifesaving Station #35, Stone Harbor Borough; Flanders Hotel, Ocean City; and Little Egg Harbor U.S. Life Saving Station #23 (U.S. Coast Guard Station #119), Little Egg Harbor Township. Additionally, an addendum to the Finding of Adverse Effect includes the visual adverse effect finding for Haddon Hall/Resorts Casino Hotel. The Cumulative Historic Resources Visual Effect Assessment has also been revised and EIS Section 3.10 and Appendix N have been updated to reflect cumulative impacts and finding of cumulative adverse effect on Brigantine Hotel, Brigantine City; Atlantic City Boardwalk, Atlantic City; Atlantic City Convention Hall, Atlantic City; Ritz-Carlton Hotel, Haddon Hall/Resorts Casino Hotel, Atlantic City; Riviera Apartments, Atlantic City; Vassar Square Condominiums, Ventnor City; House at 114 South Harvard Avenue, Ventnor City; Lucy the Margate Elephant, Margate City; Ocean City Boardwalk, Ocean City; and Ocean City Music Pier, Ocean City. BOEM plans to hold an additional Consultation Meeting (second quarter 2023) to receive further input from consulting parties on the identification and evaluation of historic properties within the Project APE, the agency’s assessment of effects on historic properties resulting from the Project, and Ocean Wind’s proposed mitigation

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		measures to be included in the Memorandum of Agreement. Additional Consultation Meetings may be scheduled if required to achieve agreement on resolution of adverse effects. This approach is consistent and compliant with the requirements of Section 106 of the NHPA. As part of the ongoing Section 106 consultation, consulting parties may provide input on alternative mitigation to resolve adverse effects on historic properties. This may include input from Cape May County on mitigation for the two properties in Cape May County that BOEM finds to be adversely affected by the Proposed Action (Ocean City Boardwalk, Ocean City; and Ocean City Music Pier, Ocean City).
1202-0013	BOEM has violated the letter and spirit of NEPA and the NHPA by refusing tosubject its permitting review to public scrutiny.BOEM has violated the NHPA by refusing to make public certain reports that would assist the public in determining impacts to the community. Section 304 of the NHPA allows federal agencies to keep confidential certain types of sensitive information about historic properties such that disclosure would result in a significant invasion of privacy cause damage to the historic property or impede the use of a traditional religious site by practitioners.[Footnote 16: 54 U.S.C. § 307103; 36 C.F.R. § 800.11I.] Determining which material to keep confidential must be made in coordination with the Secretary of the Department of the Interiorthrough the National Park Service. The policy behind the confidentiality rule is designed to balance the policy of transparency of environmental permitting laws against historic preservation needs where public disclosure could lead to harm. No consulting party has requested confidentiality in this matter. Despite this fact BOEM has apparently made the historic resource reports confidential in their entirety.To our knowledge BOEM has not coordinated its decision with the National Park Service to keep confidential nearly every document concerning historic property visual and cumulative effects assessments as Section 304 requires. Instead BOEM and Ørsted have prevented the public from having access to the identification of historic properties adverse effects visual simulations and the proposed resolution of	BOEM has met and will continue to meet the requirements of both NEPA and the NHPA regarding the public sharing of information about its permitting process and consulting with and receiving comments from consulting parties and the public. BOEM has provided multiple opportunities for Section 106 consulting parties to review information about the Project and provide their comments on the Project and shared information. This includes the distribution of the complete terrestrial archaeological resources report, complete marine archaeological resources report, complete historic resources visual effects assessment, complete cumulative visual effects assessment report, and a technical memorandum detailing the delineation of the APE for the Project on March 21, 2022; and the supplemental architectural intensive-level survey report on April 1, 2022. Ocean Wind revised the distributed technical reports for BOEM based on consulting party comments and information from the revised versions of these reports is included in the Final EIS. On June 24, 2022, BOEM distributed the Draft EIS to consulting parties for review and comment. BOEM will distribute the Final EIS to consulting parties on concurrent with publication of the Notice of Availability in the *Federal Register*. To date, BOEM has held five Consultation

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	adverse effects. For example BOEM has done so by removing or not posting on its project websites the following documents: Marine Archaeological Resources Assessment Terrestrial Archaeological Resources Assessment Memorandum on the Updated Historic Resources Visual Effects Analysis Offshore Historic Resources Visual Effects Analysis Onshore Historic Resources Visual Effects Analysis Cumulative Historic Visual Effects Analysis the memorandum on B'EM's Area of Potential Effect Delineation B'EM's proposed Memorandum of Agreement to resolve adverse effects and Ørsed's proposed mitigation measures to offset adverse effects. Nor has BOEM made public its consultation meeting transcripts presentations or meeting summaries. Instead BOEM has kept the public from having access to this information and purported to limit what consulting parties can share claiming some unspecified need for confidentiality. As elected officials with an affirmative duty to keep their community informed the County finds these vague requirements particularly troubling.Moreover BOEM has refused to respond to legitimate questions concerning the basis for its nondisclosure thus creating confusion among consulting parties especially local governments who need public input to assist with consultation. Therefore BOEM must make public all documents associated with the Ocean Wind 1 and all other offshore wind consultations with appropriate redactions as necessary in coordination with the National Park Service.***For the reasons discussed above BOEM should revise the DEIS so that it fully identifies historic properties within the Area of Potential Effects and resolve them appropriately for all of these properties. In addition because BOEM has refused to allow the public to review information related to Ocean Wind 1 it must reissue the DEIS and its associated appendices and allow the public a reasonable opportunity to comment.[See Attachment A: Comments on Ocean Wind 1 Technical Reports May 23 2022][See Attachment B: New Jersey SHPO Comments on Ocean Wind 1 Technical Reports May 31 2022]Respectfully submittedWilliam J. CookPartnercc: Christopher Koeppel Advisory Council on Historic PreservationChristopher Daniel Advisory Council on Historic PreservationShawn LaTourette New Jersey Historic Preservation OfficeElizabeth Dragon New Jersey Historic Preservation	Meetings (March 8, 2022, May 4, 2022, November 30, 2022, February 10, 2023, and April 24, 2023) to discuss the Project and materials previously distributed to consulting parties. BOEM provides meeting summaries, which include links to the recorded meeting, as well as PDFs of meeting presentation slides for each Section 106 Consultation Meeting to consulting parties. Additionally, the general public was notified of the release of the Draft EIS on June 14, 2022, and provided a 45-day period to review and comment on the Draft EIS. The comment period was extended by an additional 15 days to August 23, 2022. BOEM has provided public summaries of technical reports (Marine Archaeological Resources Assessment, Terrestrial Archaeological Resources Assessment, and Historic Resources Visual Effects Assessment), available via the BOEM's Ocean Wind 1 COP webpage: https://www.boem.gov/ocean-wind-1-construction-and-operations-plan. The Draft Section 106 Memorandum of Agreement was provided as an attachment to the Draft EIS Appendix N to allow for public comment and is also available via the link above. In addition, BOEM has made the Cumulative Historic Resources Visual Effects Assessment available to the public via https://www.boem.gov/renewable-energy/state-activities/ocean-wind-1. BOEM's consultation with the National Park Service for Section 304 compliance for this Project is consistent with the approach applied to previous offshore wind projects in BOEM's program. Redacted documents will be prepared following issuance of the ROD.

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	OfficeKate Marcopul New Jersey Historic Preservation OfficeEmily R. Manz Preservation New JerseyLt. Colonel Ramon Briganti District Engineer U.S. Army Corps of EngineersBetsy Merritt National Trust for Historic Preservation	
1259-0119	Cultural Resources (3.10). The offshore region of New Jersey is rich with cultural resources including popular dive sites and a treasure trove of both maritime and terrestrial history. According to the Professional Association of Diving Instructo"s "It is estimated that there are over 5000 shipwrecks on New Jer'ey's coast from vessels that are hundreds of years old to more modern wrec"s." [Footnote 100: Explore Diving in New Jersey PADI (last accessed August 14 2022) https://www.padi.com/diving-in/new- jersey/.] Diving is also a contributor to the New Jersey tourism industry. There are natural features and archaeological resources structures and features as well as historic properties in the area of the Proposed Action.The DEIS acknowledg"s "the Lease Area and two export cable corridors have a high probability for containing shipwrecks downed aircraft and related debris fiel"s." [Footnote 101: DEIS at 3.10-4; Ocean Wind 1 COP Volume III at F-1 (2022).] The cultural resources identified for review in the Draft EIS includ": "onshore landfall locatio–s - 8 archaeological resources 10 historic structures offshore cultural resourc–s - 16 submerged landform feature' ('ancient submerged landfo'ms') (13 in lease areas and 3 within 2 export cable corridors) 19 potential submerged cultural resources identified with remove-sensing studies (12 in lease area 7 in 2 export cable areas) both known and potential shipwrecks offshore visual ar–a - seven historic districts and 34 individual historic properties onshore visual ar–a - three historic properti"s." [Footnote 102: DEIS at 3.10-4.]	Impacts on tourism from the Project are not a consideration under Section 106. However, the EIS does address these impacts in Section 3.18, *Recreation and Tourism*. BOEM has identified 19 submerged archaeological resources within the marine APE (Targets 1–19). BOEM will prioritize avoidance of these resources through modification of the PDE. All 19 submerged archaeological resources identified in the marine APE will be avoided by the Project. However, encroachment into the 50-foot buffers of these two resources is unavoidable, Ocean Wind has committed to development and implementation of one or multiple Historic Property Treatment Plans in consultation with consulting parties who have demonstrated interest in specific historic properties and property owners to address impacts on archaeological resources and ancient submerged landform features if they cannot be avoided. Additionally, Ocean Wind has committed to the following APM as conditions for approval of issuance of BOEM's permit related to submerged archaeological resources that cannot be avoided: performing additional investigations of these resources for the purpose of determining eligibility for listing in the NRHP. If a resource is determined eligible, BOEM will require Phase III data recovery investigations and alternative mitigation such as preparation of public outreach materials and presentation of technical findings for the purposes of resolving adverse effects.
1259-0120	The Draft EIS determines impacts to cultural resources from the Proposed Action will "e "modera"e." Clean Ocean Action finds fault in this assessment. If the Draft EIS itself states impacts from the No Action Alternative will be minor to major how could less impacts be associated with the Proposed Action (e.g. moderate)	BOEM's classification for levels of impact is addressed in Section 3.3. Table 3.10-2 has been added to Section 3.10 to define the four levels of impact considered in BOEM's analysis.

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	from additional structures and infrastructures added? This shows an inconsistency in the Draft EIS.	
1259-0121	The DEIS describes impacts on cultural resources in the geographic analysis area “s "perman”nt" a“d "adver”e." The Draft EIS states: Construction of offshore wind projects could result in impacts on cultural resources on the seafloor caused by anchoring in the geographic analysis area. The placement and relocation of anchors and other seafloor gear such as wire ropes cables and anchor chains that affect or sweep the seafloor could potentially disturb marine cultural resources and ancient submerged landforms on or just below the seafloor surface. The damage or destruction of submerged archaeological sites or other underwater cultural resources from these activities would result in the [Bold and Italics: permanent and irreversible loss of scientific or cultural value and would be considered major impacts (emphasis added).] [Footnote 103: Id. at 3.10-7.] Yet the mitigation measures required by BOEM of offshore wind developers are lacking in the DEIS. As stated by BOEM offshore wind developers are requir“d "to conduct geophysical remote sensing surveys of proposed development areas to identify cultural resources and implement plans to avoid minimize or mitigate impacts on these resourc”s." However there are no mitigation plans or details included in the Draft EIS. BOEM claims that as a result of conducting the surve“s "impacts on marine cultural resources from anchoring and gear utilization are considered unlikely and would only affect a small number of individual marine cultural resources if they were to occur resulting in long-term localized adverse impac”s." [Footnote 104: Id. at 3.10-8.] This statement is inappropriate and premature without knowing the results of the surveys.	Mitigation measures are addressed in Appendix N, Section N.4, *Actions to Avoid, Minimize, or Mitigate Adverse Effects*. BOEM will prioritize avoidance of submerged archaeological resources through modification of the PDE. All 19 submerged archaeological resources identified in the marine APE will be avoided by the Project. However, encroachment into the 50-foot buffers of these resources is unavoidable, Ocean Wind has committed to the development and implementation of one or multiple Historic Property Treatment Plans in consultation with consulting parties who have demonstrated interest in specific historic properties and property owners to address impacts on archaeological resources if they cannot be avoided. Additionally, Ocean Wind has committed to the following APM as conditions for approval of issuance of BOEM’s permit related to submerged archaeological resources that cannot be avoided: performing additional investigations of these resources for the purpose of determining eligibility for listing in the NRHP. If a resource is determined eligible, BOEM will require Phase III data recovery investigations and alternative mitigation such as preparation of public outreach materials and presentation of technical findings for the purposes of resolving adverse effects. BOEM will prioritize avoidance of ancient submerged landform features. Three of the 16 ancient submerged landform features will be avoided. Ocean Wind has committed to the development and implementation of one or multiple Historic Property Treatment Plans in consultation with consulting parties who have demonstrated interest in specific historic properties and property owners to address impacts on to the 13 ancient submerged landform features that cannot be avoided. Additionally, Ocean Wind has committed to the following APMs as conditions for approval of issuance of BOEM’s

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		permit related to ancient submerged landform features that cannot be avoided: preconstruction geoarchaeological analysis consisting of archaeological core processing and artifact screening; tribal participation in lab processing of core samples, data analysis, and update to paleolandscape reconstruction model; open-source geographic information system and story maps; ancient submerged landform features post-construction seafloor impact inspection; and tribal outreach and preparation of educational materials developed with participating tribes such as ethnographic/oral history study.
1259-0122	The Draft EIS also notes the unavoidable damage that will occur to submerged landform feature“: "Offshore construction would result in geographically widespread and permanent adverse impacts on portions of these resources…[T]he magnitude of these impacts would remain moderate to major due to the permanent irreversible natu”e." The Draft EIS also stat“s "impacts from the Proposed Action on nine ancient submerged landforms within the Lease Area cannot be avoid”d." [Footnote 105: Id. at 3.10-13.] What are the nine ancient submerged landforms? Are they significant to the ecosystem and marine life? How will these landforms and ecosystems surrounding these forms be adversely affected? The Draft EIS does not address these basic questions.	The 13 ancient submerged landform features that Ocean Wind anticipates being unable to avoid are identified as Targets 21–26, 28–31, and 33–35. Ancient submerged landform features are remnant submerged landscape features considered by Native American tribes in the region to be culturally significant resources as the lands where their ancestors lived and as locations where events described in tribal histories occurred prior to inundation. As such, their significance is limited to past human habitation and not necessarily to the ecosystem and marine life. These ancient submerged landform features have the potential to be adversely affected through disturbance as part of Project construction and installation activities that would destroy intact archaeological materials.
1259-0123	Regarding inshore impacts to cultural resources the Draft EIS state“: "information pertaining to identification of historic properties within the inshore cable route added to the Project in March 2022 and associated with Oyster Creek landfall locations will not be available until after the Final E”S." [Footnote 106: Id. at 3.10-17.] How can the public and interested parties as well as BOEM and other appropriate agencies adequately assess the impacts to cultural resources if the information will not be available until after the Draft EIS and the Final EIS? The impacts from inshore cable routes must be identified and evaluated before the Final EIS is complete.	Information regarding Oyster Creek landfall locations and identification of historic properties within the inshore cable routes has been added to the Final EIS. Please see revisions in Section 3.10.1 and Appendix N (Sections N.3.1.1 and N.3.1.2). In addition, BOEM distributed revised Marine Archaeological Resource Assessment and Terrestrial Archaeological Resource Assessment technical reports on November 11, 2022, which include analysis of the Oyster Creek landfall locations. This information was presented in Consultation

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		Meeting #3 on November 30, 2022, and participants were provided an opportunity to share input.
1267-0003	Figure 2-3 includes a route for the Onshore Cable to pass through the Historic District of Ocean City. It was pointed out during the scoping for this EIS that if open cut construction is used with standard dewatering damage to masonry and brick foundations (pre-1932) should be expected. The 140-year old Reverend William Burrell and Reverend Ezra B. Lake Houses are located as close as 29 feet to the proposed cable. Foundation damage to these buildings due to dewatering would result in establishment of a building collapse hazard area 1-1/2 times the height of the building and would immediately suspended cable construction work in the building collapse hazard area. The Draft EIS does not examine these impacts.	The Historic District of Ocean City is outside of the Preferred Alternative onshore export cable route for the BL England interconnection. Because Ocean Wind does not intend to run the onshore export cable through the historic district, dewatering of this area would not be required and foundation damage or other impacts would not occur. In the event that one of the other two landfall options were selected by BOEM as the Preferred Alternative, Ocean Wind would design a dewatering process for review and approval by NJDEP that avoids impacts on surrounding foundations.
1278-0003	I belong to another organization the NJ Historical Divers Association that is trying to identify and map the many unknown wrecks and cooperated with NOAA in 2014 to supply sport divers to map the wreck of the Robert J. Walker an 1860 government owned survey vessel now on the National Register of Historic places off Atlantic City that may be endangered by this project.	The Marine Archaeological Resource Assessment (COP Volume III, Appendix F-1) prepared by Ocean Wind identified the U.S.C.S.S. Robert J. Walker as a recorded archaeological site within 1.6 kilometers (1.0 mile) of the marine preliminary APE (COP Volume III, Appendix F-1:31). U.S.C.S.S. Robert J. Walker is 1,085 meters (3,560 feet) outside of the proposed Oyster Creek offshore export cable route corridor (COP Volume III, Appendix F-1:31). The U.S.C.S.S. is further discussed on page 33 of Appendix F-1 of COP Volume III.
1278-0005	There is at least one National Register shipwreck (USCSS Robert J. Walker) about 10 miles off Atlantic City that could be threatened by any of the two export cables from this project. But because BOEM has foolishly decided not to include the specific coordinates of the routes of that cable or because it has not been completely surveyed yet(?) it is not clear from the DEIS if the Walker is threatened.	As noted in the response to comment 1278-0003, U.S.C.S.S. Robert J. Walker is outside of the marine preliminary APE and would not be affected by the Project. Indicative offshore route drawings for the BL England and Oyster Creek offshore export cable routes are in COP Volume III, Appendix U, Conceptual Plans and Typical Design Drawings.
1278-0007	The DEIS has committed to avoiding 12 potential submerged archeological resources (shipwrecks) in the lease area (wind turbine area - WTA) for Ocean Wind 1. (3.10-15) BOEM or Ocean Wind suggests a 50-meter buffer zone. However I would like to comment on the inadequacy of such a buffer zone. In 1997 the NJ Council of Diving Clubs reported to the NY Army Corps of	A Post-Review Discoveries Plan for Submerged Cultural Resources has been developed and will be implemented to reduce potential impacts on any previously undiscovered archaeological resources (if present) encountered during construction. Archaeological monitoring and the implementation of the post-review discoveries plan would reduce potential impacts on

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	Engineers a shipwreck being hit by a sand mining dredge in Belmar Borrow Area Six.	undiscovered archaeological resources to a negligible level by preventing further physical impacts on the archaeological resources encountered during construction, such as the shipwreck encountered in the New York USACE sand mining dredging project.
1278-0009	Furthermore there will be up to 98 Wind Turbine Generators with 190 miles of cable laid in this relatively small WTG area. (Table 5-1). It is almost inevitable that several of the 12 wrecks will be hit and damaged if not during the WTG construction then by the cable burying equipment regardless of the narrow 50-meter buffer. So what happens if the WTG or cable laying equipment damages a potentially eligible National Register shipwreck? In all other federal projects the requirement for a Phase Two or Phase Three archeological investigation would be made.	BOEM will prioritize avoidance of submerged archaeological resources through modification of the PDE. All 19 submerged archaeological resources identified in the marine APE will be avoided by the Project. However, encroachment into the 50-foot buffers of these resources is unavoidable, Ocean Wind has committed to the development and implementation of one or multiple Historic Property Treatment Plans in consultation with consulting parties who have demonstrated interest in specific historic properties and property owners to address impacts on archaeological resources if they cannot be avoided. Additionally, Ocean Wind has committed to the following APM as conditions for approval of issuance of BOEM's permit related to submerged archaeological resources that cannot be avoided: performing additional investigations of these resources for the purpose of determining eligibility for listing in the NRHP. If a resource is determined eligible, BOEM will require Phase III data recovery investigations and alternative mitigation such as preparation of public outreach materials and presentation of technical findings for the purposes of resolving adverse effects.
1278-0010	I saw that requirement mentioned in the Unanticipated Discoveries Plan for Submerged Cultural Resources but is it to be implemented in all cases if the cable laying equipment hits or damages a surveyed shipwreck? The artifact training program for project and contractor staff by a Qualified Marine Archaeologist is a good idea but what might also be a good idea for recognizing shipwrecks artifacts is to organize a tour of the NJ Shipwreck Museum at Info Age 2201 Marconi Rd Wall Township or a tour of the NJ Maritime Museum 528 Dock Rd Beach Haven NJ. What your likely to find however is reluctance on the motorized barge	The Post-Review Discovery Plan is implemented for all Project activities. BOEM appreciates the recommendation to include consultation with the New Jersey Shipwreck Museum as part of artifact training program and will consider its inclusion in this mitigation measure. Compliance with the Post-Review Discovery Plan by Ocean Wind and its contractors will be a condition of BOEM's lease issuance. BOEM may cancel a lease for non-compliance.

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	captain to report any cultural material if a stop work order is threatened.	
1278-0011	What concerns me a lot more is an electrical cable being laid near or inadvertently over a low lying old wood or metal shipwreck and that would be most of them off of NJ. Wrecks are intensely fished because they are focal points for marine life and fish and party charter and private boats will anchor with a lot of line out and sometimes with two anchors so that the boat can be maneuvered over the wreck by adjusting the anchor ropes. The anchor ropes could easily extend beyond 50 meters (162 feet) of bottom. As a diver I have seen wrecks uncover over 4 feet and the area near the wreck can uncover due to scouring. Dive boats will often throw a grapple up wind of a wreck and let it drag into the wreck. What would happen if an electrical cable were partially uncovered and an anchor or grapple hook snagged it? For this reason alone it would be advisable to have at least a 100-meter buffer zone around any surveyed shipwreck due to anchoring issues. Anchoring during construction for large construction vessels could extend far far beyond 50 meters and is a direct threat to the 12 wrecks in the WTG area.	The Draft EIS states that the array and substation interconnector cables have a target burial depth of 4 to 6 feet (1.2 to 1.8 meters) below the stable seabed. Seafloor disturbance for anchoring of construction vessels would be approximately 26 feet (8 meters). The maximum vertical seafloor disturbance from export cable burial is approximately 6 feet (1.8 meters) and 26 feet (8 meters) for associated anchoring/spudding of construction vehicles. As Project components will be buried at the specified depths beneath stable seabed, it is unlikely these components will be uncovered. Furthermore, array and substation interconnector cables and export cables are designed to withstand exterior damage. See COP Volume I, pages 100–107, for further details related to cable design and construction.
1278-0013	According to the DEIS there are 7 wrecks in the area of the Export cables three along the BL England corridor and four along the Oyster Creek corridor (Appendix N-11). The DEIS does not say how close the cable will come to the wrecks except for two wrecks that would actually be within the 50-meter buffer.	The Draft EIS states that the Project would not encroach on the 50-foot buffers of any of the seven shipwrecks. All seven shipwrecks will be avoided entirely by the Project.
TRANS-0079-0006	If you have not already done so you need to develop measures or metrics to quantify the four level classification scheme you developed that categorizes the potential beneficial impacts and inverse impacts of alternatives as either negligible minor moderate or major. With such a monumental project unquantifiable conclusions about impacts are not acceptable	BOEM’s classification for levels of impact is addressed in Section 3.3. Table 3.10-2 has been added to Section 3.10 to define the four levels of impact considered in BOEM’s analysis.

O.6.10 Demographics, Employment, and Economics

Table O.6.10-1 Responses to Comments on Demographics, Employment, and Economics

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0111-0005	On page 3.11-20 it states the cost will be "...an increase in their monthly energy bill of $1.46 for residential customers.." That is only a fraction of the cost borne by the ratepayers and all the residents of New Jersey. What is the real cost including all the subsidies and tax credits from the State of NJ and the US Government to construct erect and operate the wind turbines.. Without the inclusion of all the costs the EIS is materially misleading to the read	Subsidies and tax credits are not disclosed in the Ocean Wind 1 COP and cannot be analyzed in the EIS.
0948-0003	POINT IV. NEPA AND BOEM'S OWN MISSION STATEMENT AND RULES AND REGULATIONS ENACTED THEREUNDER REQUIRE A FAR MORE COMPREHENSIVE COST BENEFIT ANALYSIS OF ENVIRONMENTAL ANDECONOMIC RISKS WITH DEFENSIBLE CALCULATIONS ARISING THEREUNDER. As per comments rendered at the virtual hearing conducted as to the within proposal of "Ocean Wind 1" the Draft Environmental Impact Statement contains woefully inefficient calculations or in many instances not even references to the vast economic and environmental value of the tracks of ocean involved the commercial and recreational fisheries and indeed the value of the ocean environment and certain species in and of themselves. Such a comprehensive scientific cost benefit analysis is required under NEPA as well as BOEM's own Mission Statement. Similarly the DEIS does not include the previously referenced NEPA valuation and the potential diminution of value in cumulative and indirect impacts of the project. Again as I have argued previously at various BOEM related forums the value of the fisheries from an environmental standpoint and simply as a current and future life generating food source for future generations has been seriously discounted if not totally ignored. The statutory outlines enacted under the National Environmental Policy Act (NEPA) and BOEM's own Rules and Regulations require such an economic analysis. The current DEIS contains a paucity of such information and barely attempts calculations necessary to reference the vast risks involved in the current proposals and collateral damage and quantifiable defensible true values associated therewith. As difficult as this process might be a comprehensive evaluation process must be engaged in. This area of valuable ocean eco-system along with its current value a cost benefit analysis of various risks to fisheries our commercial and recreational fishing industry the values of species themselves our tourism industry and the impact upon the shore and shipping all should be factored into such assessments and conclusions. Such an evaluative cost	Cumulative impacts and discussion have been added across all Chapter 3 sections. Extensive discussion regarding the impact on fisheries can be found in EIS Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*. Section 3.11, *Demographics, Employment, and Economics*, of the EIS discusses the economic impact on fisheries and the cascading impacts on other sectors such as retail seafood. The costs and benefits of the Ocean Wind 1 project are discussed throughout the EIS. However, BOEM has determined that a quantitative cost benefit analysis is not feasible given the available information. In addition, a quantitative cost benefit analysis is not necessary for BOEM to make an informed decision.

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	benefit analysis of the cumulative and indirect impacts the various risks and current values of the eco-system and the species of fishes involved is an essential undertaking in order to appropriately consider the within narrow yet massive proposal along with the other eleven (11) other projects proposed off the New Jersey/New York coastline.	
0948-0006	POINT VITHE DEIS CONTAINS INSUFICIENT DATA AND DISCLOSURE OF ALL FUNDING SOURCES OF THE APPLICANT AND ANY GROUPS ASSOCIATEDWITH THE APPLICANT WHO PROVIDED TESTIMONY. Any realistic estimate of the cost benefit analysis of the project and it's funding cumulative and indirect impacts should include the full disclosure of the project as well as funding of all groups associated with the applicant who provided testimony. Transparency and full disclosure of all funding of the applicant is also necessary for any realistic weighing process of alternative actions including a "no action alternative" to remain in place pending the implementation of a useful peer-reviewed pilot project. Similarly BOEM's realistic credibility assessment as to the weight and value of the applicant's presentation requires such complex financial data and background. To render a determination as to the DEIS without such complete financial data and the full disclosure of all funding sources would be arbitrary and capricious. Based on all of the aforesaid procedural as well substantive arguments presented I would ask that BOEM rejects without prejudice the current Draft Environmental Impact Statement to implement a "no action alternative".	Funding sources and other financial information are proprietary and are not disclosed in the Ocean Wind 1 COP or incorporated into the EIS.
0984-0018a	The maximum amount of power to be provided by the development of this site should not be used in the Demographics Employment and Economic calculations.	Maximum outputs discussed in this section are a summary of what was analyzed in the *U.S. Offshore Wind Power Economic Impact Assessment* (AWEA 2020). The analysis in this EIS section is based on the proposed output of 1,100 MW and clearly states that the output of this Project will be *up to* 1,100 MW.
0984-0018b	BOEM should reject the EIS as incomplete for failure to produce a document that describes all the [Bold: Major Impacts] Association with Demographics Employment and Economics. The [Bold: Major impacts] on the demographics inclusive but not limited too racial economic and environmental by the systemic racism policies of BOEM is evident in the omission of the food desert and the impoverished community of color that are being impacted by this development site.	Section 3.12, *Environmental Justice*, discusses environmental justice populations (low-income and minority persons) that may be affected by this Project.

Comment No.	Comment	Response
0984-0018c	The mandatory use of union workers limits the backbone of the United States economy the sole proprietor. It will also force more preliminary and assembly work to be done overseas. BOEM has failed to recognize in the EIS the Major Impact to the ports that will be developed to facilitate the construction. Displacing current Blue Economy workers will create a void in the workforce with skills like commercial fishing after the construction phase is completed. This can been seen around the world where what was thriving waterfronts become vacant after the offshore wind energy companies leave. The developers have already promised to use US citizens but talk is cheap. The Jones Act Violations of having US citizens onboard vessels is being challenged and are not being enforced.	Activities at ports are expected to continue, with the addition of offshore wind development, and improvements to existing ports and channels would be beneficial to other port activity.
1012-0013a	3. [Bold: Socio-Economic Impacts] Since the cost of this project is substantial and will impact millions of New Jersey household budgets socio-economic data is essential to reach a reasoned decision. Socio-economic aspects are also important in assessing how the project contributes to the defined goals of delivering environmental justice and spurring well-paying union jobs and economic growth. Therefore the DEIS should have included a full socio-economic benefit and cost analysis for this project and in the context of the other currently planned offshore wind projects in the full plan for NJ (as the impacts are cumulative). There has also been considerable misinformation provided regarding project benefits that should be clarified. For example thousands of created jobs have been claimed without pointing out that many are short-lived. Both the number and duration of jobs should have been presented. There is no discussion of how the project intends to comply with the Jones Act. There is no breakdown of jobs created here versus jobs supported overseas (where the turbine components are manufactured) nor a breakdown of which work performed locally will be done by local workers as distinguished from foreign workers on temporary assignment here. There is no assessment on the potential jobs lost in fisheries sport fishing tourism and the impacted local economy. There has been no assessment of the local economic impact and resulting jobs lost because of higher electric rates. According to a study by the Beacon Hill Institute [Footnote CB1: The Beacon Hill Institute The Cost and Benefit of New Jersey's Offshore Wind Initiative June 2011.https://www.beaconhill.org/BHIStudies/NJ-Wind-2011/NJWindReport2011-06.pdf] the jobs lost would outweigh the jobs created. The EIS should present the increased electric costs to NJ ratepayers from this project (the estimate from the BPU decision was up to $4.259 Billion for the first 20 years of operations)	Cumulative impacts are addressed across all Chapter 3 resource sections. Information on Project costs is proprietary and details of planned offshore wind activities are not defined at the same level as the Proposed Action, such that a cumulative cost benefit analysis is not feasible. In addition, BOEM does not find that a cost benefit analysis is needed to support BOEM's decision-making. Section 3.11, *Demographics, Employment, and Economics*, states that many of the jobs generated by offshore wind may be temporary, lasting 1 year or less. Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, does discuss revenue exposure and potential for displacement of some commercial fishing operations. Impacts on for-hire recreational fishing are anticipated to be beneficial. Developing estimates of federal and state subsidies is outside the scope of the EIS.

Comment No.	Comment	Response
	and the cumulative electric cost increases for the full NJ 7500 MW program. It should show how those cost numbers were derived and to what extent it incorporates the added costs to guarantee adequate backup power and to make the necessary upgrades to the transmission system. The EIS should also show what costs will be paid by NJ taxpayers in the form of federal and state tax subsidies to support this project (estimated at in excess of $1Billion) and to support the full NJ program. All of this impacts every New Jerseyan especially the economically disadvantaged. Presentation of these numbers should include a calculation as to how the average NJ ratepayer would be impacted by the associated rate increases.	
1012-0013b	The DEIS should also estimate the socio-economic costs to the local communities -such as the impacts on tourism rentals and property values and to local commercial and recreational fisheries. Those subjects are addressed qualitatively but not quantified. The "take aways" from the BOEM-sponsored University of Delaware study [Footnote V2: University of Delaware Atlantic Offshore Wind Energy Development: Values and Implications for Recreation and Tourism sponsored by the Bureau of Ocean Energy Management (BOEM) March 2018 https://espis.boem.gov/final%20reports/5662.pdf] and the North Carolina State University study [Footnote V3: North Carolina State University the Amenity Costs of Offshore Wind Farms- Evidence from a Choice Experiment in August 2017. https://cenrep.ncsu.edu/cenrep/wp-content/uploads/2016/03/WP-2017-017.pdf] on tourism rentals and property values should be extrapolated to reflect the size of turbines used on this project (and those planned) rather than the smaller turbines they evaluated. If that is done the "take aways" are substantially different from what is presented in the DEIS and do NOT support its narrative. The North Carolina study also suggests a different conclusion on the impact of the night lighting. The jobs electricity pricing and economic impact should be part of the analysis on how this project effects environmental justice. The DEIS in part addresses the significant visual impact on historic properties. Visual simulations should be provided for these as well as for the closest shore points to the turbines and to each of the state parks and protected natural areas. That would allow a more complete framework for evaluating the visual impact.	Impacts on recreation and tourism are addressed in Section 3.18 and impacts on commercial and for-hire recreational fishing are addressed in EIS Section 3.9. The analysis in Section 3.18 has been updated to reflect the size of the WTGs proposed for the Ocean Wind 1 Project. Visual simulations from representative viewpoints are included as Appendix D to the *Ocean Wind Visual Impact Assessment Report* (COP Volume III, Appendix L; Ocean Wind 2023) and additional analysis of cumulative impacts on historic properties is provided in the *Cumulative Historic Resources Visual Effects Analysis* technical report.
1071-0001	In my opinion the Ocean Wind Draft Environmental Impact Study (DEIS) should be revised in several key areas specifically related to viewshed and the impact on the economic future of the region. To be specific Sections 3.10 3.11 3.12 3.18 and 3.20 in the Draft Report significantly understate the negative impact of the project and its alternatives on the local beach communities.	Section 3.20 identifies minor to major impacts on scenic and visual resources due to the presence of structures based on viewshed analysis.

Comment No.	Comment	Response
1086-0020	Costs for Ratepayers Cape May County will be a primary recipient of the energy generated by Ocean Wind 1. As a result ratepayers within Cape May County will be forced to pay higher rates than they did previously for other sources of power. The County is concerned that offshore wind turbines will produce energy that is more costly than land-based energy. While the County may be willing to pay more for clean energy sources there are other options than offshore wind such as nuclear and solar power that offer significant advantages over offshore wind. Orsted has declined to provide any estimate of what users will have to pay for its electricity. Based on the best available data there is no doubt that prices for ratepayers in Cape May County will be significantly above current electricity prices. Wind turbine-based electric utilities are very expensive to build. For this project each tower will support a 12MW turbine far larger than any similar power supply in the world. Orsted's decision to build monopiles nearly as tall at the Eiffel Tower reflects the industry's effort to reduce capital construction costs by maximizing size. [Footnote 31: For Offshore Wind Energy Bigger is Much Cheaper; Inside Climate News; November 18 2021 [Embedded Hyperlink Text (https://insideclimatenews.org/news/18112021/inside-clean-energy-offshore-wind-cost/)]] Offshore wind's construction costs are higher than land-based plants and the U.S. Department of Energy reports that "operational expenses are higher for offshore wind energy than land-based wind generation" noting that wind and wave conditions lead to increased downtime and expense. [Footnote 32: Offshore Wind Market Report 2021 Edition U.S. Department of Energy; Office of Energy Efficiency & Renewable Energy [Embedded Hyperlink Text (https://www.energy.gov/eere/wind/articles/offshore-wind-market-report-2021-edition-released)]] Furthermore while wind turbine output decreases over time operating and maintenance costs increase. [Footnote 33/34: Out to Sea: The Dismal Economics of Offshore Wind; Manhattan Institute; August 2020 [Embedded Hyperlink Text (https://www.manhattan-institute.org/dismal-economics-offshore-wind-energy)]] The U.S. Energy Information Administration predicts that offshore wind is 3.4 times more expensive than power produced by a natural gas plant. [Footnote 35: Offshore Wind Energy: A Very Very Expensive Electricity Source; Institute for Energy Research [Embedded Hyperlink Text (https://www.instituteforenergyresearch.org/wp-content/uploads/2013/06/Offshore-Wind-Energy-DRS-4.pdf)]] Considering the high costs of operation and the diminishing energy output over time and the growing demand for electricity there is little evidence that this project will actually result in the reduction of fossil fuel usage in Cape May County. With the limited information currently available on what residents will pay Cape May County is unable to support the project in its current form. NJBPU should require a	As stated in section 3.11, *Demographics, Employment, and Economics*, according to the BPU OREC Award, ratepayers could see an increase in their monthly energy bill of $1.46 for residential customers, $13.05 for commercial customers, and $110.10 for industrial customers (New Jersey Office of the Governor 2019). Offshore wind energy projects could produce energy at long-term fixed costs, which could provide stability against fossil fuel price volatility once built, resulting in a minor beneficial impact.

Comment No.	Comment	Response
	disclosure from the developer on what the expected costs are for residents. In addition NJBPU should hold consumers harmless if the project does not produce a significant portion of its generating capacity as has been done in Virginia. [Footnote 36: Application of Virginia Electric and Power Company For approval and certification of the Coastal Virginia Offshore Wind Commercial Project and Rider Offshore Wind; Commonwealth of Virginia State Corporation Commission August 5 2022; Case No. PUR-2021-00142] Heating Systems in South Jersey The US Energy Information Administration reported in 2020 that more than 80% of homes in New Jersey are heated with natural gas and nearly half of the energy used by New Jersey homes is related to space heating. [Footnote 37: Home Heating in New Jersey [Embedded Hyperlink Text (https://www.eia.gov/consumption/residential/reports/2009/state_briefs/pdf/nj.pdf)]] For this project to effectively reduce emissions in New Jersey residents would be required to change from natural gas to electric heating systems which are currently not installed in the majority of homes. Therefore offshore wind has limited potential to benefit our residents because it will serve only a fraction of our population while forcing higher costs of electricity on each of our residents.	
1247-0004a	These actions are already driving investment decisions. The Network closely tracks the market and found that public and private investors committed $2.2 billion in new funding in 2021 including commitments to develop nine major component facilities that will manufacture the foundations towers cables and blades of an offshore wind turbine. In 2022 the market generated $4.6 billion in new lease revenues for the U.S. government showing an extraordinary growth in interest in the U.S. market. Advancing the Ocean Wind project is crucial to maintaining this momentum. In the face of growing global demand sending clear market signals to attract investment to the U.S. is critical to ensuring U.S. offshore wind deployment goals are met.	Appendix F and Section 3.11 identify ongoing investment in the Port of Paulsboro for foundation fabrication and in the New Jersey Wind Port at Hope Creek, New Jersey for WTG pre-assembly.
1247-0004b	Direct Benefits to New Jersey and the U.S. Supply Chain The proposed Ocean Wind 1 project is already directly contributing to the formation of a U.S. supply chain and major investments are dependent on its advancement. As a cornerstone of the project Ørsted and EEW are finishing construction on a $250 million monopile manufacturing facility at the Paulsboro Marine Terminal the first monopile facility constructed in the U.S. and one of only two planned for development in the U.S. This manufacturing facility will create more than 500 high-paying jobs at full build-out and Ocean Wind will source its (up to) 98 monopile foundation structures from this facility. It is likely that the Ørsted/EEW site will also supply monopiles to other offshore wind projects. As the NREL report "The Demand for a Domestic Offshore Wind Energy Supply Chain" lays	Appendix F and Section 3.11 identify ongoing investment in the Port of Paulsboro for foundation fabrication and in the New Jersey Wind Port at Hope Creek, New Jersey for WTG pre-assembly and associated job creation.

Comment No.	Comment	Response
	out buildout of the U.S. market in achievement of the administration's 30 GW goal will approximately 200 monopiles per year over the next decade with some years reaching peak demand of nearly 300 making the success of the Paulsboro monopile facility a priority for the U.S. supply chain. As part of their commitment to the state of New Jersey Ørsted has also signed an agreement to utilize the NJ Wind Port a first purpose-built U.S. offshore wind facility in the U.S. This port situated in the Delaware River Basin and with no height limitations should be a premier port facility heavily utilized by Central Atlantic wind projects for logistics and potentially manufacturing. The same NREL report notes New Jersey Wind Port is one of three east coast ports rated near-ready for Wind Turbine Installation Vessel use. Advancement of the Ocean Wind project would have other direct impacts on New Jersey's economy. The project would support an estimated 663 full-time equivalent (FTE) job-years during development 6598 FTE job-years during construction 6114 FTE job-years during operations and 1202 FTE job-years during decommissioning (COP Volume II Table 2.3.1-4; Ocean Wind 2022). Jobs tend to be high paying averaging from $88000 to $96000 for the construction phase and $99000 for the operations phase (DEIS Section 3.11.5).	
1259-0125	Demographics Employment and Economics (3.11) The Draft EIS is also charged with evaluating the socioeconomic impacts of the Proposed Action yet the document is deficient in such an analysis. The Draft EIS does identify several "irreversible and irretrievable impacts" from the Proposed Action to Demographics Employment and Economics. The impacts of Ocean Wind 1 will be experienced by many businesses especially commercial fishing operations and by extension the restaurants that purchase landings from these fishing businesses. However the Draft EIS does not appear to account for the loss of fishing jobs restaurant jobs and the rising cost of fuel and materials for commercial fishing vessels and businesses as well as for the Proposed Action itself. This contributes to a broader theme: the costs of Ocean Wind 1 have not been fully disclosed. Considering the higher costs associated with offshore wind development it is imperative that the costs be communicated as part of this analysis to determine the socioeconomic impacts of the Proposed Action. The expected ratepayer impacts of this Proposed Action have not been communicated. The New Jersey Board of Public Utilities ("BPU") initiated a stakeholder process for discussing the ratepayer impacts but no report has been released yet. How can socioeconomic impacts be assessed and evaluated in a DEIS if the entire cost of the project and associated upgrades and cost of the	Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, discloses revenue exposure for commercial fishing operations and qualitatively assesses potential impacts on commercial fishing revenue, jobs, and shoreside services. Impacts on ratepayers are not known and have therefore not been assessed in the EIS.

Comment No.	Comment	Response
	generated electricity is not disclosed?	
1259-0126	Also the DEIS does not account for the rising costs of materials supply chain limitations and the labor shortage that will most certainly increase the costs of the Proposed Action and therefore the socioeconomic impacts. In addition "Business growth can be stifled by increasing capital costs as well as infrastructure and logistics issues. Offshore wind turbines are vulnerable to erosion because they are situated in harsh marine climates for decades. Offshore wind turbines are also located miles from the shore making them difficult to access particularly in bad weather. As a result even minor issues would be costly to resolve in terms of maintenance transportation and logistics." [Footnote 112: Nikhil Manrokar Offshore Wind Energy Market is Estimated to Surpass USD 135.23 Billion By 2028 Reports and Data (August 1 2022) https://www.einnews.com/pr_news/583960938/offshore-wind-energy-market-is-estimated-to-surpass-usd-135-23-billion-by-2028.]How will these increased costs affect the socioeconomic factors?	Costs associated with materials and labor for the proposed Project are not disclosed in the Ocean Wind 1 COP and cannot be analyzed in the EIS.
TRANS-0003-0005	With respect to our economic and other logistic concerns I first note that when it comes to the employment generated by Ocean Wind 1 Orsted touts the many jobs that Orsted will create the project will create rather. However the DEIS includes no meaningful accounting for the impact that all of these jobs all of these people all of these cars will have on local ecosystems and infrastructure. Are we sure that the bridges and roads of South Jersey can handle the relocation of hundreds or thousands of families to the area? How about the local housing market utilities services plus consider the impact that constructing and maintaining the wind port and other onshore facilities supporting Ocean Wind 1 will have on local ecosystems and communities.	Activities at ports will remain the same, with the addition of offshore wind development, and improvements to existing ports and channels would be beneficial to other port activity. Section 3.11, *Demographics, Employment, and Economics*, states that overall, operation of the Proposed Action would generate 2,780 job-years of skilled permanent labor (direct job-years) and over 6,000 total job-years created (direct job-years plus indirect and induced job creation) (COP Volume II, Section 2.3.1.2.2; Ocean Wind 2023). This section of the COP also states that impacts on traffic, noise ,and public services would not be noticeable. COP Section 2.3.1.2.1 states that there will be non-local workers who may require housing, and that temporary housing is readily available in the area. Impacts on temporary housing could be reduced by conducting construction outside of summer months when there may be temporary

Comment No.	Comment	Response
		housing competition from tourists.
1194-0002d	Robust socioeconomic analysis is critical to reach maximum economic benefits from offshore wind projects. The FEIS should detail all anticipated job-creation involving port utilization and development supply chain and manufacturing of offshore wind components construction operations and maintenance and decommissioning. In addition to salary information should include health and safety certifications training pathways recruitment and retention plans project labor agreements and union neutrality commitments if applicable and commitments and requirements for targeted hire of disadvantaged and underrepresented communities.	Analysis of planned activities such as port improvements and associated job creation are described in Section 3.11 and Appendix F. Information on salaries, training pathways, recruitment, and retention plans would vary across the supply chain and would not be under the direct control of Ocean Wind. Hiring targets that may be included in contracts for the Project are at the discretion of Ocean Wind, and are not known.

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O.6.11 Environmental Justice

Table O.6.11-1 Responses to Comments on Environmental Justice

Comment No.	Comment	Response
1259-0128	Environmental Justice (3.12) It is imperative that the communities within the geographic analysis area be directly consulted and provided full disclosure of all potential health related and ecosystem impacts of all industrial offshore wind projects and associated facilities. COA identifies some concerns below based on the information in the DEIS and urges BOEM to engage local EJ communities in the geographic analysis area on these and other concerns of these communities.	BOEM has facilitated effective public outreach throughout the EIS process as demonstrated through broad participation in scoping meetings and public hearings and substantial public input received through comments submitted on regulations.gov or through verbal testimony at public meetings during scoping and the public review period for the Draft EIS. BOEM has not identified disproportionately high and adverse effects on environmental justice populations and no stakeholders representing environmental justice or disadvantaged communities have requested consultation and coordination outside of the public involvement process undertaken for NEPA.
1259-0129	The DEIS claims environmental justice communities will benefit from the displacement of fossil fuel facilities with completion of the Proposed Action (e.g. offshore wind turbines). However the DEIS does not provide evidence that fossil fuel facilities will indeed be closed or displaced in the region or beyond. Also renewable industrial facilities will have environmental and public health impacts that must be evaluated and accepted by local communities. Indeed impacts from the Proposed Action will still be experienced by communities in the geographic analysis area. Locally these impacts include: air emissions noise lighting loss of coastal water access loss of income health impacts from vehicle and vessel emissions as well as traffic and other quality of life impacts. [Footnote 113: DEIS at 3.12-11.] In addition onshore development can "reduce access to coastal areas and working waterfronts that communities rely on for recreation employment and commercial or subsistence fishing." Some of the impacts will be "irreversible and irretrievable" yet the Draft EIS overall finds that environmental justice impacts will be "negligible to minor." This is inconsistent. Also adding more industrial facilities including those for renewable energy development will exacerbate impacts on these already overburdened	As stated in Section 3.4, *Air Quality*, impacts from fossil fuel facilities are expected to be mitigated partially by implementation of this Project (as well as other planned offshore wind energy projects in the area), to the extent that these projects would result in an overall net reduction in emissions from fossil-fueled power-generating facilities. On September 22, 2022, Governor Phil Murphy signed Executive Order No. 307, increasing New Jersey’s offshore wind goal by nearly 50 percent to 11,000 MW by 2040, confirming the state’s renewable energy goals and intent to transition to renewable energy sources (see Final EIS Section 1.2).

Comment No.	Comment	Response
	communities.	When considering all impacts on environmental justice populations, the impact levels may vary based on the IPFs. When considered together, as stated in the conclusion and Table S-2, the overall impact of the Proposed Action and action alternatives on environmental justice populations is moderate, not negligible to minor.
1259-0130	The Ocean Wind 1 Draft EIS states "the geographic analysis area for environmental justice includes the counties where proposed onshore infrastructure and potential port cities are located as well as the counties in closest proximity to the Wind Farm Area: Atlantic Cape May Cumberland Gloucester Ocean and Salem Counties New Jersey; Charleston County South Carolina; and Norfolk Virginia." The community that will be most burdened by Ocean Wind 1 and its impacts is Atlantic City NJ. This urban coastal city is designated by the State of New Jersey as a "low income and minority" environmental justice community. Atlantic City is the closest municipality to the Ocean Wind 1 turbines and offshore substations and will host an onshore interconnection point and large O&M facilities. The Applicant's O&M facility will be used as a regional O&M center for multiple Ørsted projects in the mid-Atlantic including for the Proposed Action as well as a construction management base. The O&M facility would contain office warehouse and workshop space; dockside harbor facilities; and parking facilities. Extensive bulkhead work is required and "approximately 6448 square feet of open water habitat waterward of the high tide line and approximately 7650 square feet of adjoining wetlands would be filled behind the proposed bulkhead." [Footnote 114: Public Notice No. NAP-2021-00187-39 U.S. Army Corps Engrs. Philadelphia District (November 3 2021) https://www.nap.usace.army.mil/Portals/39/docs/regulatory/publicnotices/Public-Notice-2021-00187-39.pdf.] Further up to 6 vessels a maximum length of approximately 98 feet and a beam [width] of 33-36 feet would be based at the site. Two floating dock structures would be installed to allow for vessels to moor at the site. These structures would be offset from the bulkhead by 5 feet and would be 99 feet long and 14.5 feet wide. Twenty 24-inch diameter piles would be installed at the site to secure the floating structures. A movable gangway would be attached to the uplands and would cross over the mean high water line to allow for access to the vessels using these structures. Four vessels	As discussed in Section 3.12, *Environmental Justice*, with respect to cumulative impacts, the O&M facility for Atlantic Shores South is proposed in Atlantic City, New Jersey, similar to the Proposed Action. Operational emissions would overall be intermittent and widely dispersed throughout the vessel routes from the onshore O&M facilities and would generally contribute to small and localized air quality impacts. Emissions would largely be due to vessel traffic related to O&M and operation of emergency diesel generators. These emissions would be intermittent and widely dispersed, with small and localized air quality impacts. Only the portion of those emissions resulting from ship engines and equipment operating within and near the O&M facilities in Atlantic City would affect environmental justice populations. Therefore, during operations of offshore wind projects, the air emission volumes resulting from O&M activities are not anticipated to be large enough to have impacts on environmental justice populations. Vessel traffic and noise associated with the O&M facility would be typical of facilities within working

Comment No.	Comment	Response
	would be moored to the floating structures and two vessels would be moored to the bulkhead facing west. Electrical water sewage and fuel lines would be run internally inside the floating docks in sealed conduits to supply the vessels. [Footnote 115: Id.] This is an extensive port expansion in an already overburdened community. The DEIS also states another O&M facility will be built in Atlantic City for the Atlantic Shores offshore wind facilities. Multiple large scale offshore wind facilities cumulatively in the same region will amplify local and regional impacts.	waterfronts and would not be associated with high and adverse effects.
1259-0131	In the Draft EIS BOEM takes the indefensible position that "[t]he impacts at specific ports close to environmental justice populations cannot be evaluated because port usage has not been identified." This is an inconsistency as the number of vessels and vessel trips are indeed noted in the DEIS as well as the COP: The construction phase of the Proposed Action would generate 20 to 65 vessels operating in the Wind Farm Area or over the offshore export cable corridor route at any given time (COP Volume I Section 6.1.2.6.5; Volume III NSRA Section 5; Ocean Wind 2022). In total the Proposed Action would generate approximately 3847 vessel trips during the construction and installation phase (COP Volume I Section 6.1 Tables 6.1.2-1 through 6.1.2-5; Ocean Wind 2022). On average the Proposed Action would generate approximately 10 vessel trips per day during regular operations. [Footnote 116: DEIS at 3.16-13.] A Draft EIS is clearly the appropriate venue for making such evaluations. This Draft EIS in fact states that some of "those emissions resulting from ship engines and equipment operating within and near the O&M facilities in Atlantic City would affect environmental justice populations."	See response to 0609-0016 above.
1259-0134	In sum communities will be adversely impacted by the Proposed Action and other industrial offshore wind projects and support facilities proposed in the region. Yet no mitigation measures are included in the Draft EIS. In addition the DEIS provides no evidence to support the claim that the Proposed Action will displace fossil fuel facilities.	Appendix H identifies APMs and agency-proposed mitigation to minimize impacts across a range of resource topics that tier to the environmental justice analysis.
TRANS-0003-0007	Environmentally overburdened communities will also be impacted by increased traffic from vessels cars and the manufacturing of parts for offshore wind.	EIS Section 3.12 discloses potential impacts on environmental justice populations from air emissions, traffic, noise, and lighting associated with Project construction, O&M, decommissioning, and port utilization.
0984-0025	A proper EIS that calculates the impacts of a decrease in fishing can be used to calculate the increase in the amount malnutrition and child mental development. The [Bold: Major Impact] of the increased cost of seafood with a simple supply	Quantitative analysis to calculate the potential increase in seafood prices attributable to the proposed Project is not

Comment No.	Comment	Response
	and demand chart will show the additional costs to the consumers. The USDA has the calculations on the price increase / decrease ratio on a ten cent basis on how many people can afford a nutritional meal. The applicant and BOEM have refused to address the cost of seafood and the impacts to the countries people whom are already in need. The comments that only the wealthy can afford fish was not true in the coastal communities but will be with the lack of inclusion and understanding of the [Bold: Major Impacts] that are committed from this EIS.	feasible, as the degree to which commercial fisherman would avoid fishing in the Lease Area is not known. Commercial fishing would not be excluded within the Lease Area, and whether to engage in commercial fishing within the Lease Area would be at the discretion of each commercial fishing vessel operator. Potential impacts on subsistence angling (which is typically shore based) would be temporary and primarily affect areas near cable landfalls during construction.

O.6.12 Finfish, Invertebrates, and Essential Fish Habitat

Table O.6.12-1 Responses to Comments on Finfish, Invertebrates, and EFH

Comment No.	Comment	Response
0222-0010	Uncertainty also exists regarding the impact on invertebrate resources such as the effects of [Bold: EMFs and underwater noise] (e.g. generated from pile driving). The available information on invertebrate [Bold: sensitivity to EMF is equivocal] (Hutchinson et al. 2020) and [Bold: sensitivity to sound pressure and particle motion effects is not well understood] for many species nor are synergistic or antagonistic impacts from multiple Impact Producing Factors. Similarly specific secondary impacts such as [Bold: changes in diets throughout the food chain] resulting from habitat modification are [Bold: not well known] for finfish and invertebrates	Discussion informed by Hutchison et al. 2020, Harsanyi et al. 2022, and Albert 2020 has been added to Section 3.6, *Benthic Resources*, to clarify that impacts on specific organisms are documented under specific conditions; however, the data are inadequate to predict the impacts of EMF. Discussion of potential impacts of underwater noise from pile driving on invertebrates has also been expanded in Section 3.6, informed by text has been added to Section 3.6.5 based on reviews of Popper et al. 2022, Carroll et al. 2017, and Roberts et al. 2016, for example. Potential alterations in productivity due to wind-wake effects have also been added to Section 3.6.
0984-0063	Future Offshore Wind Activities Accidental releases of fuel fluid hazmat that will cause contamination of New Jerseys Beaches are inevitable. The history of land based wind turbines can be easily transformed to the future experiences of wind turbines at sea and multiplied since the response time to at sea. Accidents have delays associated with wind and sea conditions. There is also the statistically known collisions that will take place creating greater degradation to the environment and loss of life. The loss of anchoring sites by other seabed users forcing Anchorage in alternative sites was not and should have been addressed. As an example heavy matting in the estuary to mitigate the high mortality rate to the blue claw crab population will remove a calculable number of acres of seabed for anchorage. Taking the crabs future as a dominant figure in estuaries rivers and bays ecosystem we should look at the science from the European Union when it comes to crabs that burry around the cables. The eggs of the female crabs cook when the crab burry around the warmer mud. This is already to be mitigated in Sandy Hook Long Island Sound and Barnegat Bay with the placement of over 300 miles of cement matting. The matting is used to	Discussion of potential impacts of accidental releases has been expanded in Section 3.13.3. Vessel collisions and associated releases of contaminants are addressed in Section 3.16, *Navigation and Vessel Traffic*. Anchoring at alternative sites is addressed in Section 3.18, *Recreation and Tourism* (e.g., "Vessel anchoring for construction of the Proposed Action would have localized, short-term, minor impacts on tourism and recreation due to the need to navigate around vessels and work areas…"). Matting is presently not included in proposed measures to reduce impacts on

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	prevent the crabs from burring around the cables and away from any impact of the EMFs. Paving the bottom of the sea is a [Bold: major impact] and needs to be removed during decommissioning.	blue crabs so that removal will not be an issue. Blue crabs continue to be included in monitoring plans but are highly mobile with broad habitat requirements and the flexibility to respond to disturbance; therefore, blue crabs are not anticipated to be affected by the Proposed Action.
0984-0064	The biggest threat to the Deleware Bay horseshoe crab population is at sea industrial energy development sites "offshore wind". Development sites outside of Deleware Bay are the wintering grounds for the horseshoe crabs of New York and New Jersey. The pile driving of the bases for the turbines will have a 100% mortality rate of any crabs in the mud within a nautical mile (NM) of each tower put into place. A 50% horseshoe crab mortality rate is expected from 1NM to 11/2 NM. The known mortality rate is only the first major concern for the horseshoe crabs future. The impact of EMFs on horseshoe crabs is a [Bold: major impact.] If that crabs are displaced by the development of this site the smaller impacts of other sites will have a greater impact. The horseshoe crab population is already threatened by the removal of sandy beach sites that are needed for reproduction. The applicants impact on additional beach locations being removed for cable landings is a [Bold: major impact]. The horseshoe crab is significant since multiple federal and threatened endangered species rely on their eggs. The science based mortality rate of the horseshoe crab due to EMF and sediment temperatures associated with the cables needs to part of any EIS and mitigated to the fullest extent with the easy solution being not to grant the applicant since there is a scenario of complete collapse of the horseshoe crab dependent ecosystem. Cable replacement and maintenance will increase the mortality rate on horseshoes crabs during hibernation along with other bottom dwelling species.	Horseshoe crabs are highly mobile, with broad habitat requirements and the flexibility to respond to disturbance because (benthic species with high dispersal are generally less affected by disturbance than more sedentary assemblages). Short-term and permanent benthic disturbance to the Carl N. Shuster Horseshoe Crab Reserve, established to protect the overwintering population of horseshoe crabs, is anticipated due to the Proposed Action. Impacts are described in Section 7.2 of the EFH assessment and include 145 acres of benthic habitat disturbance. The reported impact of pile driving on horseshoe crabs is not documented.
0984-0065	The second concern beyond what we already know is the effects of the electromagnetic field (EMF) that comes from the miles of cable that will be in place when the sites are fully developed. Remembering that the horseshoe crab is genetically closer in relationship to the spider there is little known other than the horseshoe crab avoids the EMF when placed near a cable. This best science available approach would suggest that the cables coming to shore and into the estuaries will have a [Bold: "major impact"] on the horseshoe crabs migration.	Discussion of EMF has been expanded in Section 3.6, informed by Hutchison et al. 2020, Harsanyi et al. 2022, Albert 2020 to clarify that impacts on specific organisms are documented under specific conditions; however, the data are inadequate to predict the impacts of EMF.
0984-0066	With multiple cables and the questionable reference to (33 feet apart) the amount of Anchorage loss is a [Bold: Major Impact]. The secondary impacts	Potential impacts of the Proposed Action on SAV and benthic invertebrates due to

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	that is required to be addresses in the EIS on anchorage displacement is the impacts to recreational and commercial fishing eel & widgeon grass beds and other marine life that rely on these grasses such as grass shrimp. The point is that when you start removing the base of the eco-system such as the grasses you affect everything including food security. It is simple the less fish the more the coastal source of protein costs the more fish costs the more food insecure people we have in the coastal communities. There is plenty of information that discusses the "Food Desert" in coastal communities of which a proper calculation of the impacts of a decrease in anchorage can be placed into a calculation on a increase in the amount not malnutrition and child mental development a [Bold: major impact]. The discussion of EMFs and their major impacts is an intentional omission of the facts. The cables from each stationary tower has to have slack. There is exposed cable from the tower and the cable is at a shallop depth until it reaches its desired burial depth. There is a known amount of cable that becomes unburied after installation because of sediment drift. After installation if not during additional rocks will deposited by the applicant to reduce the movement of the cable and rebury the exposed cable. The omission of the impacts of the additional debris and the impacts of changing the marine eco-system by the depositing non-native structure is needed in the EIS. The EMF from the cables will have a [Bold: Major Impact] on the marine life around each tower and the impact will change much of the the entire East Coasts marine life distribution patterns. Like all the stationary artificial reefs there is a biological negative net some of marine life. Fisheries regulators will undoubtedly have to figure out what that reduction in the biomasses will be and how it will ultimately affect the fisheries management plans and food security.	anchoring are included in Sections 3.6 and 3.13 and were revised to reflect more refined estimates of acres of anchoring impacts. Impacts on SAV are considered to range from minor to moderate. The potential impacts of anchoring on these resources are addressed in response to comment 0984-0063. The potential impacts of cable degradation and invasive species are addressed in response to comment 0984-0072. Discussion informed by Hutchison et al. 2020, Harsanyi et al. 2022, and Albert 2020 has been added to Section 3.6, *Benthic Resources*, to clarify that impacts on specific organisms are documented under specific conditions; however, the data are inadequate to predict the impacts of EMF. Nonetheless, due to the small footprint of existing undersea transmission lines within the benthic geographic analysis area and the fact that EMF decreases rapidly with distance from the cable, impacts from EMF would be minor.
1192-0003	This environmental impact statement fails to protect ecosystem services. The DEIS neglected to identify irreversible and irretrievable commitments of resources for eelgrass. If it really was a concern we suggest that the NJ Department of Environmental Protection immediately begin a TMDL study of Eelgrass. Clearly it is a concern of many (see Appendix A).	Impacts on SAV (inclusive of eelgrass) are addressed in Section 3.6; acres of impacts of SAV affected were revised and included in the Final EIS. The comment to NJDEP about total maximum daily loads is noted; total maximum daily loads are established for impaired waterbodies and would not be developed for eelgrass communities.
1192-0008	Eelgrass is in the Natural Cycle for Barnegat Bay and it should be more prominent in the DEIS. Just as the reconstruction of Route 35 in the Barrier Islands more north of the present project doomed the eelgrass in Seaside Park etc. this project is not protective of the natural cycle in Barnegat Bay. Even so	The discussion of SAV/eelgrass, including its historic decline in Barnegat Bay, water quality, climate change, and the potential

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	the DEIS recognizes eelgrass' critical importance but not the effect disturbance of it will have on the ecosystem. The DEIS states that "Cable routes that intersect sensitive EFH such as eelgrass beds or rocky bottom and other more complex habitats may cause long-term or permanent impacts; otherwise impacts of habitat disturbance and mortality from physical contact with finfish and invertebrates would be recovered in the short term and overall impacts would be expected to be minor to moderate. [Footnote 9: DEIS page 270]During Construction "Compensatory mitigation for impacts on seagrass are difficult and may not always result in restoration of SAV to pre-impact conditions (Bologna and Sinnema 2012). The two most common species of seagrass in New Jersey back barrier lagoons are eelgrass (Zostera marina) and widgeon grass (Rupia maritima)." [Footnote 10: Ibid 118] This is not true.· We need a Total Maximum Daily Load (TMDL) [Footnote 11: Section 303(d) of the Clean Water Act authorizes EPA to assist states territories and authorized tribes in listing impaired waters and developing Total Maximum Daily Loads (TMDLs) for these waterbodies. A TMDL establishes the maximum amount of a pollutant allowed in a waterbody and serves as the starting point or planning tool for restoring water quality. https://www.epa.gov/tmdl] for Eelgrass before any approvals of this plan moves forward.	impacts of the Proposed Action have been expanded in Section 3.6. Although local mortality of benthic fauna, habitat alteration, and SAV losses are likely to occur, BOEM does not anticipate population-level impacts on benthic organisms; habitat could recover after decommissioning activities. Irreversible and irretrievable impacts on benthic resources are therefore not anticipated. These impacts are discussed in Appendix L of the EIS.
1192-0024	Ecosystem services are not protected. The DEIS neglected to protect Eelgrass' irreversible and irretrievable commitments of resources.	Although local mortality of benthic fauna, habitat alteration, and SAV losses are likely to occur, BOEM does not anticipate population-level impacts on benthic organisms; habitat could recover after decommissioning activities. Irreversible and irretrievable impacts on benthic resources are therefore not anticipated. These impacts are discussed in Appendix L of the EIS.
1259-0035	3. Deficiencies of the Analysis Concerning Submerged Aquatic Vegetation SAV habitats are designated as Essential Fish Habitats by the National Marine Fisheries Service ("NMFS"). These submerged communities contribute to one of the most productive ecosystems in the world supporting biogeochemical cycling physical stabilization of sediments and life cycle habitat needs of multiple aquatic species. SAV provides a nutrient source nursery area and critical habitat for commercially and recreationally important fish benthic and marine mammal populations (de Boer 2007) including threatened and endangered species. [Footnote 18: See Scientific Advisory Board Submerged	The EIS recognizes the importance of SAV and EFH in the Project area and the SAV portion of Section 3.6, *Benthic Resources*, has been expanded to more fully assess impacts on SAV. Potential impacts on EFH have been addressed in the EFH assessment (submitted to NMFS). The EFH assessment is summarized in Section 3.13 of the EIS.

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	Aquatic Vegetation and Habitat: Survey and Mapping Methodologies Review N.J. Dept. Envmtl. Prot. (2021) https://dspace.njstatelib.org/bitstream/handle/10929/74097/sab-savmapping.pdf?sequence=1&isAllowed=y.]Mapping the distribution and extent of eelgrass is a critical first step in understanding managing and protecting shallow-subtidal estuarine habitats. [Footnote 19: See Michael Bradley et al. 2021 Tier 1 Mapping of Submerged Aquatic Vegetation (SAV) in Rhode Island and Change Analysis Univ. R.I. (2021) http://www.crmc.ri.gov/sav/Tier1_Mapping_SAV_2021.pdf.] However SAV maps alone are not sufficient to determine the presence/absence of regulated SAV habitat and such data can be used only for informational purposes. The SAV mapping project by the University of Rhode Island recommends a three-tier approach for northeastern US estuaries: Tier 1 - Digital aerial photographs are used as base maps to create digitized polygons; Tier 2 - percent cover assessments at evenly-spaced plot locations as grids; and Tier 3 - the most detailed method to measure biomass plant height and other ecological metrics. [Footnote 20: Environmental Data Center Submerged Aquatic Vegetation (SAV) Mapping and Monitoring Univ. R.I. (last accessed Aug. 22 2022) https://www.edc.uri.edu/initiatives/submerged-aquatic-vegetation-sav-mapping-and- monitoring/.]	Recreationally and commercially important fisheries are discussed in Section 3.9 of the EIS.
1259-0036	More recently the Scientific Advisory Board - Ecological Processes Standing Committee's (EPSC) report to NJDEP (2021) concluded that a dedicated monitoring program performed on an annual basis or semi-annual basis is necessary to assess the health of SAV meadows and to avoid missing any significant changes. [Footnote 21: See Bradley et al. supra n. 18.] Further such monitoring should include both remote sensing and in situ sampling for a robust evaluation of SAV extent and health. New and recent monitoring techniques should be adopted including UAVs to perform rapid cost-effective monitoring. Trend analyses between species show that sampling frequency (e.g. annual vs. biennial) impacts their accuracy and demonstrate the importance of increasing sampling frequency. [Footnote 22: See Dr. Elizabeth A. Lacey Barnegat Bay Submerged Aquatic Vegetation Monitoring Program 2021 Final Report Barnegat Bay Partnership (2021) https://www.barnegatbaypartnership.org/wp-content/uploads/2022/04/Barnegat-Bay-Submerged-Aquatic-Vegetation-Monitoring-Program-2021-Report.pdf.]	Ocean Wind has prepared a SAV Monitoring Plan (Inspire 2022) and SAV Preliminary Mitigation Plan (Ocean Wind 2022). The plans describe Ocean Wind's proposed pre- and post-construction monitoring activities, SAV restoration program, and annual reporting commitments.
1259-0037	The bay's seagrasses are an important element of the bay ecosystem because they harness energy and nutrients that are consumed by other organisms. The seagrass beds also provide a critical structural component in an otherwise	The discussion of seagrasses in Section 3.6, *Benthic Resources*, has been expanded to include the value of SAV with

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	barren sandy bottom serving as essential habitat for a host of organisms from shellfish and crabs to fish and waterfowl. However in recent years the bay's seagrasses have suffered due to the host of problems including declining water quality dredging brown tides algal infestation boat scarring and disease (Kennish et al. 2003). [Footnote 23: See Richard G. Lathrop et al. Final Report: Submerged Aquatic Vegetation Mapping in the Barnegat Bay National Estuary Update To Year 2003 Rutgers U. (2004) https://crssa.rutgers.edu/projects/sav/downloads/CRSSAreport2004-02_SAV_Mapping_in_the_BBay_Natl_Esstuary_Upd_2003.pdf] Remote-sensing and manual time-series trends to study the impacts of Superstorm Sandy showed that seagrass cover continued to decline between 2006-2013. In fact the decline has been observed from 1968 onwards and occurred throughout the entire Bay. [Footnote 24: See Brian R. Calder & Larry A. Mayer IOCM Research in Support of Super Storm Sandy Disaster Relief NOAA Co-operative Agreement NA14NOS4830001 Univ. N.H. (2015) http://sandy.ccom.unh.edu/publications/library/2015-12-29_FinalReport.pdf.]	respect to carbon sequestration, EFH for numerous species, and its decline in Barnegat Bay. The additional research citations are included to support the discussion.
1259-0038	The 2021 BBP-CCMP Vulnerability Assessment Report identifies how SAVs are facing increased threats from climate change risks and eutrophication of the Bay's waters. [Footnote 25: See David J. Yozzo BBP CCMP Vulnerability Assessment Report Barnegat Bay Partnership (2019) https://www.barnegatbaypartnership.org/wp-content/uploads/2022/01/CCVA-Final-Report.pdf. COA is a member of the Advisory Committee and Scientific and Technical Advisory Committee of BBP.] As such a wealth of recent and publicly available scientific literature reaffirms that SAV is a vulnerable and fragile habitat and any adverse impacts will result in a cascade of harmful impacts through the ecosystem. Despite these and other available studies the assessment done by Ocean Wind 1 is sparse sporadic in phases and not during the growing season or under warm water temperatures. Ocean Wind as stated in the DEIS is yet to complete field characterization surveys in more planned survey areas which is very critical to the Project and should have been included in the DEIS to assess true impacts.	Section 3.6 has been expanded to include recent scientific information and literature citations that support the discussion.
1259-0043	ii. Finfish Invertebrates and Essential Fish Habitat (3.13)Ocean Wind 1 will have more significant impacts on finfish invertebrates and essential fish habitat ("EFH") than acknowledged in the Draft EIS. Lease Area OCS-A 0498 is within the New Jersey Wind Energy Area which in turn is located within the Northeast Wind Energy Area an area abundant in fish assemblages with diverse habitat. The geographic analysis area covers affected environments for finfish invertebrates and essential fish habitat including demersal and pelagic fisheries	Section 3.13 has been expanded to provide additional discussion of impacts on EFH for numerous species, including the recreationally and commercially important species listed. Additional discussion is supported by scientific research, as cited in the text.

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	resource species which are primarily in federal waters; estuarine fisheries resource species which are interstate migrants; protected species; and highly migratory species. Among these there are a number of species that require relatively rare types of habitats for one or more life stages and those that have limited mobility during one or more life stages.The following species have been identified as "species of concern" and the list includes many kinds of marine life including commercially valuable shellfish species with limited mobility as juveniles and adults: sea scallops (Placopecten magellanicus) Atlantic surf clams (Spisula solidissima) and ocean quahogs (Arctica islandica). The immobile attached egg masses (egg mops) of the longfin squid (Doryteuthis pealeii) represent another such life stage. Also included are juvenile Atlantic cod (Gadus morhua) which prefer gravelly or vegetated bottoms and adults that prefer rocky pebbly or gravelly bottoms as well as black sea bass (Centropristis striata) which require structured refuge habitats as juveniles and adults and show strong site fidelity toward favorable habitats. In fact seasonal trawl surveys conducted by Northeast Fisheries Survey Center between 2003 and 2016 in the New Jersey Wind Energy Area (approx. 344000 acres) show that this is a taxon- rich area. Grab sampling yielded ninety-four (94) infaunal taxa numerically dominated by polychaetes. Sand shrimp sand dollars and dwarf warty sea slugs were the numerical dominants (96%) among the twenty-four (24) taxa of epibenthic (beam trawl) fauna. The 113 taxa of megafauna identified include thirty-nine (39) with managed fisheries.	
1259-0044	Taxonomic presence and distribution between seasons showed ninety-six (96) taxa in the warm season and fifty-nine (59) in the cold season. Although there is considerable overlap in the lists of taxa present in the two seasons the distributions of biomass numbers and frequency of catch for the two seasons are quite different. For example Atlantic croaker longfin squid and scup dominated the warm season fauna while Atlantic herring little skate and spiny dogfish dominated the cold season. There is also considerable overlap among species present and dominance with other offshore wind energy lease areas especially those near New York waters. This critically highlights the need to understand the impacts of proposed lease areas in the NY/NJ Bight region including cumulative impacts. Plus further underscoring this point the impacts of Ocean Wind 1 and other offshore wind development in the Bight cannot be measured let alone understood given the lack of baseline data concerning the interaction of this development with local species and their habitats.	Data available from numerous sources such as federal, state, and local agencies, academia, and data collected by Ocean Wind were used to develop the EIS. Analyses presented in the EIS are based on available scientific information and sources of data are cited. Information reported in this comment is presented in the EIS in Section 3.13.
1259-0045	Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC)Species of concern in the NY/NJ Bight have zones of Essential Fish	EFH relevant to the Proposed Action was identified in consultation with NMFS. The

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	Habitat ("EFH") that are defined either for the species as a whole (i.e. all life stages) or as separate zones for each life stage. The Bight includes EFH for at least twenty-seven species including blue fish summer flounder and black sea bass and the designation applies across life cycle stages-from larvae to juveniles and adults. [Footnote 29: The essential fish habitat (EFH) mapper Natl. Oceanic and Atmospheric Admin. (2021)(Degrees Minutes Seconds: Latitude = 39º 29' 54" N Longitude = 75º 42' 42" W) https://www.habitat.noaa.gov/apps/efhmapper/efhreport/.]	Southern New England HAPC for cod spawning recently designated by NEFMC in June 2022 has been added to the EIS. The EFH assessment includes a comprehensive analysis of impacts of the Project on EFH (BOEM 2022).
1259-0046	Additionally there are four artificial reef areas mapped offshore adjacent to the proposed Oyster Creek offshore export cable corridor as well as one artificial reef area mapped offshore adjacent to the BL England offshore export cable corridor. The proposed Oyster Creek export cable would cross various sensitive and critical inshore habitats such as shoals intertidal and subtidal flats and especially Submerged Aquatic Vegetation ("SAV"). SAV has been identified as a critical parameter to improving and maintaining the health of Barnegat Bay for many years including in the recently released 2021 Comprehensive Conservation and Management Plan ("CCMP"). [Footnote 30: See Barnegat Bay Partnership 2021 Comprehensive Conservation and Management Plan for Barnegat Bay-Little Egg Harbor Estuary https://www.barnegatbaypartnership.org/wp-content/uploads/2021/12/BBP-CCMP-Updated- Dec-2021-forScreens.pdf.] Critical habitats continue to be lost including freshwater and tidal wetlands (important for flood protection water quality and wildlife habitat) and seagrass beds (critical nursery habitat for many fish and shellfish species). [Footnote 31: See Barnegat Bay Partnership State of the Bay Report 2016 (2017) https://www.barnegatbaypartnership.org/wp-content/uploads/2017/08/BBP_State-of-the-Bay-book-2016_forWeb.pdf.] SAV in particular has been routinely highlighted as a holistic target to protect and restore the Bay.	BOEM concurs with the locations of existing artificial reef sites near the Project, identified from the NOAA Office of Coastal Management InPort library. Eleven artificial reefs were identified in the general vicinity of the Proposed Action; however, only four are entirely or in part within the geographic analysis area for benthic resources (Figure 3.6-2 in Section 3.6 of the EIS): Atlantic City reef, Great egg reef, Ocean city reef, and Deepwater reef. Collectively, these four reef areas represent approximately 6.5 square miles (16.8 km^2) of extensively modified seafloor due to the placement of structures such as ships, tanks, railroad cars, concrete debris, and reef balls.
1259-0047	The geographic analysis area and the Project Area also include several finfish species that are state and federally managed. These include: American eel (Anguilla rostrata) Atlantic croaker (Micropogonias undulatus) Atlantic herring (Clupea harengus) Atlantic menhaden (Brevoortia tyrannus) Atlantic striped bass (Morone saxatilis) Atlantic sturgeon (Acipenser oxyrhynchus oxyrhynchus) black drum (Pogonias cromis) black sea bass (Centropristis striata) bluefish (Pomatomus saltatrix) cobia (Rachycentron canadum) scup (Stenotomus chrysops) shad (American shad [Alosa sapidissima] and hickory shad [Alosa mediocris]) and river herring (alewife [Alosa pseudoharengus] and blueback herring [Alosa aestivalis]) Spanish mackerel (Scomberomorus maculatus)	BOEM concurs that these species, including the ESA-listed sturgeon, are likely to occur in the geographic analysis area.

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	monkfish (Lophius spp.) spiny dogfish (Squalus acanthias) spot (Leiostomus xanthurus) summer flounder (Paralichthys dentatus) tautog (Tautoga onitis) weakfish (Cynoscion regalis) winter flounder (Pseudopleuronectes americanus) and coastal shark species. American shad alewife and striped bass are some of the anadromous fish species in the Project area that migrate up rivers to lower-salinity environments annually for spawning. Atlantic sturgeon (Acipenser oxyrinchus) a species protected under the Endangered Species Act ("ESA") is also found in the geographic analysis area.	
1259-0048	Environmental concerns - existing and emerging Global climate change is affecting all marine environments. The New Jersey shelf in particular has been experiencing increasingly elevated temperatures in both surface and bottom depths. According to a recent study marine estuarine and riverine habitat types in the Northeast U.S. were found to be moderately to highly vulnerable to stressors resulting from climate change. [Footnote 32: Farr et al. 2021.] In general rocky and mud bottom intertidal SAV kelp coral and sponge habitats were considered the most vulnerable habitats to climate change in marine ecosystems. [Footnote 33: Id.; DEIS at 3.13-11.] Similarly estuarine habitats considered most vulnerable to climate change include intertidal mud and rocky bottom shellfish kelp SAV and native wetland habitats. [Footnote 34: Farr supra n. 31.] Riverine habitats found to be most vulnerable to climate change include native wetland sandy bottom water column and SAV habitats. [Footnote 35: Id.] On the same note finfish and invertebrate migration patterns can be influenced by warmer waters as can the frequency or magnitude of disease. For example due to warming waters there has been a northward shift in some fish species including highly migratory species like the tiger shark. As a result there are fish species (e.g. mahi mahi wahoo and Spanish mackerel) that may experience a northward shift toward Ocean Wind 1 over time and eventually become affected by the project during operation and decommissioning.	BOEM recognizes the influence of climate change on fish distributions and a discussion of these potential impacts is included in Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*.
1259-0049	The Draft EIS states that the impacts resulting from Ocean Wind will be negligible to moderate for finfish invertebrates and EFH but this cannot be true; impacts will be more significant. In the context of other proposed construction activities until 2030 including other lease areas in the geographic analysis area as well as changes to the marine environment from climate change the Draft EIS is lacking in a detailed assessment including cumulative impacts of the project.	A major impact “would affect the viability of the population and would not be fully recoverable. Impacts on habitats would result in population-level impacts on species that rely on them” (defined in EIS Section 3.13.2). Per this definition, impacts on finfish, invertebrates, and EFH would not be major and are described as ranging from negligible to moderate for these resources.

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1259-0053	On a final note the Draft EIS does not provide an adequate analysis of Ocean Wind 1's impacts on Atlantic sturgeon. A recent study indicates that only 250 adults return to the Delaware River to spawn. [Footnote 39: See Shannon L. White et al. Evaluating sources of bias in pedigree-based estimates of breeding population size Ecological Applications (2021) https://esajournals.onlinelibrary.wiley.com/doi/epdf/10.1002/eap.2602.] Ocean Wind 1 activities within the Delaware River Delaware Bay and open ocean need to be assessed for impacts to this endangered species. In fact the Delaware Riverkeeper Network filed a 60-day notice of intent to sue the National Marine Fisheries Service for violating multiple sections of the Endangered Species Act. These violations concern the Biological Opinions issued to the Army Corps of Engineers for the New Jersey Wind Port project and the Edgemoor Container Port project. According to the Network if permitted by the Army Corps these commercial ports could threaten the continued existence of the Delaware River Estuary's genetically unique population of Atlantic sturgeon. [Footnote 40: Delaware Riverkeeper Network Intends To Sue NOAA Fisheries Over Wind The Fisherman (Aug. 22 2022) https://www.thefisherman.com/article/delaware-riverkeeper-network-intends-to-sue-noaa-fisheries-over-wind/.]	Section 3.13 has been expanded to include a full discussion of the ESA-listed Atlantic sturgeon and the potential impacts of relevant IPFs on the sturgeon. Potential impacts on the Atlantic sturgeon analyzed for the USFWS BA have now been added to the EIS.
1259-0055	Anchoring. The Draft EIS understates the impact that vessel anchoring will have on finfish invertebrates and EFH. The document states that vessel anchoring will cause short-term impacts on finfish and invertebrates in the immediate area where anchors and chains meet the seafloor in offshore sandy environments. These impacts include turbidity which affects finfish and invertebrates as well as injury mortality and habitat degradation primarily of invertebrates. Anchoring wind turbines may also cause temporary or permanent impacts in the immediate area where anchors meet the sea floor. [Footnote 42: See Riya Ajmera Mutual Benefits for Offshore Wind Energy in the Mid-Atlantic: Science and Policy Strategies to Mitigate Harm to Marine Species and Maximize Benefits for Renewable Energy Monmouth U. (2021) https://www.monmouth.edu/uci/documents/2021/10/riya-ajmera-uci-offshore-wind-energy-paper.pdf/.] Additionally clouding and sedimentation during construction can cause damage to fish eggs can damage and or disturb spawning grounds for fish. The introduction of hard substrate (here anchors) to the environment can cause alteration of food species availability and abundance which in turn may alter community composition and abundance of fish. [Footnote 43: See OSPAR Commission Assessing the environmental impact of offshore wind farms (2008) https://www.ospar.org/documents?v=7114.] During construction operation and	Discussion of anchoring in Section 3.13 has been expanded to include the acres of anchoring impacts anticipated and the potential impacts on Atlantic sturgeon and its prey from anchoring. The impacts of anchoring on sturgeon are considered short term and negligible due to their high mobility and the estimated low number of vessels (26) expected to be operating in a typical workday for cable installation.

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	decommissioning of an offshore wind farm the foundations anchors and cables will alter benthic habitat and organisms. [Footnote 44: See U.S. Offshore Wind Synthesis of Environmental Effects Research Benthic Disturbance from Offshore Wind Foundations Anchors and Cables (2022) https://tethys.pnnl.gov/sites/default/files/summaries/SEER-Educational-Research-Brief-Benthic-Disturbance.pdf.]	
1259-0056	Anchoring would affect nineteen (19) acres under the Proposed Action and the combined impacts from ongoing and planned activities including the Proposed Action could collectively affect up to 2682 acres (10.9 km2) (although some of this may occur after the resource has recovered from the earlier impacts). The Draft EIS claims that if anchoring occurs in sensitive SAV habitat impacts would likely be moderate and long term within that specific habitat. However the project area includes sensitive benthic organisms eel-grass beds and hard bottom habitats and any impact to these resources would be long term and permanent. Moveover eelgrass beds in the Barnegat Bay region has been identified as critical for the health of the Bay and is one of the holistic targets for ecosystem restoration of the Bay.(CCMP 2021)EFH and HAPC for highly migratory species such as the Tiger shark also lie within the project boundaries. It is a gross simplification for the Draft EIS to state that Ocean Wind 1 will contribute an undetectable increment to the combined impacts of anchoring from ongoing and planned activities including offshore wind on finfish and invertebrates. Similarly there is no supporting evidence for the Draft EIS to state "All impacts would be localized turbidity would be temporary and displacement and mortality from physical contact would be recovered in the short term." The development of multiple wind farms in the region each containing dozens of turbines will result in cumulative impacts on EFH and HAPC that need to be investigated.	The impacts on SAV beds and other benthic habitats is anticipated to range from negligible to moderate. No permanent impacts are anticipated. Long-term impacts that may occur are expected due to O&M activities but these habitats are anticipated to recover following decommissioning. The discussion of potential impacts on SAV has been expanded and the acres of impacts were revised based on the final cable alignments and included in the Final EIS.
1259-0057	Electromagnetic Fields (EMF)The Draft EIS unfairly minimizes the impacts that electromagnetic fields ("EMF") from Ocean Wind 1 will have on finfish invertebrates and EFh. The document states that "[t]he Proposed Action would slightly increase the impacts of EMF in the geographic analysis area beyond those described under the No Action Alternative. The combined impact on finfish invertebrates and EFH would likely be negligible and localized though long term." However increased numbers of subsea cables from future OSW farm projects and other marine industries may lead to cumulative effects in heavily developed regions. The potential for cumulative effects from EMFs has not been characterized in studies or research to date. Even so the EMF from a single cable needs to be considered in the context of other cables in the area	Discussion of EMF has been expanded in Section 3.6, informed by Hutchison et al. 2020, Harsanyi et al. 2022, and Albert 2020 to clarify that impacts on specific organisms are documented under specific conditions; however, the data are inadequate to predict the impacts of EMF.

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	(i.e. existing and proposed cables) as well as other activities that might occur in the region. For example the addition of new cables might increase the number of subsea cables a migratory species will encounter along its migratory route. These scenarios need to be studied to understand the actual interactions that may occur. [Footnote 45: https://tethys.pnnl.gov/sites/default/files/summaries/SEER-Educational-Research-Brief-Electromagnetic-Field-Effects-on-Marine-Life.pdf]	
1259-0060	Presence of Structures. The Draft EIS states "Various impacts on finfish resulting from the presence of new structures associated with the Proposed Action are described in detail in Section 3.13.3.2. New structures could affect finfish migration through the area by providing unique complex features (relative to the primarily sandy seafloor) and altering water currents; this could lead to retention of those species and possibly affect spawning opportunities. Impacts on fish migration as a result of structures associated with offshore wind are unknown as studies related to this potential impact are not available.	BOEM concurs. This statement is in Section 3.13.3.2.
1259-0061	Although not designed as artificial reefs offshore wind energy development projects have similar impacts-both desired and undesired: they may offer possibilities for nature enhancement but at the same time be a nuisance to nature. For the sake of environmentally friendly marine management it is of utmost importance to distinguish desirable from undesirable impacts and to take action to promote the former while at the same time mitigating the latter. To that end a proper understanding of mechanisms behind the impacts is needed in order to develop effective nature-inclusive designs. For example requirements may include eco-designing scour protection layers to enhance fish habitat or restore oyster beds and deploying add-on structures such as fish hotels. To this end the Draft EIS never considers whether possible positive ecosystem effects from Ocean Wind 1 will be nullified upon the project's eventual decommissioning.	Discussion regarding the potential impacts of WTGs as opportunities for the establishment or spread of invasive species (and associated citations) has been added to Sections 3.6 and 3.13. The effects of decommissioning are presented for each resource in the EIS.
1259-0062	Offshore wind construction and operation activities can also cause possible habitat disturbance for species of concern including black sea bass sea scallop ocean quahog and surf clam. EFH for these species of concern overlap with the Project Area for Ocean Wind 1 so these species-as well as the potential for their habitat disturbance-cannot be ignored.	Potential impacts of Project construction and operations on EFH for species such as black sea bass, sea scallop, ocean quahog, and surfclam are addressed in Section 3.13.
1259-0063	Highly Migratory SpeciesHighly Migratory Species ("HMS") such as tuna swordfish and sharks live and migrate throughout the Atlantic Ocean. These species are unique because they traverse domestic and international boundaries and must be analyzed more closely in the Draft EIS due to their presence in the Project Area for Ocean Wind 1.NOAA's EFH mapper shows	Impacts on highly migratory species are addressed in Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*. Impacts expected from climate change events such as increased

Comment No.	Comment	Response
	that the proposed wind farm will impact sixteen (16) HMSs including four (4) species of tuna and ten (10) shark species. It must be noted that this climate-driven shift in distribution of marine species is some of the highest in the US Northeast Continental Shelf LME. During periods of anomalously high sea-surface temperatures movements of tracked sharks shifted beyond spatial management zones with underlying protection from commercial fishing and bycatch. With these induced-shifts these study results have implications for fisheries management human-wildlife conflict and ecosystem functioning. This has been documented in a more recent study on the apex predator the Tiger shark (Galeocerdo cuvier). [Footnote 50: Hammerschlag et al 2022.] Tiger sharks satellite-tracked in the western North Atlantic between 2010 and 2019 revealed significant annual variability in the geographic extent and timing of their migrations to northern latitudes from ocean warming. [Footnote 51: https://onlinelibrary.wiley.com/action/doSearch?ContribAuthorRaw=McDonnell%2C+Laura+H.]Warming effects within the wind turbine fields caused by sun radiation on monopoles and transference into waters as well as the increased infrastructure itself may affect the migratory pathways and activities of these important species. Moreover the cluttered underwater areas may impact these species as well. These impacts will be increased with each monopole within projects including increased contributions to cumulative impacts from other nearby OSW projects. Yet the Draft EIS does not include any assessment of how to address and mitigate these impacts. A pilot project would enable scientists to study evaluate interpret and determine consequences such that development reductions or mitigation strategies could be implemented.	magnitude or frequency of storms, shoreline changes, ocean acidification, and water temperature changes would be expected to affect highly migratory species. The impacts of offshore wind on highly migratory species are unknown and new studies are just now getting underway, including Pilot Studies for Regional Fisheries Monitoring in Relation to Massachusetts and Rhode Island Offshore Wind Area (to be completed in 2023).
TRANS-0068-0004	Speaking of navigation just a couple of other brief points. First especially in light of the lawsuit filed by Delaware River Keeper Network this week it's particularly glaring that the draft EIS fails to consider the impacts of endangered Atlantic sturgeon and their habitat on navigation and navigability for vessels involved in Ocean Wind 1.	Potential impacts on the Atlantic sturgeon have been analyzed for the NMFS BA and are incorporated into the Final EIS.
TRANS-0069-0004	The fishery section in the Ocean Wind DEIS is deficient. This is concerning since BOEM itself noted in 2017 that offshore wind will have significant impacts on the central fish habitat. Essential fish habitat or EFH developed by the Regional Fishery Management Council identified at least 27 species including bluefish summer flounder black sea bass to name a few and included various lifecycle stages from larvae to juveniles to adults. The Mid-Atlantic Fishery Management Council has also designated habitat areas of particular concern for summer flounder within the Mid-Atlantic and New England. Black sea bass sea scallops surf clams all have the potential for habitat disturbance and these	Results of the EFH assessment have been incorporated into the EIS (Section 3.13), as appropriate, to further the discussion of potential impacts on EFH.

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	are already described as being vulnerable to impacts to climate change from climate change. There is a clear need for peer reviewed independent studies and that takes time to do. Time for the results and time for independent peer review. There are so many uncertainties but still some prominent officials in the review process of offshore wind proposals in this region comfortably describe the planning for offshore wind as “building the plan as we are flying it.” This is unacceptable. With so much at stake its unacceptable.	
TRANS-0080-0001	The long term impacts of electromagnetic fields and transmission cables have not been studied and recent reports shows that benthic creatures like lobsters and crabs are likely to be impaired at birth with deformities that limit mobility.	Discussion informed by Hutchison et al. 2020, Harsanyi et al. 2022, and Albert 2020 has been added to Section 3.6, *Benthic Resources*, to clarify that impacts on specific organisms are documented under specific conditions; however, the data are inadequate to predict the impacts of EMF.

O.6.13 Land Use and Coastal Infrastructure

Table O.6.13-1 Responses to Comments on Land Use and Coastal Infrastructure

Comment No.	Comment	Response
0984-0007	Onshore Export Cable. The applicants EIS fails to address the additional retrenching that historical is needed with an initial landfall site. The applicant EIS fails to address the Environmental impacts of sites for replacement cables during the lifespan of the operations. The onshore export cables will interfere with the currently engineered plans to provide a hard pipe sewer system on Island Beach State Park (IBSP) thus creating additional environmental impacts. Historic amounts of fecal-coliform is found in the proposed construction sites where addition flotsam will exacerbate the volume and create additional beach closures far away from the proposed construction areas. Over 2% of IBSP that has been almost untouched since 1609 will now become an industrial site for outdated energy technology. The extreme Environmental impact on the IBSP preservation areas will certainly threaten species like the Pink Lady Slipper terrapins and beach plumbs in the area being considered for the Industrial Construction Yard. The proposed burial depth is inadequate and will create additional environmental impacts not identified in the EIS. The constant re-exposure of groins placed along New Jersey Beaches and at the cable exposure boondoggle in Rhode Island site provides examples that the applicant is knowledgeable of and has intentionally failed to address the major impacts Environmental impacts of.A incomplete EIS to this extreme requires the applicant to resubmit the EIS and re-start the public comment period. The onshore export cable portion of the EIS is purposely incomplete and cumulatively has to be recognized as a [Bold: Major Impact.]	Onshore cables are not expected to need to be replaced during the lifespan of the Project. As described in Section 2.1.2.3.1, *Onshore Activities and Facilities,* cables and other onshore infrastructure will be routinely inspected for faults or failures. BOEM is aware of the proposed project to create a new sanitary sewer system on Island Beach State Park. Because construction for the sewer system is scheduled to begin as early as December 2022, there will be no overlap in construction times with the Proposed Action. Onshore export cables will be routed to avoid conflicts with existing infrastructure. Potential impacts of the Proposed Action on onshore habitat and species, including terrapins and coastal flora, are described in Section 3.8, *Coastal Habitat and Fauna*. Target burial depth is determined based on an assessment of seabed conditions from G&G surveys and the risk of interaction with external hazards such as fishing gear and vessel anchors. A CBRA would be developed prior to construction and coordination with agencies would also inform final target burial depth. The Cable Burial Plan would be reviewed by the Certified Verification Agent and BOEM. Potential impacts of EMF from onshore export cables on the beach-going public are analyzed in Section 3.18.5, *Impacts of the Proposed Action on Recreation and Tourism.*
0984-0008	Onshore Substations. There is nothing temporary about the 3 acres of workspace. From construction to maintenance to decommissioning the Environmental impact will exist past the lifespan of the project. The Jersey Shore is "SAND" traditional mitigation of construction sites will	The temporary workspace at each substation will only be used during construction of the substation. Following construction, the temporary workspaces would be restored to previous conditions and no

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	not work in this environment and is not addressed purposely within the EIS. The attempt of the applicant to greenwash this phase of the project is criminal in nature and the applicant should be prosecuted to the full extent of the law. Industrial development sites are major impacts to the environment any where they are located in the United States. The onshore substations are in fact a [Bold: Major Impact.]	change to the land use or character of the environment is anticipated. During the O&M phase of the Project, materials needed for maintenance activities will be stored at the O&M facility in Atlantic Shores. Ocean Wind has submitted a conceptual decommissioning plan as part of the COP. Ocean Wind is required to submit a decommissioning application that will undergo BOEM technical and environmental reviews, including an opportunity for public and municipal, state, and federal management agency comments. Construction mitigation measures that have been developed specifically for this Project are described in Appendix H, *Mitigation and Monitoring*.
0984-0021	3.14 Land Use and Coastal Infrastructure. The use of preserved lands state and federal parks should be prohibited. The use of these lands to provide cost savings to the developers is a crime within current proposed environmental justice parameters. The development project exceeds the cost threshold contained within the EO and individual states directives. The predictable legal actions that will follow with the use of public lands will terminate the viability of the project and should be recognized as a [Bold: Major Impact] within the EIS. The use of BOEM / Dept. of Interior legal council to determine the legal exposure to the use of preserved lands state and federal parks is a conflict since they are the lessor of the proposed development site. Furthering the legal exposure of desecrating preserved lands state and federal parks is the proposed infrastructure that will be built on these lands. The charter of the protected areas removes the opportunity of industrial sites from being developed on the lands. Any change within the natural environment especially for a generation (20 years) is a [Bold: Major Impact.]	As described in Section 3.14.5, *Impacts of the Proposed Action on Land Use and Coastal Infrastructure*, the above-ground structures on shore include the substations proposed at BL England and Oyster Creek. The BL England substation in Upper Township, New Jersey is within a zoning district where electrical substations are permitted, subject to conditions to ensure compatibility with surrounding land uses. The Oyster Creek substation in Lacey Township, New Jersey is within an industrial zoning district where an electrical substation is consistent with existing land use. Two options are being considered for the portion of the Oyster Creek cable route that crosses Island Beach State Park. From the landfall location on the Atlantic Shore side of Island Beach State Park, the Inshore Export Cable Route option would use HDD and exit into Barnegat Bay directly across from the Atlantic Ocean landfall. The Prior Channel Route option would make landfall on the Atlantic Ocean side of Island Beach State Park via HDD, then would follow previously disturbed roads and parking lots and would exit the island at an existing

Comment No.	Comment	Response
		maintenance area via open-cut trenching within a channel that was previously dredged. Both route options were designed to minimize impacts on Island Beach State Park. Following construction, cable route corridors would be returned to their previous condition and no change to the land use or character of the environment is anticipated.
0984-0055	The power outages seen around the world are from the cable malfunctions. The developer plans on selling its interest in the cables. The creation of a third party utility company to manage the electric distribution and maintenance should be contained in the EIS. What is significant about the lack of transparency is that the EIS can have di?erent impacts when operated by a company only Responsible for cable operations. The applicant needs to be specific in what will be sold. The responsibilities of mitigation and research will need to be transferable and financially supported within any permit. The request of monetary relief from the financial burden of cable maintenance will expedite the sale of the cables. Money needs to be placed in upfront costs to prevent any act of fiscal irresponsibility. The cost of replacing the cables and the cumulative impact of cable replacement with abandonment penalties should be set aside at a multiple of the calculated amount. The current inflation rate and the cost associated with the sale of the cables has not been presented by the applicant. This alone is a sign of a white collar crime by falsifying the application. The applicant had the opportunity to correct this and had chosen not too claiming it is proprietary. The amount of taxpayers money invested in the development of public utilities is not proprietary. The actions by the applicant to greenwash the impacts in the EIS are criminal and the application should be denied. The United States Attorney General should be called in to investigate the collusion of omission by BOEM and the applicant.	Electricity generated by the Project will connect into the existing electrical grid at the Oyster Creek and BL England substations. Ocean Wind is not responsible for maintaining the existing electrical grid; however, it will remain responsible for the maintenance of the Project components, including onshore cables, through the lifespan of the Project.
1259-0135	xi. Land Use and Coastal Infrastructure (3.14). The Proposed Action includes onshore construction of facilities and infrastructure. From land disturbance port utilization new large port areas parking lots and structures to onshore and inland cabling routes and transmission infrastructure it is clear that there will be extensive [Italics: onshore] impacts from [Italics: offshore] wind facilities. The Draft EIS fails to	Impacts on land disturbance and port utilization from the Project components, including onshore structures and the onshore export cable routes, are described in detail in Section 3.14, *Land Use and Coastal Infrastructure*. Enhancements to ports or new port areas are not proposed as part of this

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	comprehensively identify and address the onshore consequences of the Proposed Actions.	Project.
1259-0136	Regarding land disturbance the Draft EIS states the "removal or disturbance of habitat associated with onshore activities could create long-term irreversible impacts."121 What is the total land area that will be developed (e.g. number of acres) as a result of the Proposed Action including all of its development components? Where? When and for how long will impacts occur from this development? What resources and wildlife will be impacted? The Draft EIS does not address these critical questions.	As described in Section 3.14.5, *Impacts of the Proposed Action on Land Use and Coastal Infrastructure*, based on the landfall options with the longest onshore cable routes, construction of the Oyster Creek onshore export cable could result in up to 32 acres of temporary disturbance, and construction of the BL England onshore export cable could result in up to 48 acres of temporary disturbance. Figure 2-2 and Figure 2-3 show the proposed onshore export cable routes. Both the BL England and Oyster Creek onshore substations would be sited on previously developed lands. The proposed Oyster Creek substation would occupy up to 31.5 acres (127,476 m^2) and be sited on the former Oyster Creek nuclear plant in Lacey Township. The proposed BL England substation would occupy up to 13 acres (52,609 m^2) and be sited on a former coal, oil, and diesel plant in Upper Township. Impacts on wildlife as a result of these facilities are described in Section 3.8, *Coastal Habitat and Fauna*.
1259-0137	The communities that will withstand the construction operation maintenance and decommissioning of these offshore wind facilities will be subjected to the impacts for the long- term. The Draft EIS states installation of the cable landfall sites and underground cable routes would temporarily disturb neighboring land uses through construction noise vibration dust and travel delays along the affected roads. These impacts are anticipated to last for the duration of construction…The corridors would be maintained through regular vegetation trimming and herbicide application." [Footnote 122: Id. at 3.14-10.]The Draft EIS fails to identify and review the environmental impacts from the use of such herbicides in fragile coastal communities and ecosystems.	Ocean Wind has committed to measures to minimize impacts on coastal habitat and fauna, including avoiding areas of unique or protected habitat or known habitat for threatened or endangered and candidate species to the extent practicable (TCHF-01) and conducting maintenance and repair activities in a manner to avoid or minimize impacts on sensitive species and habitat such as beaches, dunes, and the near-shore zone (TCHF-02). These mitigation measures are outlined in Appendix H, *Mitigation and Monitoring*. Additional information on potential impacts of the landfall sites and onshore export cable routes can be found in Section 3.8, *Coastal Habitat and Fauna*.

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1259-0138	In addition the land disturbance outlined in the Draft EIS will have impacts on stormwater collection and management. The Draft EIS states "Construction of the onshore substation would require a permanent site including area for the substation equipment and buildings equipment yards energy storage stormwater management a parking area an access road and landscaping." [Footnote 123: Id. at 3.14-11.] The Draft EIS does not however review the impact of adding more impervious cover in shore communities where stormwater runoff and flooding events are frequent occurrences and problems. Will BOEM require green infrastructure to be used in the development of these onshore facilities? To what extent? What types of green infrastructure?	Both the BL England and Oyster Creek onshore substations would be sited on previously developed lands with an urban land use classification with and include existing impervious cover. The proposed Oyster Creek substation would occupy up to 31.5 acres (127,476 m^2) and be sited on the former Oyster Creek nuclear plant in Lacey Township and the proposed BL England substation would occupy up to 13 acres (52,609 m^2) and be sited on a former coal, oil, and diesel plant in Upper Township. Analysis of impacts on stormwater runoff is unnecessary, as any additional impervious cover created as a result of the Oyster Creek and BL England onshore substations will be limited.
1259-0139	The Draft EIS also notes that "Impacts on land use and coastal infrastructure would be additive only if land disturbance associated with one or more other projects occurs in close spatial and temporal proximity." There are 24 other offshore wind projects or leased areas with associated onshore infrastructure anticipated in this region. It is likely that the impacts on land use and coastal infrastructure will be exacerbated due to the numerous facilities being constructed simultaneously and subsequently operational in the same region.	The cumulative impacts of the Proposed Action in combination with other ongoing and planned offshore wind activities on land use and coastal infrastructure are described in Section 3.14.5.1, *Cumulative Impacts of the Proposed Action*.
1259-0140	As another example of land disturbance impacts and a deficiency in the DEIS BOEM states: Portions of the Oyster Creek onshore export cable corridor [are] within lands approved for acquisition by USFWS as part of the Edwin B. Forsythe National Wildlife Refuge; however as they have yet to be acquired by USFWS [Bold and Italics: these lands do not need to be evaluated for impacts relative to the refuge.] [Footnote 124: Id. at 3.14-11. Emphasis added.]Why did BOEM not evaluate these land resources in the DEIS? When will the public have the opportunity to assess and understand the impacts to that land area? By not evaluating these lands and the potential impacts on them any impacts from the Proposed Action will be unknown as the baselines would not be assessed and impacts may be identified too late. BOEM should require the assessment of the "lands approved for acquisition by USFWS." BOEM is essentially writing a "blank check"' for these lands to be used without public review. It also begs the question what other lands has BOEM failed to evaluate in the DEIS for impacts related to	Impacts on the portions of the Oyster Creek onshore export cable corridor within lands approved for acquisition by USFWS as part of the Edwin B. Forsythe National Wildlife Refuge were considered in Section 3.14.5, *Impacts of the Proposed Action on Land Use and Coastal Infrastructure*. The sentence highlighted was intended to specify that, because the land has not been acquired for the wildlife refuge, the potential impacts would not be considered as part of the impacts on the wildlife refuge, not that impacts on this land would not be evaluated at all.

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	Ocean Wind 1? Again BOEM must disclose the total amount and location of lands affected and proposed for use by the Proposed Action.	
1259-0141 & -0142	Regarding additional land disturbance the export cable corridor to Oyster Creek crosses the fragile environs of Island Beach State Park an area of almost untouched coastal beauty in Ocean County. The NJDEP describes Island Beach State Park as following: Miles of sand dunes and white sandy beaches offer habitat to maritime plants and diverse wildlife that is almost the same as it was thousands of years ago. Island Beach State Park contains outstanding examples of plant communities such as primary dunes thicket freshwater wetlands maritime forest and tidal marshes. The state's largest osprey colony as well as peregrine falcons wading birds shorebirds waterfowl and migrating songbirds are found here. Island Beach is nationally known as a unique resource with over 400 plants identified including the largest expanses of beach heather in New Jersey. [Footnote 125: Island Beach State Park Overview N.J. State Park Serv. (Aug. 22 2022) https://www.nj.gov/dep/parksandforests/parks/ islandbeachstatepark.html.] In the Draft EIS BOEM maintains that because the State Park has been designated an "Otherwise Protected Area" pursuant to the Coastal Barrier Resources Act "consultation with USFWS [Bold and Italics: is not required] and the only federal spending restriction is a prohibition on federal flood insurance" (emphasis added). How could this natural coastal habitat along the Jersey Shore not require consultation with an agency whose mission is "conserve protect and enhance fish wildlife plants and their habitats for the continuing benefit of the American people"? [Footnote 126: Mission and Vision U.S. Fish & Wildlife Serv. (last accessed Aug. 14 2022) https://www.fws.gov/about/mission-and-vision.] COA urges BOEM to consult with US Fish and Wildlife Service about the impacts expected at Island Beach State Park from the export cable that will traverse through important habitat en route to Oyster Creek. In addition mitigation measures must be identified and agreed upon among those interested in protecting the integrity and ecosystem of Island Beach State Park.	USFWS is a cooperating agency and has been involved in the development of the Ocean Wind 1 EIS. BOEM is also consulting with USFWS under the ESA, and the results of ESA consultation are included in the Final EIS. Because Island Beach State Park is an Otherwise Protected Area under the Coastal Barrier Resources Act, separate consultation outside of the NEPA process is not required in this case.
1259-0143	Further the Pinelands region of New Jersey is an incredibly historic and ecologically significant area that must be considered properly and responsibly when it comes to identifying and evaluating the onshore impacts of the Proposed Action. The Draft EIS states:Portions of the	Section 3.14.1, *Description of the Affected Environment for Land Use and Coastal Infrastructure*, was edited to clarify that, while all of the onshore activities are outside of the state-

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	Onshore Project area are within the New Jersey Pinelands which feature some of the largest unbroken tracts of Atlantic coastal pine forests in the eastern U.S. stretching across more than seven counties of New Jersey…[P]ortions of the export cable corridors are within the federally designated Pinelands National Reserve (New Jersey Pinelands Commission 2021). The Great Egg Harbor River is a 129-mile river system and was designated as a Wild and Scenic River by Congress in 1992 (USNPS 2016). It is almost entirely within the Pinelands National Reserve and drains into wetlands within the reserve. [Footnote 127: DEIS at 3.14-2.]The DEIS does not identify mitigation measures to address the unavoidable impacts to the Pinelands region as a result of the Proposed Action.	designated Pinelands Area, portions of the BL England export cable corridor are within the federally designated Pinelands National Reserve. The proposed onshore export cable corridors in Marmora and Beesley's Point are within the Regional Growth Pineland Management Area, where sewered and industrial uses are permitted. Proposed onshore export cable corridors on Island Beach State Park do not fall within the Pinelands National Reserve.
1259-0144	Regarding the presence of structures where the offshore export cables cross currently undeveloped areas there would be a permanent conversion of land to utility right-of-way or easement. Specifically for the Oyster Creek cable route undeveloped land would be permanently disturbed and roadways associated with a confined disposal facility (CDF) would be disturbed. The Draft EIS fails to identify and evaluate the substances contained in the CDF and what impacts will result from the disturbance caused by the Proposed Action.	Portions of a previous option for the Oyster Creek onshore export cable corridor followed abandoned roadways associated with the Oyster Creek confined disposal facility. The Oyster Creek onshore export cable corridor route has been refined to make landfall and travel west, taking advantage of previously disturbed areas where possible along the Holtec property. The crossing of Oyster Creek and Route 9 would be conducted using trenchless technology methods to an existing private road, and the route would continue within the existing private road to the substation parcel. The confined disposal facility would not be disturbed under either route option. Additional information on the proposed onshore cable route options was added to the Final EIS.
1259-0145	Regarding the utilization of ports the DEIS indicates the ports of Paulsboro Hope Creek and Port Elizabeth NJ and the Ports of Charleston and Norfolk are included in the project in addition to the landfall locations and onshore substations. The Draft EIS states "Proposed uses at existing port facilities would be consistent with the current land uses occurring at these locations and are not expected to result in changes to land use or zoning." This statement is false. For instance the proposed port expansion for the Wind Port facility in Lower Alloways Creek included an application by Orsted to NJDEP to redesignate or declassify 150 acres of wetlands. [Footnote 128: Tom	The Proposed Action does not include port expansion activities but would use ports that have expanded or would expand to support the wind energy industry generally. For instance, the New Jersey Wind Port may be used for WTG pre-assembly and load out, but the expansion of this port is not part of the Ocean Wind 1 Project. Additional information was added to the Final EIS to clarify.

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	Johnson Wetlands no more. NJ redraws map to boost offshore wind project NJ Spotlight News (Mar. 25 2022) https://www.njspotlightnews.org/2022/03/wetlands-pseg-power-150-acres-reclassified-wind-port-project/.] What other changes have been made to land use or zoning in New Jersey to advance offshore wind support facilities?	
1259-0146	The Draft EIS also acknowledges that "[i]f multiple offshore wind energy projects are constructed at the same time and rely on the same ports this simultaneous use could stress port resources and could potentially increase the marine and road traffic noise and air pollution in the area." [Footnote 129: DEIS at 3.14-6.] One such area is Atlantic City which will be home to multiple onshore facilities and activities from the Proposed Action Ocean Wind 2 and 3 as well as other offshore wind projects (e.g. Atlantic Shores 1 & 2). The Draft EIS acknowledges that Atlantic Shores is also planning an O&M facility for Atlantic City. Therefore two known O&M facilities for offshore wind will stress port areas and impact the surrounding communities. The DEIS does not account for the impacts from more than one O&M facility in Atlantic City.	As described in Section 3.14.3.2, *Cumulative Impacts of the No Action Alternative*, in cases where individual ports are stressed due to simultaneous offshore wind construction-related activity, localized, short-term, adverse impacts are anticipated. Activities at O&M facilities are not expected to be as impactful as construction activities because vessel trips from O&M facilities would only occur during routine and non-routine maintenance activities. The cumulative impacts of offshore wind projects in the region on port utilization are presented in Section 3.14.5.1, *Cumulative Impacts of the Proposed Action*.
1259-0147	In addition the identified ports are in ecologically sensitive coastal areas and will impact local wetlands in those regions. Meanwhile scientists recommend that wetlands be protected to combat climate change improve and maintain water quality provide natural flood control and to protect the diversity of species in wetland habitats. Construction for Ocean Wind 1's O&M facility will result in the destruction of 10 acres of wetlands. To add further insult to environmental injury no mitigation was required. The acquisition of the last remaining waterfront access point for Atlantic City communities for the Ocean Wind 1 Operations and Maintenance port was a missed opportunity to restore wetlands.	Ocean Wind would be required to provide compensatory mitigation for any wetlands that cannot be avoided or minimized as part of the Section 404 permitting process. The details of that mitigation would be part of the final Section 404 permit issued to Ocean Wind. BOEM has not proposed any specific mitigation measures for wetlands (as stated in Section 3.22.8), but Ocean Wind has proposed several measures that would avoid and reduce impacts on wetlands. Those measures (e.g., GEN-13) are cited throughout the Proposed Action analysis in DEIS Section 3.22, *Wetlands*. If BOEM decides to approve the Project, BOEM may include additional measures that would be conditions of the Project approval. All of these APMs are in Appendix H, *Mitigation and Monitoring*.
1259-0148	The DEIS also fails to identify and consider the cumulative impacts of onshore lands. More generally what are the cumulative impacts on land	The cumulative impacts of the Proposed Action in combination with other ongoing and planned

Comment No.	Comment	Response
	resources both offshore and onshore of Ocean Wind 1 as it relates to the other 24 offshore wind projects and leased areas for offshore wind off the NY/NJ coast?	offshore wind activities on land use and coastal infrastructure are described in Section 3.14.5.1, *Cumulative Impacts of the Proposed Action*.
1259-0149	Based on the above points COA strongly disagrees with BOEM categorizing the adverse impacts on land use and coastal infrastructure as "minor." The DEIS fails to include mitigation measures. Clearly land will be disturbed sometimes permanently and for the long-term and communities will be disrupted to build and support the Proposed Action. In sum the impacts from offshore wind on land resources and areas are not adequately reviewed in the DEIS.	Impacts of the Proposed Action on land use and coastal infrastructure are listed as minor because while adverse impacts would be detectable, they would be short term and localized. As described in Section 3.14.5, *Impacts of the Proposed Action on Land Use and Coastal Infrastructure*, no permanent disturbance or change in land use type is anticipated as a result of onshore substations or onshore export cables.
1274-0001	I moved to my current location in 2008. My back yard adjoins the Barnegat Bay. At that time there was 130' of land between my property and the open Bay. Over the past 14 years the bay eroded the land buffer now there is NO barrier or land between my property line and the bay. On most days the bay water intrudes on my property. I am highly concerned that I will loose my land. The wave action wash sand from the bay front to the lagoons surrounding our community. Most boats are not able to navigate the lagoons to the open bay due to the built up of the sand that wash from the front of our homes. Recently the American Littoral Society (ALS) along with Stockton University have applied remedies to the bay. These remedies have limited effect on the wave attenuation. Now we need Help. Specifically we need your help. For this project to succeed we need 2- 3 groins as well as a living shoreline. These groins would contain the sand from washing to the lagoons mitigate the erosion eventually support the marine life in the bay. As I understand from the local community leaders the project is already approved by the NJDEP. The leaders are now reaching out to the local community businesses to obtain funding. During our community meeting it was disclosed that you have an obligation to conduct mitigation projects to off set potential damage during your project. It may be beneficial for you and the bay front residents to benefit from the dredging : whereby we may use the sediments from the dredging to complete the living shoreline project. In addition of using the sediments we are reaching out to obtain funding for the groin and any additional studies needed to implement the project.	Ocean Wind has coordinated with NJDEP regarding the disposal of dredged material and has determined that dredged material would be transferred to an upland disposal facility and disposed of in accordance with USEPA Guidelines, USACE Guidelines, New Jersey Administrative Code 7:7 Appendix G for the Management and Regulation of Dredging Activities and Dredged Material in New Jersey’s Tidal Waters, and applicable State Surface Water Quality Standards at New Jersey Administrative Code 7:9B and permit conditions.

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O.6.14 Marine Mammals

Table O.6.14-1 Responses to Comments on Marine Mammals

Comment No.	Comment	Response
0007-0006	Another example is in regard to mammals. Section 3.15.3.3 Conclusions in regard to the North American Right Whale describes "As stated above the low population numbers of the NARW result in the potential to compromise the viability of the species due to the loss of a single individual." NMFS is reviewing an incidental take application during construction from Ocean Wind to take (kill) one or more North American Right Whales. That review and decision by NMFS is not yet available. Without said approval the Proposed Action is not viable. (In my opinion Ocean Wind will also have to apply to NMFS for a take quota during operations due to the increased vessel activity and increased possibility of vessel strikes. This threat may be mitigated to some extent by restrictions on vessel speed and human spotters but it will not be reduced to zero. The DEIS says we can't afford to loose one individual whale without jeopardizing the survival of the species.	Ocean Wind has not requested Level A take (that has the potential to injure a marine mammal) for NARW in the Letter of Authorization Application for the Ocean Wind 1 Project, and Level A take of NARW would likely not be authorized by NMFS.
0222-0008, 0222-0012	**0219-0008**: Monopiles and scour protection would create an [Bold: artificial reef effect] (Degraer et al. 2020) likely leading to enhanced biological productivity and increased abundance and concentration of fish and invertebrate resources (Hutchison et al. 2020). This could alter [Bold: predator-prey interactions] in and around the facility with [Bold: uncertain and potentially beneficial or adverse effects on marine mammals] **0219-0012:** In summary there are enough open questions on many significant risks of this project that BOEM should [Bold: defer implementing the entirety of the contemplated offshore wind initiative] until a [Bold: 2 year study] is performed to [Bold: dispel or prove risk mitigation] of Ocean Wind 1 and subsequent OSW tracts.	Comment noted. The comment restates the findings of the Draft EIS (Section 3.15). BOEM's analysis of incomplete and unavailable information for each Chapter 3 resource section is presented in EIS Appendix D. When incomplete or unavailable information was identified, BOEM considered whether the information was relevant to the assessment of impacts and essential to its analysis of alternatives based upon the resource analyzed. If essential to a reasoned choice among the alternatives, BOEM considered whether it was possible to obtain the information and if the cost of obtaining it was exorbitant. If it could not be obtained or if the cost of obtaining it was exorbitant, BOEM applied acceptable scientific methodologies to inform the analysis in light of this incomplete or unavailable information.

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0837-0004	BOEM acknowledges that a request to [Italics: take] marine mammals incidental to construction activities has been filed with the National Marine Fisheries Service (NMFS). This request can be authorized under the Marine Mammal Protection Act (MMPA). The issuance of an incidental take authorization is a major federal action and exonerates Ocean Wind 1 when mammals are injured or killed. Some of the factors driving the anticipated losses include impact pile driving vibratory pile driving geophysical surveys detonations of UXO vessel traffic aircraft cable laying or trenching and dredging during construction and WTG operation. The New Jersey coast currently hosts at least five marine mammals that are endangered species. The North Atlantic Right Whale is regularly observed in every season and considered a regular visitor to the Project area. The Save Right Whales Coalition has discovered extensive offshore wind projects in Europe are lethal to some marine species to a significant extent. The construction and operation of these projects in the North Atlantic right whale habitat will put this critically-endangered species under even more stress. [Footnote 5: Save Right Whales accessed August 2022 https://www.saverightwhales.net/media/press-release-nov-18.] Physiological effects to all marine mammals include short-term reversible hearing loss and irreversible hearing loss and behavioral effects include acoustic masking. It is a logical conclusion that the ambitious scope and time constraints outlined for offshore New Jersey wind farms will lead to the extinction of one or more endangered species and unprecedented damage to the faculties of many marine mammals.	Section 101(a) of the MMPA (16 USC 1361) prohibits persons or vessels subject to the jurisdiction of the United States from taking any marine mammal in waters or on lands under the jurisdiction of the United States or on the high seas (16 USC 1372(a)(l), (a)(2)). Sections 101(a)(5)(A) and (D) of the MMPA provide exceptions to the prohibition on take, which give NMFS the authority to authorize the incidental but not intentional take of small numbers of marine mammals, provided certain findings are made and statutory and regulatory procedures are met. Ocean Wind has not requested Level A take (that has the potential to injure a marine mammal) of ESA-listed NARW, blue whale, or sperm whale in the Letter of Authorization Application for the Project. See Section 3.15 of the EIS, the NMFS BA, and Ocean Wind’s Letter of Authorization Application for more details on the take authorization requested by Ocean Wind and BOEM’s assessment of effects on ESA-listed marine mammals.
0984-0022a	3.15 Marine Mammals The Extinction of marine mammals species is possible and not being addressed properly within the EIS. The change in the eco- system within the development site surrounding sites and the cumulative impacts of other Industrial at sea energy development sites is a [Bold: Major Impact] to the marine mammals food supply. The use of newly "educated" personal to be employed by the developer limits the experience to academia who are being educated by the developers on how to mitigate their exposure. The funds paid by the developer to the schools to develop this workforce with limited knowledge on what to look for is a conflict of interest. The EIS only looks at the study of the impacts and the removal of mammals within the development area. The impacts on the mammal food supply is the critical component on the survival of the marine mammals. The Atlantic City Marine Mammal Stranding Center has plenty of "Science" on stranded	The NMFS BA for the Project evaluated the energetic consequences of any avoidance behavior or masking effects of ESA-listed marine mammals in response to underwater noise sources, and potential delay in resting or foraging is not expected to affect any individual’s ability to successfully obtain enough food to maintain their health, to make seasonal migrations, or to participate in breeding or calving. Any behavioral effects would be expected to resolve within a few days to a week of exposure and are not expected to

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	marine mammals who suffered from starvation before beaching themselves. The [Bold: Major Impacts] of the development by killing the marine life specially squid for a one mile radius and a 50% mortality rate from 1-11/2 mile radius around each tower is a major impact to the food supply of the Marine Mammals. The displacement of food for marine mammals although temporary will affect the breeding habits of the marine mammals and where they forage. Forcing reproduction and foraging into the deeper waters where the highest mortality takes place- Ship Strikes. The current campaign to restrict speed of shipping around industrial energy wind fields because of the displacement of the marine mammals is a [Bold: major impact.] Consideration of the efficiency of speed reduction has shown that the amount of ship strikes have not decreased only the mortality rate. The harassment of the marine mammals by forcing them into shipping lanes where there is a reduction in mortality does not excuse the developer from violations of the marine mammal act. The displacement alone of traditional marine mammals migration corridors is a violation and a [Bold: major impact.] There is NO reason to allow a nascent industry to develop that has such a major impact that is not mitigable.	affect the health of any individual or its ability to migrate, forage, breed, or calve. In particular, it is unlikely that Project activities would measurably affect the invertebrate forage base of NARWs, blue whales, and sei whales who feed primarily on invertebrate zooplankton. No pile installation would occur from January 1 to April 30 during the time of year when NARWs are present in the region in higher numbers, reducing effects on this species. See the NMFS BA for additional information on effects of the Project on foraging and breeding for ESA-listed marine mammals.
0984-0022b	Marine mammals can hear. The noise from the wind turbines and the affect on migration of the marine mammals is a [Bold: Major Impact.] The EIS fails to address the corralling of marine life into the deeper water on the outskirts of the leased area. Even though the animals are not in the leased area forcing them to take the more dangerous route within the shipping lanes will be significant. We already average ten whale strikes a year in the New York Bight area. The endangered marine mammals whom will seek refuge from the vibrations of the wind turbines will create more of an environmental loss. A marine mammal take permit should NOT be issued to a nascent industry. The statistical calculations of mortality rate are above the threshold for preexisting marine users. A nascent industry should not be entitled to any benefit and actually be held to higher standards. Because there is a scientifically calculated mortality rate associated with the EIS and an even greater one with the cumulative impacts the application for development needs to be denied.	See responses to comments 1012-0009a–e for detailed responses related to operational noise of WTGs and the potential to disrupt migration corridors.
0984-0022c	G. [Bold: The DEIS does not assess the likelihood that those take events will block the right whale's migration.] Previous analysis of turbine installation involving one or two discrete pile driving sources assumed that a whale approaching a source above the behavior disruption level could veer to the left or the right find an "noise open route" and proceed on its migration. Here given the elevated noise levels above the 120 dB	Effects of acoustic masking are analyzed throughout EIS Section 3.15, in Sections 3.15.1, 3.15.3, 3.15.5, 3.15.6, and 3.15.9. See responses to comments 1012-0009a–e for detailed responses related to

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	criterion throughout the wind complex and across their entire migration corridor it will be very difficult for the whales to avoid the noise disturbance and continue their migration. Attempting to do will expose them to high cumulative sound exposures potentially exceeding hearing threshold shift criteria loss of communication between and separation of females from calves stranding and loss of echolocation and other navigational abilities. Masking of its communications risks the separation of females from calves during migration [Footnote W13: Anderson Cabot Center for Ocean Life A Framework for Studying the Effects of Offshore Wind Development on Marine Mammals and Turtles May 2019.] [Footnote W14: Vineyard Wind 1 NMFS Biological Opinion page 149.]. Its echolocation and navigation ability will be impaired [Footnote W16: Quantifying loss of acoustic communication space for right whales in and around a U.S. National Marine Sanctuary Leila T Hatch 1 Christopher W Clark Sofie M Van Parijs Adam S Frankel Dimitri W Ponirakis PMID: 22891747 DOI: 10.1111/j.1523-1739.2012.01908.x] while trying to find a noise open route to continue its migration. Whales seeking to avoid the noise by going closer to shore risk stranding and elevated sound exposure levels as mentioned above.	operational noise of WTGs and the potential to disrupt migration corridors.
0984-0022d	Consider a whale traveling north approaching the migratory corridor between the project area and Hudson South. In an effort to continue its migration it might tolerate the noise disturbance and continue its 25-mile 30-hour journey (@1.3 km/hr.) past the complex incurring an additional sound exposure of 50 dB for total levels likely exceeding the NMFS sound exposure level (SEL) criteria for temporary or permanent threshold hearing loss [Footnote W11: BOEM 2020-011 A Parametric Analysis and Sensitivity Study of the Acoustic Propagation for Renewable Energy Table 1-4.]. It might veer west and travel north through the wind complex incurring similar exposures. But it is far more likely that it would try to avoid the elevated sound. Traveling due west to avoid the noise disturbance would require it to go all the way to shore because the zone of influence goes that far. Traveling east to avoid the disturbance requires it to find a noise open route through the Hudson South area and once turbines are placed there that will not be possible. It would then have to go all the way around Hudson South and find a new route all the while incurring long exposure times. A recent in-depth review of behavior response studies titled A systematic review on the behavioral responses of wild marine mammals to noise: The disparity between science and policy November 2016 identified a number of studies specifically associated with whale traveling migrating and directional swimming.	See responses to comments 1012-0009a–e for detailed responses related to operational noise of WTGs and the potential to disrupt migration corridors. BOEM reviewed Rolland et al. 2012 cited by the commenter and this citation is included in the references cited for the NMFS BA.

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	BOEM should review those studies for applicability here and present the results. The burden of technical support here on BOEM is the same as discussed above for direct serious injury or fatality it must show with high confidence that not a single whale is prevented from completing its essential migration. The DEIS did not present the potential that its migration will be blocked. Common sense dictates that under this expanse of high multiple noise sources and the unattractive avoidance options discussed above it is likely that there will be at least some of the animals exposed above 120 dB who will have their migration impaired or blocked entirely and others that will be subjected to prolonged exposure above that level undergo stress [Footnote W12: Rolland R.M. S.E. Parks K.E. Hunt M. Castellote P.J. Corkeron D.P. Nowacek S.K. Wasser and S.D. Kraus. 2012. Evidence that ship noise increases stress in right whales. doi: 10.1098/rspb.2011.2429 Proc. R. Soc. B. 279 2363?2368] and be seriously injured or killed from the reactions and communications masking discussed below.	
0984-0022e	H. [Bold: The DEIS does not present a plausible transparent analysis of reaction to behavior disturbance events & potential harm or fatality outcomes.] Rather it relies on optimistic and opaque "modeling results". That is not sufficient it must disclose key equations assumptions and inputs to the model so the accuracy of its results can be determined. Regarding such an analysis The BOEM and NMFS traditionally do two analyses and compute level A and Level B takes. A third comparable level analyses is needed. A level A harassment analysis calls for an assessment of the potential to injure a marine mammal or a marine mammal stock in the wild. A level B analysis calls for an assessment of the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns including but not limited to migration breathing nursing feeding or sheltering. The two analyses try hard to separate Level A injury from Level B harassment. But in the real whale world that distinction is not so clear and lesser exposures can indirectly lead to worser outcomes. That linkage is also present in the December 21 2016 NMFS interim guidance defining the term "harass" under the Endangered Species Act (ESA) as to "create the likelihood of injury to wildlife by	Detailed discussion of the underwater acoustic and exposure modeling conducted for the Project can be found in the NMFS BA for the Project, COP Appendix R-2 posted to BOEM's website,[1] and in Ocean Wind's Letter of Authorization Application.[2] EIS Appendix J also provides an overview of key modeling assumptions. Effects of acoustic masking are analyzed throughout EIS Section 3.15, in Sections 3.15.1, 3.15.3, 3.15.5, 3.15.6, and 3.15.9, and are also analyzed in the NMFS BA for ESA-listed species.

[1] The Ocean Wind 1 COP is available at: https://www.boem.gov/ocean-wind-1-construction-and-operations-plan.
[2] Ocean Wind 1's Letter of Authorization Application is available at: https://www.fisheries.noaa.gov/action/incidental-take-authorization-ocean-wind-lcc-construction-ocean-wind-1-wind-energy-facility.

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	annoying it to such an extent as to significantly disrupt normal behavior patterns which include but are not limited to breeding feeding or sheltering." The NEPA also demands a full analysis of these reasonably foreseeable real-world paths particularly in the case of the North Atlantic right whale where serious injury or death to only one animal can spell extinction for the species. Therefore the DEIS should have assessed this third path or linkage from reactions to level B harassment exposures and from masking of the whale's sound detection and communication abilities to the "likelihood of injury" with a level of analyses comparable to that given to Level A and Level B takes. Such paths include reactions to noise stimuli causing right whales to ascend and swim just below the surface where they are more vulnerable to vessel strike not just from survey vessels but from other vessels as well. This behavior has in fact been demonstrated experimentally by Nowacek et al [Footnote W5: Nowacek et al. North Atlantic right Whales ignore ships but respond to alerting stimuli The Royal Society may 20 2003.http://myweb.facstaff.wwu.edu/shulld/ESCI%20432/Nowacek2004.pdf].	
0984-0022f	The proposed use [Footnote W15: BOEM Commercial and Research Wind Lease and Grant Issuance on Site Assessment Activities on the OCS of the NY Bight Draft EA August 2021 page 41 and Figure 9.] of the migration corridor as a new deep draft vessel lane (Exhibit D) would significantly increase the risk of vessel strike once it ascends and struggles to find a new migration route. Subsequent planned turbine placement along the inner part of the Hudson South area worsens the situation. In our comments on the NOI we recommended that the BOEM National Marine and Fisheries Service (NMFS) and the Coast Guard collaborate on a joint study to assess the synergistic impact on the right whale from the long-term operational noise of the offshore wind projects foreseen and the use of its migratory corridor as a deep draft vessel lane and include the results in the draft EIS Incidental Take Regulation (ITR) Biological Assessment and Opinion. There is no evidence in the draft EIS as to whether that was considered or done. As discussed further under the EIS scope all three federal actions the Atlantic Shores proposal leasing the inner part of Hudson South and the deep draft vessel lane bear on the impact to the whale and should be assessed together in the EIS BA and BO. There will be a similar impact on the right whale from other projects up and down the East Coast wherever their migration route intersects an elevated noise area and this cumulative impact also needs to be addressed in the EIS.	NOI comments calling for BOEM, NMFS, and USCG to collaborate on a study to assess the impact on NARW from the long-term operational noise of the offshore wind projects and the use of its migratory corridor as a deep-draft vessel lane were not submitted by the commenter on the federal docket for the Ocean Wind 1 EIS. However, BOEM’s and NOAA Fisheries’ *Draft North Atlantic Right Whale and Offshore Wind Strategy* was announced on October 21, 2022, which identifies research as one of its main goals. The Atlantic Shores project and the future potential development of the Hudson South lease area are reasonably foreseeable activities, i.e. planned actions that could occur during the life of the Project and potentially could contribute to cumulative impacts when combined with impacts from the Proposed Action and

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		other alternatives. Impacts are disclosed on this topic in Chapter 3, Section 3.15. BOEM's BA and NMFS's Biological Opinion are Project specific and impacts of offshore wind activities in the Atlantic Shores or Hudson South lease areas will be reviewed under separate NEPA and consultation processes.
0984-0022g	I. [Bold: The DEIS does not show how the masking of the whale's communications could impair or prevent its migration leading to serious injury or death.] The whales use sound to navigate along their migration. It also appears that their migration is aided by their capability to communicate with each other along the way. The impacts of the masking of those communications in causing serious harm or fatality including the impact from the obstruction or delay of the right whale's migration should have been analyzed in the DEIS as it has direct implications on their survival as a species. One path to such injury involves separation of calves from mothers as a result of masking of their communication from elevated noise levels. Such communications can employ low-amplitude signals susceptible to masking as discussed in the report Acoustic crypsis in communication by North Atlantic right whale mother–calf pairs on the calving grounds Susan E. Parks [Embedded Hyperlink Text (https://royalsocietypublishing.org/doi/10.1098/rsbl.2019.0485)] Dana A. Cusano† [Embedded Hyperlink Text (https://royalsocietypublishing.org/doi/10.1098/rsbl.2019.0485)] Sofie M. Van Parijs [Embedded Hyperlink Text (https://royalsocietypublishing.org/doi/10.1098/rsbl.2019.0485)] and Douglas P. Nowacek [Embedded Hyperlink Text (https://royalsocietypublishing.org/doi/10.1098/rsbl.2019.0485)] Published:09 October 2019. The right whale's vocalizations are normally at the 125 dB rms level for low background noise but can rise to 150 dB in the presence of high background noise (Parks et.al. The Royal Society Individual right whales call louder in environmental noise July 7 2010).The potential for loss of mother/calf communication was presented in Acoustic propagation modeling indicates vocal compensation in noise improves communication range for North Atlantic right whales Jennifer B. Tennessen Susan E. Parks June 15 2016. Using the higher 150 dB source call level in that study for a whale upcall and the 15 dB loss factor	Effects of acoustic masking are analyzed throughout EIS Section 3.15, in Sections 3.15.1, 3.15.3, 3.15.5, 3.15.6, and 3.15.9, and are also analyzed in Section 3.2.6.2 of the NMFS BA for ESA-listed species. BOEM has reviewed Tennessen and Parks 2016 and this citation is included in the references cited for the NMFS BA.

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	mother/calf communications could be blocked out to a distance of 1.3 miles from a set of 7 turbines with a noise source level of 191.4 dB as discussed above. More typical vocalizations of 125 dB would be masked throughout the entire migration corridor.	
0984-0022h	J. [Bold: The DEIS did not present any criteria for avoiding jeopardizing the Continued Existence of the North Atlantic right whale.] The EIS should have provided a clear definitive criteria to avoid the likelihood of jeopardizing the existence of the North Atlantic right whale (NARW) or causing a non-negligible impact to it. The numbers of NARW are already very low at 366 animals and in steep decline- Exhibit A. There are less than 94 females of reproductive age left. The NMFS 2020 stock assessment report for the NARW shows an average per female productivity rate of 0.06 for the years 2013 to 2017 Figure 4. It also shows (Figure 2a) an average female population of 180 leading to 11 average births per year. Table 2 shows estimated human caused fatalities at an average of 18.6 per year for that period. According to the International Fund for Animal Welfare [Footnote W10: The International Fund for Animal Welfare critically endangered North Atlantic right whales show dramatic decline and are at risk of extinction November 26 2020.] over the past five years from 2016 through 2020 17 whales died on average per year from human actions. During that same period 7 whales were born on average per year. Clearly with a human caused death rate (not including natural mortality) about twice the birth rate and a net loss of 8 to 10 whales per year current mitigating and recovery measures are not sufficient to protect the whale and any additional serious injury or fatality would "jeopardize" it under the meaning of that word which is to put (someone or something) into a situation in which there is the possibility of suffering loss harm injury or failure. Therefore the only sensible and scientifically credible criterion for the NMFS to adopt for the right whale is one of zero tolerance for any fatality or serious injury during its migration from turbine noise and the DEIS must show through the analyses described above that the criterion is met with high statistical confidence. Since the DEIS does not contain the above analyses the BOEM conclusion that the impact to the whale is only moderate is without any scientific basis and is an arbitrary conclusion.	Ocean Wind has not requested Level A take (that has the potential to injure a marine mammal) for NARW in the Letter of Authorization Application for the Project, and Level A take of NARW would likely not be authorized by NMFS. ESA consultation with NMFS is underway and findings of the Biological Opinion are incorporated into the Final EIS. However, a jeopardy decision is not expected given that no Level A take is requested for NARW.
0984-0079	The noise from the wind turbines and the affect on migration of the marine mammals is a [Bold: major impact]. The application fails to address the corralling of marine life into the deeper water on the outskirts and shallower on the west	BOEM does not concur that the Project would result in “corralling of marine life into the deeper water on the outskirts and

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	side of the leased area. Even though the animals are not in the leased area forcing mammals to take the more dangerous route is a [Bold: major impact]. The applicants development site is increasing vessel traffic just outside of their footprint. Ship strikes is the number one cause of death to marine mammals. Forcing marine mammals outside of the development site with hard structures cables EMF rocky bottoms and the displacement of forage into a condensed area of vessel traffic is a [Bold: major impact] that is not calculated in the EIS. The cold water pool area already averages ten whale strikes a year and there continues to be significant money and removal of industry to reduce the impacts.	shallower on the west side of the leased area." EIS Section 3.15 analyzes the impacts on marine mammals related to displacement effects and vessel strike. APMs and BOEM-proposed mitigation to reduce impacts associated with vessel strike are described in EIS Appendix H. With implementation of known and highly effective measures such as reduced vessel speeds and ships maintaining minimum distances from marine mammals, BOEM determined that the impact of vessel traffic would be minor for pinnipeds and odontocetes and minor to moderate for non-listed mysticetes. As the death of a single NARW could lead to population-level consequences and the application of mitigation cannot rule out the potential for this effect to occur, this impact is considered moderate to major for NARW.
0984-0103	It should be noted in the EIS that the permits for the take of fish by the developers within the leased areas will be issued by the Department of Interior. However the permit to harass marine mammals is currently issued by the Development of Commerce. Since The Department of Interior is the leasing Agency they can create their own Marine Mammal Exemption program and administrator it within BSEE. NMFS should NOT be the agency providing the marine mammal exemption certificate for an action at sea created by BOEM. This administration change of is a [Bold: major impact] that should be contained within the EIS.	Ocean Wind has not requested incidental take for ESA-listed fish (i.e., Atlantic sturgeon). The commenter's request for a change in how incidental take permits are administered is outside the scope of the Ocean Wind 1 EIS.
0984-0104a	The impact of EMF on marine mammals are significant. Marine mammals change direction and take larger detours around the industrial energy zones. The probability of corralling the marine mammals into the shipping lanes is extremely high since placement of towers that have exposed cables releasing High EMFs before burial and close to the source of generation are impaling the mammals magnetic threshold. The placement of towers are anticipated to be < 1 nautical of separation. This impact of EMFs will have a permanent impact on the mammals migration patterns. The applicants use of marine mammal deterents such a sonic devices (Pingers) in and around the shipping lanes have been	BOEM does not concur that marine mammals would be "corralled into the shipping lanes" or encounter "exposed cables releasing high EMFs." Cables are buried before they are energized and before the wind farm is commissioned. Ocean Wind proposes WTG spacing of approximately 1 nm by 0.8 nm and the use of marine mammal deterrents such as

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	found to be costly to maintain and unreliable due to other ocean users interactions. Plus the intentional harassment of marine mammals is prohibited. The fact that the EMFs inhibit free movement of the marine mammals constitutes harassment of the marine mammals.	sonic devices (Pingers) is not identified as an APM in EIS Appendix H. Ocean Wind's Letter of Authorization would authorize the incidental (but not intentional) take of small numbers of marine mammals, if it is approved. EIS Section 3.15 analyzed impacts of EMF on marine mammals and concluded that EMF effects would be negligible.
0984-0104b	The developers' EIS should also anticipated the cumulative development zones major impacts on marine mammals that they are party too. There is anticipated to be 125 to 230 vessels in operation at one time. If all these vessels are to be using the shipping lanes the chances of whale strikes will increase 300%	Cumulative impacts of the Proposed Action in combination with other ongoing and planned activities, including related to vessel strike, are analyzed in EIS Section 3.15.5.1.
0984-0107	BOEM has purposely left out corralling in the EIS but does refer to the impacts of migration patterns in the EMF section that paints a cruel demise of the marine mammals with the intentional poisoning of the mammals while starving them all while intentionally harassing them with boats helicopters bubble machines and numerous defining audio devices.	See responses to comments 0984-0022 and 0984-0104a.
1086-0005	Environmental Impacts and Marine Species. The County has environmental concerns relating to the placement of the turbines sound produced during construction operation and decommissioning that will persist over 35 or more years with associated impacts to birds benthic habitats fisheries and marine mammals. Location The wind turbines in the proposed array are directly within one of the most densely trafficked areas of the migration route of the critically endangered North Atlantic Right Whale (NAWR) (see Figure 1). At the time of writing there are estimated to be less than 340 NAWR's remaining with less than 90 females of reproductive age. [Footnote 9: North Atlantic Whale Consortium 2021 Report Card [Embedded Hyperlink Text (https://www.narwc.org/uploads/1/1/6/6/116623219/2021report_cardfinal.pdf)]] There is currently an ongoing Unusual Mortality Event for the NAWR as a result of vessel strikes and entanglements according to the National Marine Fisheries Service. [Footnote 10: Active and Closed Unusual Mortality Events [Embedded Hyperlink Text (https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events)]] In addition there are dozens of other marine mammals that use these corridors to migrate and feed such as humpback fin sei sperm and minke whales bottlenose dolphins common dolphins harbor porpoises and seals. A study	Planned offshore wind projects are considered reasonably foreseeable activities, i.e., planned actions that could occur during the life of the Project and potentially could contribute to cumulative impacts when combined with impacts from the Proposed Action and other alternatives. EIS Appendix F (*Planned Activities Scenario*) describes the methodology used for assessing impacts from planned activities in the EIS. Using the methodology described in Appendix F, each resource-specific environmental consequences section in Chapter 3 of the EIS discusses cumulative impacts. The comment does not raise a concern with the analysis in the Draft EIS and no

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	published in July 2022 reported that Humpback whales have a mean occupancy time of 37.6 days around New Jersey and the New York Bight area and that 31.3% of whales returned to the area from one year to the next. [Footnote 11: Brown D. Robbins (2022). Site fidelity population identity and demographic characteristics of humpback whales in the New York Bight apex. Journal of the Marine Biological Association of the United Kingdom 1-9. doi:10.1017/ S0025315422000388] Turbines located in this wind farm area combined with turbines from the 13 other active lease areas proposed by BOEM create a nearly continuous physical blockade extending for over 168 miles across the State of New Jersey that will inhibit the feeding breeding and migration of the NAWR and other marine mammals and create widespread underwater noise impacts resulting from the operation of turbines. The Construction and Operation Plan states that construction would involve roughly 3847 vessel trips during construction and installation over 1100 annual trips for operation and maintenance and 20-65 vessels simultaneously during construction. This is just for Ocean Wind 1 not including the simultaneous construction of several other offshore wind farms. The significant increase in transiting vessels will undoubtedly result in a major increase in the likelihood of vessel strikes for marine mammals which is acknowledged several times in the DEIS. Vessel strikes are one of the leading causes of marine mammal mortality specifically for NAWRs. [Footnote 12: NOAA proposes new vessel speed regulations to protect North Atlantic right whales [Embedded Hyperlink Text (http://www.noaa.gov/news-release/noaa-proposes-new-vessel-speed-regulations-to-protect-north-atlantic-right-whales)]] [See original comment for Figure 1: Marco Mid-Atlantic Data Portal January NAWR Abundance Vs. BOEM Active Leases (ESRI GEBCO NOAA National Geographic). Graphic generated by Warwick Group Consultants.]	revisions were made to the Final EIS in response to the comment.
1086-0006	Noise. Cape May County is concerned about the impacts on marine mammals from noise during construction operation and decommissioning that will persist over 35 or more years. Of particular importance is the NAWR whose primary communicative frequencies are 7Hz-35Hz according to the National Marine Fisheries Service (NMFS). [Footnote 13: Taking Marine Mammals Incidental to Ocean Wind Marine Site Characterization Surveys New Jersey [Embedded Hyperlink Text (https://www.federalregister.gov/documents/2022/03/16/2022-05477/takes-of-marine-mammals-incidental-to-specified-activities-taking-marine-mammals-incidental-to-ocean)]] Data suggests that the cumulative increase of such a large number of turbines combined with other wind farms could have significant impacts on the NAWR population by creating abundant	EIS Section 3.15 addressed the activities associated with the Project that could cause underwater noise effects on marine mammals including pile driving, vibratory pile driving, geophysical surveys, detonations of UXO, vessel traffic, aircraft, cable laying or trenching, and dredging during construction and WTG operation. The EIS analyzes the impact of the Proposed Action alone and the cumulative impacts of the Proposed Action in

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	operational noise that could disrupt feeding breeding and migration of the species as well as the ability to communicate and navigate with other whales. A study commissioned by the Scottish Government found that monopile wind turbines are "audible above the background noise at least 20 km from the wind farm in all wind conditions" and that "species with hearing specialized to low frequency such as minke whales may in certain circumstances detect the wind farm at least 18 km away and are the species most likely to be affected by noise from operational wind turbines." [Footnote 14: Modelling of Noise Effects of Operational Offshore Wind Turbines including noise transmission through various foundation types [Embedded Hyperlink Text (https://www.gov.scot/publications/scottish-marine-freshwater-science-volume-4-number-5-modelling-noise/)]] Minke whales are categorized by NMFS as having the same hearing frequency band as NAWRs and live primarily in waters less than 100m deep along the outer continental shelf. Another study published by the Journal of the Acoustical Society of America found that "at distances of several kilometers the noise [from a single turbine] becomes indistinguishable from that of a single point source with a source level larger than that of any individual turbine." [Footnote 15: How loud is the underwater noise from operating offshore wind turbines? [Embedded Hyperlink Text (https://doi.org/10.1121/10.0002453)]] This study found that the cumulative source level of the 81-turbine wind farm was 175 dB re 1 μPa which nears the threshold for permanent hearing loss for the NAWR of 183 dB re 1 μPa as determined by the Navy. [Footnote 16: Finneran J. J. 2016. Auditory weighting functions and TTS/PTS exposure functions for marine mammals exposed to underwater noise. Pp. 38- 110 in National Marine Fisheries Service Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Department of Commerce NOAA. NOAA Technical Memorandum. NMFS-OPR-55.] It must be noted that the turbine operational noise study investigated [Bold Italics Underline: 81 1-MW] turbines rather than [Bold Italics Underline: 98 12-MW] turbines proposed by Ocean Wind LLC which are far larger and have twelve-times the capacity of the turbines modeled in the study. Noise levels above 120 dB re 1 μPa are categorized as disturbance-level for North Atlantic Right Whales and can result in behavioral changes and abandonment of habitats when exposed to noise levels exceeding 120 dB re 1 μPa. The failure of BOEM to capture the cumulative noise impacts of Ocean Wind 1 and the other wind farm areas along New Jersey and the Eastern Seaboard is a violation of NEPA guidelines on cumulative impact and severely threatens	combination with other ongoing and planned offshore wind activities and non-offshore wind activities. Additional analysis of operational noise has been added to Section 3.15 of the Final EIS (see responses to comments 1012-0009a–e). BOEM reviewed Tougaard et al. 2020 cited by the commenter, which is already included in the references cited for EIS Section 3.15.

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	marine mammals who use the waters off Cape May County for breeding feeding migration and other purposes.	
1109-0003	On page 66 of the NJ Offshore Wind Energy : Feasibility study Prepared for: NJ BPU in Nov 2004 pg 66 section 4.5 on Right Whales The study states -"The North American Right Whale the most endangered whale of the large whales can be found from coastal waters to the continental shelf and generally migrates within 20 miles of the shore. These whales are generally found in NewJersey's waters in the spring and fall" As previously stated in the DEIS the observation of cow calf pairings suggests that this area is a feeding and nursery habitat. We know that the DEIS has identified this wind project area as having a major impact on navigation and boat traffic and now we also know it's a suggested feeding and nursery habitat for the critically endangered right whale. This raises the concern of the danger of increasing boat strikes on cow calf combinations of The NARWs. Additionally the noise from construction blasts piling driving and general operation could have an equally deadly affect on the critically endangered North American right whale.	The EIS documents in Section 3.15 that NARWs were observed during the environmental baseline study surveys the presence of a cow-calf pair was documented, suggesting that nearshore waters off New Jersey serve as feeding and nursery habitat, Impacts on marine mammals from underwater noise and vessel strike are analyzed under the noise and vessel traffic IPFs, respectively, in EIS Sections 3.15.3 and 3.15.5. Ocean Wind has not requested Level A take (that has the potential to injure a marine mammal) for NARW in the Letter of Authorization Application for the Project, and Level A take of NARW would likely not be authorized by NMFS.
1109-0004	A study carried out by scientists at Syracuse U and Duke U called Acoustic Crypsis in Communication by North American Right Whale Mother- Calf Pairs on the Calving Grounds in Biology Letters-has determined that North American Right Whales tone down their vocalizations and "whisper" to their calves so that their calves can avoid predators that they are vulnerable to. If the mother and calf cannot communicate due to construction and operational noise of 98 turbines and with the information found in the summary of noise impacts in their feeding and nursery habitat- where does that leave the ability for survival?	Operational noise from operating WTGs is low frequency (60 to 300 Hz) and at relatively low sound pressure levels near the foundation (100 to 151 dB re 1 μPa), decreasing to ambient levels within 1 kilometer (Lindeboom et al. 2011; Tougaard et al. 2009; Dow Piniak et al. 2012). Noise generated by operating WTGs would be detectable out to a few kilometers in areas with very low ambient noise levels but would be below ambient in areas with high ambient noise from shipping or wind. While underwater sound generated by WTGs is audible to marine mammals, including NARWs, the sound levels are lower than the regulatory injury threshold, typically are lower than the behavioral thresholds, and often are lower

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		than the ambient sound levels that these animals typically experience. Given the attenuation of the WTG-generated sound levels within 1 to 2 kilometers, it is highly unlikely that migrating NARWs would be behaviorally affected by the operating WTGs.
1109-0005	On Page 319 SUMMARY OF NOISE IMPACTS "Considering the extent of offshore wind projects planned in the geographic analysis area (Appendix F) it is likely that underwater noise impacts sufficient to cause adverse effects on marine mammals occur. ...impact pile driving UXO detonations and to a lesser extent vibratory pile driving could cause PTS/injury-level effects in marine mammals. UXO detonation may also cause non-auditory mortality at close range. All noise sources have the potential to cause behavior-level effects and some may also cause TTS in certain species".* TTS is a relatively short-term reversible loss of hearing following noise exposure* PTS is an irreversible loss of hearing (permanent damage) So how and why would we know this and proceed with this offshore wind project in such an important migratory corridor for 5 endangered species including one critically endangered and many other marines mammals and fish species. The concern is about the North American Right Whale the Humpback Whale Fin whale Sei Whale Minke whale Sperm Whale Long Finned Pilot Whale Common Bottlenose Dolphin Short Beaked Common Dolphin Atlantic White Sided Dolphin Atlantic Spotted Dolphin Risso's Dolphin Harbor Porpoise HarborSeal Gray Seal. (also all these animals were listed in the Takes). Again why are we knowingly doing this? We can do better and we need to do better.	Impacts of underwater noise on marine mammals are analyzed in EIS Section 3.15. Ocean Wind has incorporated APMs in its Letter of Authorization Application as presented in EIS Appendix H, Table H-1. Additional agency-proposed mitigation to reduce impacts on marine mammals are described in Table H-2. APMs and agency-proposed mitigation measures are enforceable and would reduce impacts of the Project on marine mammals.
1116-0001	The North Atlantic Right Whale ("NARW") population is now estimated to be at only 336 individuals [Footnote 2: H.M. Pettis et al. North Atlantic Right Whale Consortium 2021 Annual Report Card: Report to the North Atlantic Right Whale Consortium (2022) https://www.narwc.org/uploads/1/1/6/6/116623219/2021report_cardfinal.pdf.] and its Potential Biological Removal ("PBR") is down to 0.7. "This means that for the species to recover the population cannot sustain on average over the course of a year the death or serious injury of a single individual due to human causes."[Footnote 3: Federal Register Vol. 87 No. 146 at 46922 (2022) ("NMFS Proposed Speed Rules").] Subsection 8(p)(4) of the OCLSA sets forth certain requirements that the Secretary "shall ensure" are met. One of those requirements are that the Secretary ensure the protection of the environment	Ocean Wind has incorporated APMs in its Letter of Authorization Application as presented in EIS Appendix H, Table H-1. Additional agency-proposed mitigation to reduce impacts on marine mammals are described in Table H-2. APMs and agency-proposed mitigation measures incorporated into the ROD for the EIS are enforceable and would reduce impacts of the Project on marine mammals. Ocean Wind has not requested Level A take (that has the potential to injure a marine

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	which includes the marine environment. Thus BOEM has a statutory duty to ensure that not a single NARW suffers serious injury or death. A similar duty exists under the Marine Mammal Protection Act ("MMPA"). National Marine Fisheries Service ("NMFS") must not issue an IHA for any take of the NARW unless NMFS can and does prescribe measures necessary to ensure that death or serious injury of a single whale does not occur.	mammal) for NARW in the Letter of Authorization Application for the Project, and Level A take of NARW would likely not be authorized by NMFS.
1116-0003	As the DEIS states (3.15-3) "NARWs were observed during the EBS surveys (i.e. detected visually or acoustically) in every season and are considered regular visitors to the Offshore Project area (NJDEP 2010). During these surveys foraging was observed and the presence of a cow-calf pair was documented suggesting that nearshore waters off New Jersey serve as feeding and nursery habitat (NJDEP 2010). Initial sightings of females and subsequent confirmations of these same individuals in calving grounds illustrate that these waters are part of the species' migratory corridor (NJDEP 2010). NARWs may use the waters off New Jersey for short periods of time as they migrate or follow prey movements or they may remain in the area for extended periods of time." Ocean Wind is incompatible with protecting the NARW and incompatible with the Secretary's duties under the OCSLA.	BOEM is coordinating with federal agencies and state and local governments in accordance with requirements to ensure that renewable energy development occurs in a safe and environmentally responsible manner.
1234-0004	Finally this area is the site of right whale Atlantic sturgeon and other endangered turtle species for a portion of the year. Fisheries are held to significant regulatory restrictions to minimize potential impact. BOEM must develop a similar system to ensure the whales Atlantic sturgeon and other marine endangered species continued protection prior to approving this project with possible significant acoustic impacts during construction and operation. This must address the cumulative effects of these projects on right whales during all phase of the projects through decommissioning. Table 3.9-4 commercial development of federally permitted vessels in mid Atlantic and New England fisheries and level of fishing by port omits Atlantic City Barnegat and Sea Isle. There is also no consideration of the impact of cooling of the transmission operations off shore in this draft COP/DEIS. This should be considered and addressed.	Appendix H of the Ocean Wind 1 EIS describes the APMs and additional agency-proposed mitigation being considered to reduce impacts on marine mammals. APMs and agency-proposed mitigation measures incorporated into the ROD for the EIS are enforceable and would reduce impacts of the Project on marine mammals, sea turtles, and fish. Table 3.9-4 identifies the top 20 highest revenue ports in the geographic analysis area. This table was updated for the Final EIS and now includes Atlantic City and Barnegat Light. As noted by the commenter, cooling of transmission operations is not specified in the COP and therefore is not analyzed on the EIS.
1259-0067	The geographic analysis area (Figure 3.15-1) included in the Draft EIS is likely to capture the majority of the movement range for most species in this group but it fails to include all areas that would be transited by Project vessels. For example	Vessel traffic effects on marine mammals involving transits from Europe were analyzed in Section 3.2.6.7 of the NMFS

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	the Draft EIS must consider the very real possibility that local supply chains will not be established on the timeline required for Ocean Wind 1's construction resulting in impacts to marine mammal species from vessels traversing the Atlantic Ocean in order to support this project. [Footnote 54: See John Engel U.S. offshore wind generation goals have a supply chain problem Renewable Energy World (Aug. 13 2021) https://www.renewableenergyworld.com/wind-power/u-s-offshore-wind-generation-goals-have-a- supply-chain-problem/.] This is a significant concern and a glaring omission resulting in an incomplete assessment of Ocean Wind 1's impacts.	BA and are incorporated by reference into Section 3.15 of the EIS. ESA consultation with NMFS is ongoing and findings of the Biological Opinion are incorporated into the Final EIS.
1259-0068	Twenty (20) marine mammal species have the potential to interact with the Project as they are likely to have regular or common occurrences in the Project area (DEIS 3.1.5.1). Of particular note is the fact that this region is the migratory corridor for the highly endangered North Atlantic right whale [Footnote 55: Luke Hanna Is Offshore Wind Development a Threat to the North Atlantic Right Whale? TETHYS (Aug. 27 2012) https://tethys.pnnl.gov/stories/offshore-wind-development-threat-north-atlantic-right-whale.] which has less than 340 surviving individuals and is in serious danger of becoming extinct. Nevertheless Ocean Wind 1 and its immediate vicinity overlap with a hotspot for marine mammal strandings during the last two decades. These stranding events have routinely included seals porpoises dolphins humpback whales fin whales and other whales routinely but the Draft EIS never considers the potential consequences of placing an industrial-scale wind energy development project within this pre-existing stranding hotspot. This is a significant concern that BOEM must address in its environmental review for Ocean Wind 1.	The commenter has not provided a citation for the assertion that the geographic analysis area is a “hotspot for marine mammal strandings.” As reported in the NMFS BA, there have been no recorded strandings of sei whales or sperm whales in New Jersey since 2008. Blue whales are known to be an occasional visitor to U.S. Atlantic Exclusive Economic Zone waters, with limited sightings. Ten fin whales are reported to have stranded along the New Jersey coast from 2008 to 2017. Of these, nine were determined to be the result of vessel strikes and one was ruled an entanglement. APMs and potential agency-proposed mitigation that would reduce the risk of vessel strike and entanglement for marine mammals are included in EIS Appendix H. APMs and agency-proposed mitigation incorporated into the ROD for the EIS would be enforceable and would reduce impacts of the Project on marine mammals.
1259-0069	North Atlantic right whales are considered regular visitors to the Ocean Wind 1 Project area. [Footnote 56: DEIS at 3.15-3.] In fact foraging and even the presence of a cow-calf pair have been documented suggesting that nearshore waters off New Jersey serve as feeding and nursery habitat. Initial sightings of females and subsequent confirmations of these same individuals in calving grounds confirm that these waters are part of the species' migratory corridor.	The commenter restates information contained in the Draft EIS. Impacts of the Project on ESA-listed marine mammals are analyzed in EIS Section 3.15 and the NMFS BA for the Project.

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	[Footnote 57: DEIS at 3.15-3.] These observations in turn reaffirm the serious risks that Ocean Wind 1 poses to this highly endangered species and the need for a critical eye with respect to the scope of harms from introducing even more anthropogenic activity into the species' range.	
1259-0070	Next the Draft EIS inaccurately overestimates the North Atlantic right whale population at 412. More accurately the North Atlantic Right Whale Consortium currently estimates the population census to be 336. [Footnote 58: H.M. Pettis et al. 2021 Report Card North Atlantic Right Whale Consortium (2021) https://www.narwc.org/uploads/1/1/6/6/116623219/2021report_cardfinal.pdf.] Plus with reproducing females estimated to be less than 100 this species has even become the most recent addition to NOAA Fisheries' Species in the Spotlight which is an agency-wide effort launched in 2015 to spotlight and save marine species that are among the most at risk of extinction in the near future. The newest threat to the North Atlantic right whale is the declining body lengths of calves due to sub-lethal stressors including likely impacts from climate change. Additionally anthropogenic stressors exacerbate indirect and incidental pressures on the vulnerable population and recoveries are not encouraging. [Footnote 59: See Joshua D. Stewart et al. Decreasing body lengths in North Atlantic right whales Current Biology 31:14 3174-179 https://www.sciencedirect.com/science/article/pii/S096098222100614X.]	The NMFS BA for the Project cites the draft 2021 NMFS stock assessment report population estimate of 368 for the NARW. Section 3.15.1 of the Final EIS has been updated for consistency with the NMFS BA.
1259-0071	Accidental Releases According to the Draft EIS the region experiences frequent and chronic accidental releases of fuels fluids and hazardous materials from ongoing activities and these risks will increase with increasing vessel traffic over the next 35 years. However the marine mammals in this region are already subject to anthropogenic stressors and uniquely vulnerable to their impacts. Additional risks include increased sedimentation from land and seabed disturbance as well as trash and debris. Ocean Wind 1 and related activities are only likely to further stress the marine mammals.Due to the aforementioned limitations on the impacts analysis the Draft EIS's statement that "these impacts from accidental release and discharges from other offshore wind activities would likely be minor for mysticetes odontocetes and pinnipeds and are likely to result in long-term consequences to individuals that are detectable and measurable but do not lead to population- level effects" cannot be accurate. Regarding the North Atlantic right whale for instance the Draft EIS acknowledges that these impacts would not be minor. Nevertheless it categorizes these impacts as moderate for North Atlantic right whales on the basis that they would result in population-level effects through detectable and measurable impacts on the individual but the population can be expected to sufficiently recover.	Section 3.15.3 of the Final EIS is clarified to state that impacts from accidental release and discharges from other offshore wind activities would likely be minor for mysticetes, odontocetes, and pinnipeds, except for NARW. However, if these releases or discharges were to occur, they are likely to result in long-term consequences to a few individuals that are detectable and measurable but would not lead to population-level effects. Impacts from accidental release and discharges from planned offshore wind activities would likely be moderate for NARW and have the potential to result in population-level effects through detectable and measurable impacts on the individual, but the population should sufficiently recover.

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TRANS-0002-0005	The timing when can construction happen if we need to take into account the migration timing and considerations for all the marine mammals we have offshore and so many other species.	APMs in EIS Appendix H (*Mitigation and Monitoring*) would limit impact pile driving and UXO detonations between January and April.
TRANS-0004-0003	According to the DEIS marine mammal composition in the marine mammal geographic analysis area includes 38 species. 20 of those have a potential to interact with the project five of these are marine mammals that are classified as endangered the Blue Whale Fin Whale Sea Whale Sperm Whale and the North Atlantic Right Whale. The geographic analysis area is likely to capture the majority of movement for most species in the group but does not include all areas that would be transited by projects in Europe. Local supply chains are not established and that is the biggest unknown.	Vessel traffic effects on marine mammals involving transits from Europe were analyzed in Section 3.2.6.7 of the NMFS BA and are incorporated by reference into Section 3.15 of the EIS. ESA consultation with NMFS is ongoing and findings of the Biological Opinion are incorporated into the Final EIS.
TRANS-0004-0004	Impacts of no action alternated on marine mammals is described to be minor however with normal mitigation measures impacts of these alternatives are described as being negligible to major. It is unclear in the DEIS how these alternatives will just result in very negligible impacts. Coming to the North Atlantic Right Whale it is not surprising that these species were observed during the (inaudible) they occur in all seasons the wind energy areas coincide with their north south migratory corridor from th gulf of Maine to the coast of Georgia and Florida. They also use a near shore habitus for foraging. DEIS actually inaccurately overestimated the population as 412. The sedation model that was used is also from 2018 and does not include the mortality since then. While the species is listed as endangered it is described as not being a critical habitant in the area of direct effect. Actually the current population for this North Atlantic Right Whale is estimated to be less than 340 with reproducing females estimated to be less than 100. This species faces a serious threat of extinction. A more recent 2021 study also shows how these whales are seriously impacted by anthropogenic stressors that are actually resulting in decreased body sizes.	The impact level assigned to impacts in Section 3.15 varies by IPF and may also vary for specific species (i.e., NARW) or groups of species (i.e., LFC, MFC, or HFC). This results in a range of impacts across Section 3.15. Negligible impacts of the Project on marine mammals are associated with EMF and displacement effects, water quality impacts (i.e., turbidity) resulting from cable emplacement, accidental releases and discharges, operational lighting, and gear utilization. The NMFS BA for the Project cites the draft 2021 NMFS stock assessment report population estimate of 368 for the NARW. Section 3.15.1 of the Final EIS has been updated for consistency with the NMFS BA.
TRANS-0042-0003	To start it doesn't make sense for the National Marine Fishery Service to close the public comment period for Ocean Wind 1's incidental harassment authorization application and refer to BOEM's analysis for NEPA's purposes before the full scope of impacts to marine mammals can be fleshed out through the DEIS process	NMFS is conducting a separate but parallel review of Ocean Wind's Letter of Authorization Application and the full scope of impacts related to this narrower aspect of the Proposed Action are fully disclosed in the Letter of Authorization Application.

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		The scope of the Ocean Wind 1 EIS encompasses, but is broader than, the decision that NMFS will make on the Letter of Authorization. As such, it is appropriate for these processes to run in parallel.
TRANS-0079-0005	Concerning marine mammals I would like to see a more thorough discussion concerning the North Atlantic Right Whale. Today there are only about 350 remaining with fewer than 100 breeding females. Human activities like fish strikes and fishing gear entanglements are driving this species to the brink of extension. I would like to see a more thorough discussion if the construction and use of these wind turbines will impact current Right Whale migration roots and will it alter current shipping roots there by making the whales more susceptible to vessels strikes.	Impacts on NARWs are discussed in more detail in the NMFS BA for the Project that is incorporated by reference into the EIS. ESA consultation with NMFS is ongoing and findings of the Biological Opinion are incorporated into the Final EIS.
0011-0005	Acoustical studies on operational noise are inadequate to determine the impact on marine species and no Final EIS should be issued for any project until such a study is available. BOEM states in 3.15-45 "Turbine operation noise: Offshore WTGs produce continuous non-impulsive underwater noise during operation. Current and near-term commercially available WTGs likely used for the Project range from 12.4-MW to 14.7- MW WTGs using the direct-drive GE Haliade-X 12-MW WTG. SPLs measured from direct-drive WTGs within this size range do not currently exist in the literature and modeling scenarios are limited to two studies with a high degree of uncertainty". One study published in the journal of the Acoustical Society "How could operational underwater sound from future offshore wind turbines impact marine life?"6 suggests levels as high 177 to 177 decibels at a 10 MW direct drive turbine. Using the National Oceanic Atmospheric Administration criterion for behavioral disruption for continuous noise (i.e. level B at 120 decibels) a single 10 MW direct drive turbine is expected to cause behavioral response in marine mammals up to 1.4 km (0.85 miles) distance from the turbine. As the turbines will spaced on a 1 by 1.2 mile grid the Level B threshold will likely be exceeded everywhere in the project area resulting in this having a major impact. The critically endangered North Atlantic right whale commonly seen in the project area would be severely impacted by noise harassment and there is no obvious mitigating action to protect the whale. Gamesa offers a 10 MW direct drive turbine for sale but none have been installed yet. Until actual acoustical testing is completed on such a turbine no offshore wind project should be approved.	Additional analysis of operational noise has been added to Section 3.15 of the Final EIS (see responses to comments 1012-0009a–e).
0222-0006	For installation of both the WTG and OSS monopile foundations [Bold: 24-hour-per-day pile driving] is expected to occur. Extensive acoustic monitoring and	BOEM would only approve pile driving to be initiated in low-visibility conditions if the

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	observers are planned these also include thermal or infrared cameras night vision devices and infrared spotlight. The [Bold: efficacy of these other monitoring devices is relatively unknown.] The [Bold: efficacy of deterring other marine mammal species through pile driving ramp-up procedures is unknown.]	lessee is able to demonstrate that the proposed alternative monitoring technology would be able to monitor for the same distance as daylight/high-visibility conditions. Studies are currently underway and the requested information and analysis would be provided by the lessee to BOEM and NMFS for review and approval 6 months prior to planned pile-driving activities. See BOEM-proposed measure No. 19 (Alternative Monitoring Plan for Pile Driving) in EIS Appendix H.
0390-0017	One of the main issues that will be caused by the construction and operation of OWl is that it will emit a lot of noise into the marine environment. Known as marine noise pollution this can affect the behaviors of marine animals as well as potentially causing serious injury. Pile-driving during the construction of [Bold: OWF's can generate noise up to 200 dB] while the operation generates up to 120 dB. This noise is mainly generated above the water but transmits through the tower and is then radiated into the surrounding water. Adding to pre-existing noise from other sources. This can affect animal behavior particularly those that are more sensitive to sound that rely on their use of vocalization for communication and those that use echolocation for navigation such as cetaceans (whales dolphins and porpoises).	Section 3.15 addressed the activities associated with the Proposed Action and action alternatives that could cause underwater noise effects on marine mammals including pile driving, vibratory pile driving, geophysical surveys, detonations of UXO, vessel traffic, aircraft, cable laying or trenching, and dredging during construction and WTG operation.
0658-0003	Risking Critically Endangered 350 surviving North Atlantic Right Whales & Endangered Piping Plovers that migrate where turbines are proposed. The underwater noise from these massive turbine is likely to harm these whales relying on sound for communication navigation mating and detecting prey and predators to survive.	EIS Section 3.15, *Marine Mammals*, addressed the activities associated with the Proposed Action and action alternatives that could cause noise effects on marine mammals. Impacts on piping plovers are discussed in EIS Section 3.7, *Birds*.
1259-0059	Noise Activities from Ocean Wind 1 causing underwater noise effects on finfish and invertebrates such as pile-driving drilling and vessel traffic will cause noise impacts that require mitigation to the extent they cannot be avoided. Pile-driving will produce the most intense underwater noise impacts with the greatest potential to cause injury and behavioral effects on finfish and invertebrates. Operational turbine noise meanwhile will occur over the longest duration. Therefore these effects are the focus of the comments below. In context of reasonably foreseeable environmental trends Ocean Wind 1 will contribute a	EIS Sections 3.13 and 3.15 analyze the impacts of underwater noise on finfish, invertebrates, and marine mammals for all noise sources associated with the Project including from HRG surveys, pile driving, and vessel traffic. Additional analysis of operational noise has been added to Section 3.15 of the

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	noticeable increment to the combined noise impacts on finfish and invertebrates from ongoing and planned activities including offshore winds. A serious limitation to understanding interactions between affected species and this new anthropogenic noise however is that the Draft EIS does not address the impacts of anthropogenic noise from Ocean Wind 1 turbine operations over the course of the project's lifetime. For example There is a growing understanding that anthropogenic noise such as pile-driving may affect the behavior of marine mammals and lead to spatial displacement. However there have been no empirical studies linking the consequences of this behavioral response to longer term population change. [Footnote 47: See Helen Bailey et al. Assessing environmental impacts of offshore wind farms: lessons learned and recommendations for the future 10 Aquatic Biosystems (2014) https://aquaticbiosystems.biomedcentral.com/articles/10.1186/2046-9063-10-8#:~:text=The%20major%20environmental%20concerns%20relatedof%20contaminants%20from%20seabed%20sediments.] Plus the noise caused by offshore wind development does not stop after the construction phase. The waters surrounding the lease areas will be subjected to noise generated by the turbines for the duration of the lease. Possible effects of these noises include attraction toward the noise sources avoidance of the area temporary hearing damage and permanent physical injury. As the industry expands the extent to which these effects will disrupt marine life remains unclear and requires continued research from BOEM and Ocean Wind 1.The rapid increase in the number and size of offshore wind farms means that the cumulative contribution from the many turbines will be considerable and should be included in assessments for maritime spatial planning purposes as well as environmental impact assessments of individual projects. [Footnote 48: https://tethys.pnnl.gov/sites/default/files/publications/Tougaard_et_al._2020.pdf] To date most studies on the potential effects of noise from offshore wind energy development have tended to focus on the installation and operation phases. However the four key phases of OWF development (site surveys construction operation and decommissioning) each produce sounds that have the potential to influence marine life and the EIS for Ocean Wind 1 must consider noise generated during each phase in its own context. [Footnote 49: https://tos.org/oceanography/article/acoustic-impacts-of-offshore-wind-energy-on-fishery-resources-an-evolving-source-and-varied-effects-across-a-wind-farms-lifetime]	Final EIS (see responses to comments 1012-0009a–e).
1259-0073	Underwater Noise In the present scenario the biggest threat to marine mammals in the geographic analysis area is underwater noise from proposed offshore-	Planned offshore wind projects are considered reasonably foreseeable

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	wind-related activities the science of which is unknown or known only in parts from studies being done in Europe. The DEIS does not address all the risks and impacts from underwater noise and is incomplete. Table J9 in the Draft EIS (Appendix J J-13) ("Number of Marine Mammal Level A and Level B Takes Requested for Impact Pile Driving of WTG 8-/11-meter Monopiles for the Effective Period of the Letter of Authorization (5 Years Total)") shows that if approved Ocean Wind 1 will result in Level B Harassment of 5492 marine mammals that include low- mid- and high- frequency cetaceans (LFC MFC HFC) and phocid pinnipeds (PW). This Level B harassment includes fifty-seven takes of highly-endangered whale species including twelve (12) North Atlantic right whales. This will also result in Level A Harassment Takes of 77 marine mammals. Table J10 in the Draft EIS (Appendix J J-15) ("Number of Marine Mammal Level A and Level B Takes Requested for Impact Pile Driving of Either OSS Scenario (Three 8-/11-meter Monopiles or Three Jacket Foundations Composed of 16 2.44-meter Pin Piles Each) for the Effective Period of the Letter of Authorization (5 Years Total)") shows that if approved Ocean Wind 1 will result in Level B harassment of 211 or 1423 marine mammals and a Level A harassment of 3 or 19 marine mammals including a minke whale respectively. The Draft EIS however does not take into account the significance of these impacts on marine mammals and fails to account for cumulative impacts and their harm from other projects in the geographic analysis area and in the NY/NJ Bight.	activities, i.e., planned actions that could occur during the life of the Project and potentially could contribute to cumulative impacts when combined with impacts from the Proposed Action and other alternatives. Appendix F (*Planned Activities Scenario*) describes the methodology used for assessing impacts from planned activities in the EIS. Using the methodology described in Appendix F, each resource-specific environmental consequences section in Chapter 3 of the EIS discusses cumulative impacts. The comment does not raise a specific concern with the analysis in the Draft EIS and no revisions were made to the Final EIS in response to the comment.
1259-0075	NOAA's 2018 "Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts" includes preliminary findings of a 2017 study on acoustic thresholds for harbor porpoises and also notes that these findings were recent and would be included during its Version 3.0 revision. [Footnote 65: See National Marine Fisheries Service 2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) NOAA Technical Memorandum NMFS-OPR-59 (2018) https://media.fisheries.noaa.gov/dam-migration/tech_memo_acoustic_guidance_(20)_(pdf)_508.pdf.] And yet the Draft EIS never refers to this study by Kastelein et al. from NOAA's technical guidance.	NOAA’s 2018b study is addressed in Section 3.2.6.2. of the NMFS BA for the Project.
1259-0078	The DEIS describes pile driving (PD) impacts from (i) other offshore wind activities (Section 3.15.3.2) and (ii) Proposed Action (Section 3.15.5). The Draft EIS states: "In the planned activities scenario (see Appendix F) the construction of up to 3109 (Appendix F shows an estimate of 3159) new WTG and OSS foundations in the geographic analysis area would create underwater noise and	The planned activities scenario was updated prior to publication of the Final EIS and cumulative WTG counts were updated across Chapter 3.

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	may affect marine mammal species in the area (see Section I.5.1 of Appendix I)". This seems to be an incorrect reference/typographic error it is not found).	
1259-0081	COA comments on Pile Driving Impacts in DEIS. Per the Draft EIS BOEM prepared a Biological Assessment (not cited correctly had to search the web) for the potential effects on NMFS federally listed species which found that the Proposed Action may adversely affect marine mammals (BOEM 2022). This document also states that consultation with NMFS under Section 7 of the ESA is ongoing. Indirectly this is an admission that the impacts to marine mammals from the Project and Proposed Action could be more adverse. The DEIS does not state what these consultations are and if and how the public will have a timely opportunity to review those and offer recommendations. The DEIS merely states that individual fitness-level impacts are likely. But it does not quantify what these impacts are and which species would be impacted. Additionally it merely states that these impacts would be further reduced with implementation of project-specific measures required as conditions of compliance with the ESA MMPA and other federal regulations. This is a very simplified assumption and could be erroneous to conclude. At present there are not enough regulations to monitor underwater noise.	Consultation with NMFS under Section 7 of the ESA is ongoing. This is typical at this point in the NEPA process. The BA is available on the BOEM website and results are consistent with information presented in the EIS. There is not a public comment period for consultations separate from the comment period for the Draft EIS.
1259-0082	As per the Draft EIS the Proposed Action does not have any plans for concurrent monopile location at more than one location. Will this be upheld? The reason for this concern stems from the subsequent statement in the DEIS which is provided below. The DEIS states: [Underlined: "It is likely that concurrent pile driving may be considered] appropriate or desirable if scheduled to avoid critical periods when sensitive or particularly vulnerable populations (e.g. North Atlantic right whales) are present in high densities and thus result in increasing the (i) geographical extent (ii) sound intensity of exposure (iii) greater potential for TTS and PTS effects for marine mammals present." However the Draft EIS does not factor this in the assessment and investigate the likely harm from such activities in the project area. Concurrent pile driving will cause serious harm and its impacts are not clearly quantified and needs to be avoided.	The acoustic modeling provided for this Project does not analyze concurrent pile driving, and the NMFS BA assumed that only one monopile would be installed at a time. The measures required by the final MMPA Letter of Authorization would be incorporated into COP approval, and BOEM or BSEE would monitor compliance with these measures.
1259-0083	The DEIS also acknowledges a potential scenario of multiple planned construction activities due to which it is likely that some individual marine mammals would experience two or more impact pile-driving noise exposure days within the same year. COA reiterates that this could cause serious harm to vulnerable populations and must be avoided at all costs.	Mitigation for planned activities will be reviewed for each planned project independently during that that project’s NEPA review, ESA consultation, and MMPA application (Letter of Authorization).
1259-0092	Turbine operations growing concerns:·Offshore WTGs produce continuous non-impulsive underwater noise during operation mostly in lower-frequency bands below 1500 Hz (summarized in Section 3.15.3.2).· Current and near-term	Effects of sound generated by operating WTGs are assessed in the NMFS BA for the Project. The NMFS BA determined that

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	commercially available WTGs likely used for the Project range from 12.4-MW to 14.7-MW WTGs using the direct-drive GE Haliade-X 12-MW WTG.·SPLs measured from direct-drive WTGs within this size range do not currently exist in the literature and modeling scenarios are limited to two studies with a high degree of uncertainty. Effects related to the large direct-drive WTGs to be used for the Project are likely like those outlined for offshore wind activities (without the Proposed Action) and would include behavioral and masking effects. Masking of the low-frequency calls emitted from LFC and phocid pinnipeds in water would be more likely to occur. However without further information regarding larger direct-drive WTGs the extent of these effects are unknown. In addition as the modeled values presented in StÖber and Thomsen (2021) extended upward of 177 dB re 1 μPa SPLRMS exceedances for cumulative TTS thresholds are considered possible. Turbine operations and the persistent noise from these installations have not been investigated in detail. With changes in turbine capacities design emitted noise research into their impacts is an important priority. This is an urgent priority in the proposed geographic analysis area and its likely impacts on marine mammals including highly endangered species and the DEIS is deficient in not addressing this important impact.	noise generated by WTG operation is not likely to adversely affect ESA-listed cetaceans, and the analysis completed for the NMFS BA is incorporated by reference into the EIS. ESA consultation with NMFS is underway and findings of the Biological Opinion are incorporated into the Final EIS.
1281-0007b	An even more appalling aspect of the within proposal could be seen in the lack of scientific method with any attempt at a complex economic evaluation to be applied to the critically threatened North American Right Whales. This species is in dire jeopardy due to this specific proposal and the threat of pollution generating windfarms proposed to be constructed directly in the right Whales' primary and sole migratory waterways off the New Jersey Coast. With approximately three hundred fifty (350) North Atlantic Right Whales left in the entire world the DEIS barely touches the surface as to the potential devastating if not terminating impact of this vast industrial project itself and numerous ongoing adverse impacts presented. From a noise perspective pollution generating standpoint and otherwise the construction operation and totally ignored dismantling and decommissioning process of the gigantic wind turbines themselves has insufficiently been addressed.	Noise impacts on NARWs are discussed in Section 3.2.6.4 of the NMFS BA for the Project.
1012-0007a	The presentation of noise impacts on marine mammals in the DEIS is not adequate. It downplays and tries to dismiss the impacts of operational turbine noise which are very significant and could cause non-compliance issues with both the Endangered Species and Marine Mammal Protection Acts. As explained below in detail it arbitrarily dismisses two excellent studies based on noise measurements of smaller and moderate size turbines that show a clear straight-line increase in noise source decibel (dB) level versus the power of the	These comments are focused on the assessment of the operational noise generated by WTGs. The comprehensive overview of WTG-generated noise (pages 3.15-24 to 3.15-25 of the EIS) provides a summary of available information, including the two studies/papers by

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	turbine that can easily be extrapolated to estimate the noise source level from the larger turbines proposed here. Its claim that these studies are too uncertain to make those estimates are not supported by the study data and are inconsistent with the numerous places in the DEIS where conclusions are reached with far less or no data and where other numerical estimates are used with far more uncertainty when that serves to reduce an impact as opposed to the situation here where a new and serious impact emerges.	Tougaard et al. (2020) and Stöber and Thomsen (2021) the commenter states have been dismissed in the Draft EIS. The Draft EIS does not state that these studies are too uncertain to make source level estimates but correctly points out the small sample size used in the modeling of these two papers introduces a level of uncertainty to the modeled results. Noting areas of uncertainty in the results of any paper or report allows the results to be considered in the appropriate context. The Draft EIS further points out that the Tougaard et al. (2020) and Stöber and Thomsen (2021) papers relied on geared turbines rather than the direct-drive turbines proposed for use in Ocean Wind 1. These are some of the reasons why the results of these papers cannot be extrapolated, as the commenter suggests, to the Ocean Wind 1 turbine assessment. Additionally, the Draft EIS notes that “the source levels and frequencies emitted from the larger direct-drive WTGs to be used for the Project would fall somewhere between those recorded for smaller-gear driven WTGs (e.g., 109 to 128 dB re 1 μPa SPL_{RMS} [at varying distances]) (Tougaard et al. 2009a; Lindeboom et al. 2011; Pangerc et al. 2016) and those modeled in Stöber and Thomsen (2021) (e.g., 170 to 177 dB re 1 μPa SPL_{RMS}).”
1012-0007b	With regard to other noise sources discussed in the DEIS e.g. that of pile driving during construction there are no impacts on marine mammals presented in the DEIS body itself which one might expect in an impact statement. The discussion of mitigating measures forces the reader to go to an Appendix and then to other documents to try to find what the actual distances are from the source to meet criteria what the incidences of noise exposures are i.e. "take" numbers are what	Given the extent of information on the impacts on marine mammals from noise generated during construction pile driving, the impact results were presented in an EIS appendix with references to other documents where additional details can be

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	the physical impact of those takes are on the whales. This makes the presentation essentially incomprehensible to a lay person. Further as shown below even after going all through all those documents key factors are never presented e.g. noise source levels noise loss or dissipation factors used (to enable comparison with mainstream factors used) the assumptions made regarding animal reaction to the noise and the effect on right whale's migration. So in addition to comprehensibility there is a full disclosure problem here as well. Table 1. Presentation of Marine Mammal Impact Construction Pile Driving Information Source: DEIS 1.Source Noise Level: N2.Noise Loss Factor: N3.Assumptions re animal behavior determining exposure range: N4.Exposure Range: N5.Animal Densities: N6.Takes: N7.Take Impact (specific to Migration): N Information Source: Appendix J1.Source Noise Level: N2.Noise Loss Factor: N3.Assumptions re animal behavior determining exposure range: N4.Exposure Range: N5.Animal Densities: Y6.Takes: Y (different from LOA)7.Take Impact (specific to Migration): N Information Source: LOA Application1.Source Noise Level: N2.Noise Loss Factor: N3.Assumptions re animal behavior determining exposure range: N4.Exposure Range: Y5. Animal Densities: N6.Takes: Y7.Take Impact (specific to Migration): N Information Source: COP VOL III App R-21.Source Noise Level: Y2.Noise Loss Factor: N3.Assumptions re animal behavior determining exposure range: N4.Exposure Range: N5.Animal Densities: Y6.Takes:Y7.Take Impact (specific to Migration): N BOEM can and should restructure this discussion. They can do this with two tables and then a good analysis of the potential for serious harm or fatality from level B takes as discussed below in our comments on operational noise. The first table can simply contain the noise source level the effective noise propagation loss factor that was used and the area affected to get to criteria. The second table should take the area affected multiplies it by animal density times the number of days of the activity and present the level A and level B takes.	found. It is duly noted that this makes it more challenging for readers to easily locate the relevant impact information and that some of the relevant information, such as source level for some of the pile-driving types, has not been included. However, the level of detail that the commenter is suggesting be included in the main body of the EIS instead of in appendices would make the document equally incomprehensible for most readers. This is the very purpose for moving the more technical information to appendices. Tables of the marine mammal takes associated with the proposed activities are presented in the document, but it is unclear why the commenter is suggesting that the take computation be redone. The takes were correctly computed in Ocean Wind's Letter of Authorization Application using the best available densities and activity schedule available when the application was submitted. Ocean Wind updated its Letter of Authorization Application with new marine mammal density models released by the Duke Marine Geospatial Ecology Lab on June 20, 2022. New density estimates and updates to Ocean Wind's exposure calculations have been incorporated into Final EIS Section 3.15 and Appendix J. The commenter is referred to Ocean Wind's Letter of Authorization Application and Update Memo for a comprehensive presentation of the take request.
1012-0008	[Bold: B. Vessel Surveys.] With respect to high resolution geophysical surveys the DEIS down plays the impact as well by using an unjustified low noise source level of 203 dB for the Dura Spark-240 unit versus 211dB found in other sources	The supposition that the location of the WTGs adjacent to the migratory corridor of the NARWs will likely block the migration

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	and a high 20 dB noise propagation loss factor which is not justified scientifically or consistent with the 15 dB loss factor used by the National Marine and Fisheries Services in many other take authorizations. Our detailed comments on these problems of February 25 2022 to the NMFS on the Ocean Wind 1 vessel surveys are provided in a separate comment submittal and intended to be considered by the BOEM in support of the above comment. Taken together this is not a full disclosure objective understandable presentation of noise impact to marine mammals and the BOEM should go back to the drawing board and restructure its presentation as described below. 2. [Bold: The Impact of Operational Turbine Noise on the right whale.]T he action proposed and all of the alternatives would place a large number extremely large and noisy wind turbines next to the primary migration corridor of North Atlantic right whale. It will very likely block its migration and jeopardize it continuing existence because that corridor would be permeated with noise levels above the 120 dB disturbance criteria from continuous long term operational noise from the 12 megawatt(mw) and higher power gearbox turbines proposed. Two excellent consistent studies of measured noise levels from smaller and moderate sized turbines showing a clear straight-line trend increase in turbine source noise level with turbine power were provided to the BOEM during the NOI comment period NOI1 that can readily be used to estimate the noise source level of the proposed turbines and analyze and determine the extent of that noise permeation into the corridor. A subsequent document was provided to the BOEM addressing their questions on the studies [Footnote W20: Email from Dr. Robert Stern to BOEM staff December 20 2021 ASOW WTG Acoustic Source Level Discussion.]. This is likely the worst impact of this proposal. It potentially could violate both the ESA and MMPA and make the project not viable. But rather the DEIS presents no analysis of the problem at all and tries to obfuscate and dismiss it. It falls back to an extensive discussion of smaller turbine noise levels which are not relevant to this proposal. It makes passing reference to the two studies and dismisses their use without justification. Compounding this omission and as required By CEQ NEPA Rule Section 1502.9(b) that a draft environmental impact statement discuss all major points of view on the environmental impacts and alternatives including the proposed action the DEIS presents nothing regarding the purpose and strength of these two studies by either by the authors or by Save LBI Inc. in its detailed calculations and comments on the notice of intent NOI1 and in subsequent communications [Footnote W20: Email from Dr. Robert Stern to BOEM staff December 20 2021 ASOW WTG Acoustic Source Level Discussion.]. Because this problem can bring into question the projects inappropriate location and legal compliance issues with the ESA and MMPA we	of the NARW is baseless and without merit. The commenter provides no evidence that such a displacement is reasonably likely. The protection of the highly endangered NARW from disruptive noise levels is of utmost concern to BOEM and Ocean Wind. Operational noise from operating WTGs is low frequency (60 to 300 Hz) and at relatively low SPLs near the foundation (100 to 151 dB re 1 μPa), decreasing to ambient levels within 1 kilometer (Lindeboom et al. 2011; Tougaard et al. 2009; Dow Piniak et al. 2012). Noise generated by operating WTGs would be detectable out to a few kilometers in areas with very low ambient noise levels but would be below ambient in areas with high ambient noise from shipping or wind. While underwater sound generated by WTGs is audible to marine mammals, including NARWs, the sound levels are lower than the regulatory injury threshold, typically are lower than the behavioral thresholds, and often are lower than the ambient sound levels that these animals typically experience. Given the attenuation of the WTG-generated sound levels within 1 to 2 kilometers, it is highly unlikely that migrating NARWs would be behaviorally affected by the operating WTGs. It is highly unlikely that WTG operations would cause behavioral responses in the NARW to cause displacement.

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	believe that the presentation of the operational noise issue or rather the lack of it in the DEIS is a deliberate attempt to avoid it mislead the reader and is an abuse by BOEM of its authority. We can think of no reason for an agency to spend a full-page rambling on about the noise levels from smaller turbines which have no relevance to this proposal and then devote two lines to a passing mention of the two studies that it could use to actually illuminate the issue.	
1012-0009a	[Bold: This issue must be addressed in detail in a revised DEIS to allow for public comment and a professional treatment of it.] The necessary analysis is described below. The Ocean Wind project proposes turbine placement 15 to 23 miles offshore (Figure S-1 of the DEIS). The North Atlantic right whale's primary migration corridor here extends from about 20 miles to 32 miles offshore (Exhibit B1). That critically endangered whale must migrate through that corridor south/north each year between its calving and feeding grounds to survive. Its numbers are already low and recently are declining rapidly (Exhibit A). Three miles of the project interects that corridor. As shown below noise from just the outer row of the 12 mw turbines to be used will extend another 3 miles across that corridor at levels above 120dB that will disturb its behavior. So 6 miles or half of the corridor will potentially be blocked impairing the whale's migration and threatening its existence. Given the severity of these impacts the analysis of operational noise is perhaps the most important one to be undertaken and should have been or be presented in the DEIS the Biological Assessment (BA) and the Biological Opinion (BO). To do that analysis the DEIS BA and BO should have: A. Described the precarious status of the right whale B. Estimated the source noise levels of the turbines C. Estimated the noise transmission loss and the distance over which noise levels are above criteria using appropriate noise loss factors. D. Disclosed the available data on animal densities within those distances that would clearly show its primary migration corridor adjacent to the lease area E. Estimated animal "takes" i.e. the number of events during which an animal experiences noise above thresholds F. Determined the likelihood that those takes especially Level B disturbances would block the right whale's migration G. Presented a realistic and transparent assessment of the whale's reaction to those events particularly those that could result in serious injury or fatality	As previously noted, protection of the NARW along with all other marine mammals is of utmost concern to BOEM and Ocean Wind. The data in the enclosed exhibits are undisputed. However, the conclusions drawn in regard to the proposed sound transmissions from the WTGs transecting the migratory corridor are not supported by the physics of sound attenuation. The sound generated by the operating WTGs is highly likely to be at ambient noise levels at the migratory corridor, not forming a “wall of sound” that would affect NARW behavior and would not block the NARW’s seasonal migration. These suppositions are unsupported.

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	H. Provided an analysis of how the masking of the right whale's communication by the turbines could impact its migration and/or result in serious injury or harm and I. summed up and compared those results in items 8 and 9 to pre-set criteria to avoid a threat to its existence. The DEIS does not present any of this as discussed below but first by way of explanation some technical back ground regarding underwater noise.	
1012-0009b	A. [Bold: The DEIS does not clearly show the precarious status of the right whale.] The number of critically endangered North Atlantic right whales (NARW) is already low at 366 animals and in steep decline- Exhibit A. There are less than 94 females of reproductive age left. B. [Bold: Turbine operational source noise levels were not disclosed.] [Bold: Critical to the needed analysis is an estimate of the noise level emanating from the large turbines to be used.] There are no measurements currently available from the larger turbines so the use of the best scientific data available requires that we rely on the trends shown by measurements from smaller and moderate -sized turbines.	The critical status of the NARW population is not in question. The Draft EIS clearly describes the population of the NARW as well as the existing threats to its existence, principally from fishing gear entanglement and vessel strikes. The WTGs' operational noise levels were not disclosed because they have not yet been measured. This same issue of the application of the model results from the Tougaard et al. (2020) and Stöber and Thomsen (2021) papers has been discussed herein in other comments (see responses to comments 1009-0007a, 1009-0009c, 1009-0009d).
1012-0009c	[Bold: Critical to the needed analysis is an estimate of the noise level emanating from the large turbines to be used.] There are no measurements currently available from the larger turbines so the use of the best scientific data available requires that we rely on the trends shown by measurements from smaller and moderate -sized turbines. Two such studies [Footnote W2: Uwe Stober and Frank Thomsen How could operational underwater sound from future offshore wind turbines impact marine life? The Journal of the Acoustical Society of America 149 1791 (2021); https://doi.org/10.1121/10.0003760] [Footnote 17: Tougard Hermansen Madsen How loud is the Underwater Noise from operating offshore wind turbines Journal of the Acoustical Society of America 1482888(2020)] exist that do that and show a clear linear trend of increasing noise source level with turbine power. That trend can be extrapolated out further to get an estimate of the noise level emanating from a larger turbine. The BOEM finally acknowledges in the DEIS the existence of those studies but arbitrarily	The importance and relevance of both the Tougaard et al. (2020) and Stober and Thomsen (2021) papers are without question, which is why both papers have been included in the Draft EIS. The conclusions of the commenter and BOEM regarding these results differ. It should be noted that the relationship between sound level and turbine size that the commenter notes showing "a clear linear trend of increasing noise source level with turbine power" from the Tougaard et al. (2020) paper is not accurate. Their models assumed that SPL increases linearly with WTG capacity,

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	refuses to use their results to estimate the noise from larger turbines as we describe below. It continues to base conclusions on the noise levels from smaller turbines which is technically indefensible and dismisses the issue with a single paragraph discussion. This is an egregious omission in the DEIS. A detailed noise impact analysis using the predicted source levels from those studies for 12 mw and higher power turbines must be done as described below. Such an analysis is also required By CEQ NEPA rule §150221. which states that when essential information to a reasoned decision is not directly available the agency must provide "a summary of existing credible scientific evidence that is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; [Bold: and the agency's evaluation of such impacts] based upon theoretical approaches or research methods generally accepted in the scientific community". The extrapolation of results from clear trends is generally accepted in the scientific community. The DEIS does not present estimates of the elevated underwater noise levels expected from the large gearbox turbines to be used based on two credible scientific studies [Footnote W2: Uwe Stober and Frank Thomsen How could operational underwater sound from future offshore wind turbines impact marine life? The Journal of the Acoustical Society of America 149 1791 (2021); https://doi.org/10.1121/10.000376] [Footnote W17: Tougard Hermansen Madsen How loud is the Underwater Noise from operating offshore wind turbines Journal of the Acoustical Society of America 1482888(2020)] that show clearly increasing noise levels as the power of the turbine increases. Using those trends based on actual measurements the noise source level for the larger turbines can be estimated as shown below which is critical to analyzing the problem of the impact to the whales.	which contrasts with what is known of typical mechanical systems. The relationship is logarithmic, not linear. To illustrate this, Equation 1 from the Tougaard et al. (2020) paper was implemented using a value of 15 m/s (twice the mean windspeed in New York City harbor) and a turbine size of 12 MW, which produced an L_{eq} value of 175 dB re 1μPa^2 at a range of 1 meter. However, the value at 200 meters range drops below 120 dB re 1μPa^2, which is the NMFS behavioral criteria for continuous sounds. The sound levels drop below ambient noise levels within 1 kilometer of each turbine. The monopiles for the wind farm are planned to be spaced approximately 1 nm (1.85 kilometers) by 0.8 nm (1.48 kilometers) in a southeast-northwest orientation. Therefore, from the perspective of an animal swimming through those waters, only one turbine would likely be heard at a time, and only at relatively close range to the turbine. As noted previously, most of the data used in the analysis of the Tougaard et al. (2020) paper are from geared turbines, while the wind turbines proposed for Ocean Wind 1 are direct-drive turbines. Therefore, data are not interchangeable as the commenter suggests, as direct-drive turbines are expected to be quieter than geared turbines. The commenter suggests that the EIS basing conclusions on the noise levels from smaller turbines than planned for use is technically indefensible, yet they suggest a similar approach in using data from an entirely different type of

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		louder turbine than planned for use in Ocean Wind 1.
1012-0009d	Using the Stober referenced study [Bold: broadband noise source levels for 12 mw gearbox turbines are predicted at 176 dB W2] using the root mean square trend line of Figure 1 of the study below. [See original comment for image] That 176 dB dB source noise level is confirmed by the second Tougaard study [Footnote W17: Tougard Hermansen Madsen How loud is the Underwater Noise from operating offshore wind turbines Journal of the Acoustical Society of America 1482888(2020)]. The authors there also tabulated correlated and plotted broadband sound levels as a function of wind speed power and distance. Figure 3(C) below shows the trend in received noise level at 100 meters from the source versus turbine power for monopile foundations. Drawing a trend line through that monopile data and extrapolating it out to 12 megawatts results in noise level of 130 dB. Back calculating that from 100 meters to the turbine source at 1 meter adds 47.4 dB (page 21) resulting in a [Bold: 177 dB noise source level consistent with the Stober study.] [See original comment for image] In study 1 following author Stober's suggestion the spectral root means square line is actually a better indicator of the increase in noise level as turbine power increases because it is more indicative of frequency range that the whale hears. Extrapolating that trend line in his Figure 1 out to 12 mw-for gearbox turbines to be used [Bold: results in a turbine noise source level of 186 dB.] [Bold: Subtracting 10 dB for direct drive turbines] as Stober suggests yields a broadband source level of 167 dB and a spectral source level of 176 dB. So the Stober and Tougaard studies are consistent credible and reliable and show that we are actually looking at turbine source [Bold: operational noise levels between 167 and 176 dB]. These source levels should have but were not used in the DEIS to assess the operational noise impact on the whales. The DEIS acknowledges a 177 dB level from the studies for a smaller 10 mw gearbox turbine but even refuses to use that for an analysis and instead reverts back to an irrelevant discussion of a 6-mw turbine. The DEIS dismisses these studies because of their uncertainty and small sample size. But Tougaard states in his study that it has "good explanatory power" due to an ample sample size of 46 and a coefficient of determination of 0.67 indicating that a good part of the uncertainty (in any set of measurements)	The Draft EIS does not dismiss the results of the Tougaard et al. (2020) or Stöber and Thomsen (2021) papers but includes them in the following source-level conclusion (Draft EIS page 3.15-45): "It is likely that source levels and frequencies emitted from the larger direct-drive WTGs to be used for the Project would fall somewhere between those recorded for smaller-gear driven WTGs (e.g., 109 to 128 dB re 1 μPa SPLRMS [at varying distances]) (Tougaard et al. 2009a; Lindeboom et al. 2011; Pangerc et al. 2016) and those modeled in Stöber and Thomsen (2021) (e.g., 170 to 177 dB re 1 μPa SPL_{RMS})…..In addition, as the modeled values presented in Stöber and Thomsen (2021) extended upward of 177 dB re 1 μPa SPL_{RMS}, exceedances for cumulative TTS thresholds are considered possible." Effects of sound generated by operating WTGs are assessed in Section 3.2.6.2.4.2 of the NMFS BA for the Project. Using the least-squares fits from Tougaard et al. (2020), SPLs from 11.5-MW turbines (in 20-m/s, gale-force wind) would be expected to fall below the 120 dB re 1 μPa behavioral threshold within 245 meters (about 800 feet). In lighter, 10-m/s winds (approximately 20 knots), the predicted range to threshold would be 140 meters (about 460 feet). It is noted that these ranges are substantially lower than the commenter's suggested ranges. The ranges presented in the NMFS BA have been added to the Final EIS. In addition, discussion of the uncertainty around

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	is explained by the trend line results. In addition the Stober study has an ample sample size of at least 24 measurements.	operational noise sources has been added to Appendix D (*Analysis of Incomplete and Unavailable Information*), Section D.1.12 (*Marine Mammals*).
1012-0009e	Another example of disparate approaches lies in his estimation of exposure ranges from noise sources and its impact on endangered mammals. Here it purports to use a model without any explanation of the model's key equations assumptions and inputs to predict the actual behavior of the North Atlantic right whale approaching a noise source and its reactions to various noise levels for which there is virtually no measured data. The BOEM is simply avoiding the issue because it knows that it has significant implications is regard to compliance of the project with the Endangered Species Act and the Marine Mammal Protection Act. This avoidance of what may be the most important environmental impact of this project is not acceptable.	Detailed discussion of the underwater acoustic and exposure modeling assumptions for the Project (including results of animal movement modeling) can be found in COP Appendix R-2 posted to BOEM's website and in Ocean Wind's Letter of Authorization Application. The key assumptions of the acoustic modeling are also summarized in EIS Appendix J (*Underwater Sound and Acoustic Modeling Results*). BOEM has initiated consultation with NMFS under the ESA and has incorporated results of the consultation and the Biological Opinion into the Final EIS.
1012-0009f	C. [Bold: The distance to meet Noise Disturbance Criteria was not Estimated.] The DEIS does not analyze and disclose the distance necessary for source noise to fall below the 120 dB National Marine and Fisheries Service (NMFS) level B criterion for disrupting marine mammal behavior from continuous noise [Footnote W4: Madsen et al. Wind turbine underwater noise and marine mammals: implications of current knowledge and data needs Marine Ecology Progress Series Vol 309:279-2952006 https://www.int-res.com/articles/meps2006/309/m309p279.pdf] [Footnote W5: Nowacek et al. North Atlantic right Whales ignore ships but respond to alerting stimuli The Royal Society may 20 2003.http://myweb.facstaff.wwu.edu/shulld/ESCI%20432/Nowacek2004.pdf] [Footnote W6: Van Der Hoop et al. Foraging Rates of ram-filtering North Atlantic right whales Functional ecology Volume 33 pages 1290-1306. https://core.ac.uk/download/pdf/323987541.pdf]. Using the formula in the first studyW2 for transmission loss 15 log10 (r/r0) it takes 0.8 miles [Footnote W2: Uwe Stober and Frank Thomsen How could operational underwater sound from future offshore wind turbines impact marine life? The Journal of the Acoustical Society of America 149 1791 (2021); https://doi.org/10.1121/10.0003760] [Footnote W17: Tougard Hermansen Madsen How loud is the Underwater Noise from operating offshore wind turbines Journal of the Acoustical Society of	120 dB is the acoustic threshold for behavioral effects relevant to sound generated by non-impulsive or continuous sources. When offshore wind turbines are operating continuously, they can be considered a continuous source to which the 120-dB behavioral threshold applies. Effects of sound generated by operating WTGs are assessed in Section 3.2.6.2.4.2 of the NMFS BA for the Project. Using the least-squares fits from Tougaard et al. (2020), SPLs from 11.5-MW turbines (in 20-m/s, gale-force wind) would be expected to fall below the 120 dB re 1 µPa behavioral threshold within 245 meters (about 800 feet). In lighter, 10-m/s winds (approximately 20 knots), the predicted range to threshold would be 140 meters (about 460 feet). It is noted that these ranges are substantially lower than the

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	America 1482888(2020)] [Footnote W3: Thomsen et al. The Effects of Offshore Wind Farm Noise on Marine Mammals and Fish July 06 2006. https://seagrant.gso.uri.edu/oceansamp/pdf/presentation/present_gill_europe.pdf] for the noise from a single turbine with the more conservative source noise level of 167 dB to drop to 120 dB. The 0.8-mile distance above is for a single turbine 180 dB source. At distances close to that source it dominates the received noise level. But at distances miles away the contributions from neighboring turbines become comparable and must be considered. For example with a one mile spacing just the six other turbines closest to a receiver 6 miles away will add 8.3 dB to the received noise level again using the 15 log10 (r/r0) formula. That is equivalent to having a single equivalent source for all seven turbines of 175.3 dB and that requires 3 miles to bring that level down to 120 dB. This would envelop half of the entire 12-mile-wide right whale migratory corridor with noise above the 120 dB disturbance criterion since the project also intersects another 3 miles of the corridor in the other direction. It is of course worse for the higher derived spectral noise source levels of 184.3 dB. In that case the distance to reach the 120 dB criteria is 12 miles and would envelop the entire corridor with levels above that. These distances relative to the width of the right whale's migratory corridor are shown below. [See original comment for table] [Bold: Therefore from half to all of the primary migration corridor is essentially blocked depending on whether the broadband or spectral noise source level is used.] When the entire wind complex is considered the zone of influence for behavior disruption will be even larger and the sound levels within the migratory corridor more intense. Also since the noise zone of influence is much larger than the turbine spacing of about a mile the 120 dB level will also be exceeded everywhere in the project lease area. These distances and their associated areas should have but were not presented in the DEIS. That presentation should consider all the turbines proposed as sources and provide tables and isopleths on maps showing the distances required for noise levels to decline to threshold criteria superimposed on the right whale's primary migration corridor.	commenter’s suggested ranges. The ranges presented in the NMFS BA have been added to the Final EIS. In addition, discussion of the uncertainty around operational noise sources has been added to Appendix D (*Analysis of Incomplete and Unavailable Information*), Section D.1.12 (*Marine Mammals*).
1012-0011f	E. [Bold: The impact on the Whale's Migration from operational turbine noise was not addressed in the DEIS.] The noise levels described above create a "wall" of noise across the turbine complex and the whale's migration corridor	As noted in response to the previous comment, SPLs from 11.5-MW turbines (in 20-m/s, gale-force wind) would be

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	potentially blocking it but this is not addressed in the DEIS. It will be extremely difficult for the whales to avoid that expanse of elevated noise and continue their migration. Attempting to do so could expose them to high cumulative sound exposures potentially exceeding hearing threshold shift criteria cause loss of communication between and separation of females from calves stranding and loss of echolocation and other navigational abilities. Experiments have shown [Footnote W5: Nowacek et al. North Atlantic right Whales ignore ships but respond to alerting stimuli The Royal Society may 20 2003.http://myweb.facstaff.wwu.edu/shulld/ESCI%20432/Nowacek2004.pdf] that one reaction of the right whale to such sound disturbances is to ascend and swim just under the surface where it is vulnerable to vessel strike. The proposed use by the Coast Guard [Footnote BG2: BOEM Commercial and Research Wind Lease and Grant Issuance on Site Assessment Activities on the OCS of the NY Bight Draft EA August 2021 page 41 and Figure 9.] of the right whale's migration corridor as a new deep draft vessel lane (Exhibit C) would significantly increase the risk of vessel strike once it ascends. Mitigating measures involving detection and turbine shut down are not viable for the large noise influence zones and multi-year operational time frames here leading to the need to re-consider this lease area as unsuitable for large turbine placement.	expected to fall below the 120 dB re 1 µPa behavioral threshold within 245 meters (about 800 feet). In lighter, 10-m/s winds (approximately 20 knots), the predicted range to threshold would be 140 meters (about 460 feet). WTG spacing for the Project would be 1 nm (6,076 feet) by 0.8 nm (4,860 feet) between WTGs in a southeast-northwest orientation, which would allow for the passage of whales through the array without operational WTG noise above the behavioral threshold.
1116-0005	The DEIS fails to use the best scientific evidence. The DEIS states at 3.15-4: "Based upon the most recent NOAA Fisheries stock assessment the western North Atlantic stock of NARW consists of 412 individuals (as outlined in Appendix I) (Hayes et al. 2021)." NARW population is now estimated to be at only 336 individuals. [Footnote 6: H.M. Pettis et al. North Atlantic Right Whale Consortium 2021 Annual Report Card: Report to the North Atlantic Right Whale Consortium (2022) https://www.narwc.org/uploads/1/1/6/6/116623219/2021report_cardfinal.pdf.] "North Atlantic right whales are vulnerable to vessel strike due to their coastal distribution and frequent occurrence at near-surface depths and this is particularly true for females with calves. The proportion of known vessel strike events involving females calves and juveniles is higher than their representation in the population (NMFS 2020)." Federal Register Vol. 87 No. 146 at 46922-46923 (2022) ("NMFS Proposed Speed Rules"). "Reducing vessel speed is one of the most effective feasible options available to reduce the likelihood of lethal outcomes from vessel collisions with right whales." Id. at 46923. "Vessel strikes continue to occur all along the U.S. coast from the Gulf of Maine to the Florida coast. There is no indication that strike events only occur in "hot spots" or limited spatial/ seasonal areas." Id. at 46924. in many cases the location of the strike	Under the current version of the Vessel Strike Reduction Rule (73 *Federal Register* 60173 and as amended in 78 *Federal Register* 73726), Ocean Wind has proposed a Vessel Strike Avoidance Plan composed of two subplans. Plan A complies with Seasonal Management Area speed restrictions for vessels greater than 65 feet. However, instead of slowing down to 10 knots in response to (voluntary) Dynamic Management Areas, Plan A involves relying on a robust, site-specific, real-time passive acoustic and visual monitoring system to trigger vessel slow-downs in specific Project action zones. Plan B voluntarily complies with suggested vessel speed restrictions in Dynamic Management Areas (in addition to required Seasonal Management Area speed

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	event remains unknown." Id. "[T]he current speed rule and other vessel strike mitigation efforts are insufficient to reduce the level of lethal right whale vessel strikes to sustainable levels in U.S. waters." Id. at 46925. "It remains unclear how right whales respond to close approaches by vessels (<1509 ft (460 m)) and the extent to which this allows them to avoid being struck." Id. at 46926. NMFS has determined that the PBR for the NARW defined by the MMPA as "the maximum number of individuals not including natural mortalities that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population" is 0.7 whales. NMFS Proposed Speed Rules at 46922. "This means that for the species to recover the population cannot sustain on average over the course of a year the death or serious injury of a single individual due to human causes." Id. NMFS has determined that speed of vessels is the most relevant factor in causing death from vessel strikes. Id. at 46923. Yet the DEIS has failed to take a hard look at what speed limit on all Ocean Wind's and other offshore wind vessels must be imposed all the time as part of the measures so as to result in the least practicable impact on the NARW and so as to ensure (i.e. guarantee make certain) that no death or serious injury to even a single whale from Ocean Wind's and other offshore wind vessels occurs. The DEIS has failed to take a hard look at the measures needed to ensure that there is no death or serious injury to even a single whale from Ocean Wind's and other offshore wind vessels occurs. But what is clear from the NMFS Proposed Speed Rules is that a 10-knot speed limit or lower on all vessels at all times of the year (with no exceptions) practicable and is the maximum that could be allowed but even then with speed limit below 10-knots a strike to a single NARW would cause serious injury violating BOEM's statutory duty to ensure (i.e. guarantee make certain) that there is no death or serious injury to even a single whale from Ocean Wind's and other offshore wind vessels occurs.	restrictions) in the event that passive acoustic monitoring systems are not fully operational. Ocean Wind's Vessel Strike Avoidance Plan, provided to NMFS in June 2022, provides more detail about these two subplans and is still in review by NMFS. Until the Final Rule is passed, Ocean Wind continues to request the aforementioned plans be reviewed for approval. However, Ocean Wind notes that it will comply with any and all vessel speed restrictions specified in the revised Vessel Strike Reduction Rule once finalized. BOEM believes that the proposed mitigation measures and the Vessel Strike Reduction Rule will be sufficient to address the impacts of vessel strikes on marine mammals. BOEM also notes that dynamic speed zones are only activated in the event a detection of NARW is recorded, not "whales of any kind."
1116-0006	The DEIS also fails to take a hard look at the timeframe in which there should be a complete shut-down of all Ocean Wind and other offshore wind activity for a minimum number of days (such as 10 days as proposed in NMFS Proposed Speed Rules in the case of dynamic speed zones) if a whale of any kind is located either through passive acoustic monitoring or sonar or visually by anyone including a report made to WhaleAlert app.	See response to comment 1116-0005.
1116-0007	The DEIS fails to take a hard look at the cumulative impact on the NARW from all the take already authorized and the cumulative impact from those and Ocean Wind and other offshore wind activity. NMFS has already authorized take since 2019 of 337 NARW as shown below: [Footnote 7: NMFS has an additional	The Draft EIS is not intended to be a take assessment. Takes of NARW are authorized and managed by NMFS through take authorizations and Biological

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	incidental harassment application pending where the public comment period has closed that would result in take of the NARW which is Vineyard Northeast LLC Marine Surveys offshore from Massachusetts to New Jersey (40 NARW).]	Opinions. If NMFS determines too many takes have been authorized, no further takes will be issued. However, it is not the purpose of the EIS to rule on this topic.
1116-0009	Proposed measures include initiating each pile driving event with a "soft start" where the pile driving hammer will be throttled back to less than maximum power thus giving the whales a "warning" of what is to come. The theory is that the "soft start" will convince the whales to leave the construction zone before the full-magnitude pile driving begins. The "soft start" however is not incidental harassment but purposeful intentional harassment a type of hazing designed to push the NARW out of their habitat. It is not accidental. See 50 C.F.R. 216.103 ("Incidental harassment incidental taking and incidental but not intentional taking all mean an accidental taking.") Thus soft start constitutes an intentional take that neither NMFS nor BOEM can authorize	As outlined below, soft starts will not be initiated until the pre-start clearance zones have been monitored and kept clear for 30 minutes. The pre-start clearance zones and shutdown zone for NARW are “any distance,” meaning if a NARW is sighted by a protected species observer at any distance from the pile-driving activity, the activity would be delayed or shut down. In addition, the NARW passive acoustic monitoring pre-start clearance zone was set equal to the Level B monitoring zone to avoid any unnecessary behavioral disturbance. Impact pile driving will also not occur during from January 1 to April 30 to avoid the times of year when NARWs are present in higher densities.
1116-0010	Soft start also constitutes unauthorized Level A harassment. Level A harassment as defined in the MMPA for non-military readiness activities (Section 3(8)(A)) is any act of pursuit torment or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild. Even if the "soft start" strategy effectively pushes all right whales out of the Level A exposure zone (i.e. 7.25 km from the pile driving area) there is no evidence the whales will be safe. On the contrary there is considerable evidence that the whales will be exposed to increased threats from fishing gear entanglement and vessel strikes. By forcing right whales out of the WDA the soft start program will drive the whales right into networks of fishing ropes heightening the threat of entanglement. The threat of vessel strikes against whales will also increase outside the WDA as vessels in this area are not subject to NMFS's sometimes applicable 10 knot speed limit; nor are they required to have a PSO onboard looking for whales.	Soft starts will not be initiated until the pre-start clearance zones have been monitored and kept clear for 30 minutes. The pre-start clearance zones for most marine mammals are based upon the maximum Level A zones for the whale group. These zones are to a maximum distance of 2,490 meters for impact pile-driving activities for mid- and low-frequency cetacean groups as outlined in Table 1-5B in Appendix H. It is unclear what the commenter is referring to with the 7.25-kilometer Level A exposure zone. For NARW the pre-clearance and shutdown zone is “any distance,” meaning if a NARW is sighted by a protected species observer any distance from the pile-driving activity,

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		the activity would be delayed. In addition, the NARW passive acoustic monitoring pre-start clearance zone was set equal to the Level B monitoring zone to avoid any unnecessary Level B takes. Impact pile driving will also not occur during from January 1 to April 30 to avoid the times of year when NARWs are present in higher densities. Vessels required for the Project will comply with NMFS regulations and speed restrictions and state regulations as applicable for NARW and will maintain, to the extent practicable, separation distances of greater than 500 meters from any sighted NARW or unidentified large marine mammal. In addition, between May 1 and October 31, all underway vessels (transiting or surveying) operating at greater than 10 knots will have a dedicated visual observer (or NMFS-approved automated visual detection system) on duty at all times to monitor for marine mammals within a 180-degree direction of the forward path of the vessel (90 degrees port to 90 degrees starboard). The MMPA Authorization will outline the number of Level A and B takes permitted for the Project. Level B monitoring zones are outlined in the MMPA Application and will also be monitored by protected species observers to keep track of the number of Level B takes associated with the Project. This monitoring would occur during the proposed soft-start period. Furthermore, the impact of driving whales outside the Wind Farm Area where vessels are not adhering to NMFS's voluntary dynamic speed zones is not controlled by

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		the Project. If the No Action Alternative were considered with this logic, whales would be exposed to increased risk of vessel strikes because participation in Dynamic Management Areas is voluntary at this time.
1116-0011	In addition to the extent the soft start forces feeding whales to leave and try to locate food elsewhere the loss of foraging opportunity in itself may be damaging especially given data showing that malnutrition has caused female North Atlantic right whales to lose weight and exhibit signs of reduced physical health. NMFS contends that right whales which have been prevented from foraging in the WDA during pile driving will simply come back and resume feeding once the pile driving stops. There is however no evidence to support this argument and the DEIS fails to take a hard look at that and the risk its measures pose to the NARW	As outlined above, soft starts will not be initiated until the pre-start clearance zones have been monitored and kept clear for 30 minutes. The pre-start clearance zones and shutdown zone for NARW are “any distance,” meaning if a NARW is sighted by a protected species observer at any distance from the pile-driving activity, the activity would be delayed or shut down. In addition, the NARW passive acoustic monitoring pre-start clearance zone was set equal to the Level B monitoring zone to avoid any unnecessary behavioral disturbance. Impact pile driving will also not occur during from January 1 to April 30 to avoid the times of year when NARWs are present in higher densities. These measures significantly reduce the potential for a NARW to be forced from feeding activities through soft starts.
1259-0084	The Draft EIS states that "due to the observed avoidance behavior of several marine mammal species during impact pile-driving activities certain marine mammal species (MFC HFC and pinnipeds) [Underlined: are less likely to be exposed] to underwater noise for sufficient duration to cause PTS and TTS." This cannot be true. The Draft EIS does not specify how these conclusions were drawn for a large group of species and what type of pile driving activities were used to derive these assumptions.	The paragraphs that follow this statement in the EIS outline the research that was used to draw this conclusion (please see Würsig et al. 2000; Brandt et al. 2009, 2011; Thompson et al. 2010; Tougaard et al. 2009; Lindeboom et al. 2011; Russell et al. 2016; Southall et al. 2021; and Blackwell et al. 2004).
1259-0085	The Draft EIS acknowledges that [Underlined: studies that examine the behavioral responses of baleen whales to pile driving are absent from the literature.] It further states that behavioral avoidance of other impulsive noise sources have been documented and could be used as a proxy for impact pile	The Draft EIS uses Malme et al. (1986) as well as Dunlop et al. (2017), which observed migrating humpback whales in response to seismic activities. It is

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	driving. The Draft EIS refers to a 1986 study (Malme et al. 1986) that investigated migrating gray whales' responses to seismic exploration in the Bering Sea as a proxy. Gray whales have not been sighted and its relevance to the marine mammals at potential risk in the Project is not accurate. This renders the Draft EIS flawed and incomplete for its assessment on pile driving/noise impacts.	common in effects assessments to use appropriate species as surrogates if behavioral studies on the specific species in question are not available in the literature. This information is used to help describe potential effects. In this case, behavioral studies for gray whales and humpback whales were considered appropriate surrogates for other LFC.
1259-0088	The DEIS refers to a study conducted in the North Sea on impacts of pile driving on porpoises: "Results from Brandt et al. (2011) indicate an overall reduced abundance of harbour porpoise during the 5-month installation period of the piles with the authors postulating that this was either a direct (e.g. sensory disturbance communication masking) or indirect (reduced prey availability) effect of pile-driving noise". The Project and its vicinity experience harbor porpoises throughout the year and such extended reduced abundance during the course of this Project and also with other proposed activities could pose a serious risk to porpoises and its associated ecosystem and has not been discussed in detail. Behavioral responses to changes in the acoustic environment could impact the health and vital rates of protected species or have top down effects on ecosystems and thus are critical to understand for decision makers especially when proposed actions such as the development and operation of offshore wind facilities will increase sound levels. Bottlenose dolphins in the Mid- Atlantic Bight are not habituated to elevated ambient sound levels as evidenced by their altered habitat use (Fandel et al. 2022).	Potential effects on harbour porpoises are discussed thoroughly in Section 3.15.5. Brandt et al. (2011) is referenced throughout as necessary.
1259-0089	DEIS states that impact pile-driving activities from other offshore wind development projects are likely to exceed PTS and TTS thresholds for all marine mammal functional hearing groups. However it oversimplifies the impacts and states that "due to the observed avoidance behavior of several marine mammal species during impact pile-driving activities certain marine mammal species (MFC HFC and pinnipeds) are less likely to be exposed to underwater noise for sufficient duration to cause PTS and TTS." This contradicts the Ocean Wind 1 COP which states that temporary noise from pile driving is anticipated to be the most important IPF for marine mammals and reaffirms COA's concern. The biggest concern is that studies that examine the behavioral responses of baleen whales to pile driving are absent from the literature. But the DEIS states that behavioral avoidance of other impulsive noise sources have been documented and could be used as a proxy for impact pile driving and refers to	The EIS considered the potential effects of impact pile driving thoroughly. The statement that some species may have stronger avoidance reactions to this activity that may reduce the potential for PTS and TTS effects is just one piece that was included in the assessment. Stating this does not contradict the COP. The Draft EIS uses Malme et al. (1986) as well as Dunlop et al. (2017), which observed migrating humpback whales in response to seismic activities. It is common in effects assessments to use

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	Malme et al. (1986) study on the responses of migrating gray whales to seismic exploration in the Bering Sea. This type of comparison lacks the required evidence or thoroughness and cannot be applied directly to other cetaceans in the Project Area. [Footnote 68: See Construction & Operations Plan Ocean Wind 1 Wind Farm (2022) https://www.boem.gov/sites/default/files/documents/renewable-energy/state- activities/OCW01_COP%20Volume%20I_20220614.pdf.]	appropriate species as surrogates if behavioral studies on the specific species in question are not available in the literature. This information is used to help describe potential effects. In this case, behavioral studies for gray whales and humpback whales were considered appropriate surrogates for other LFC.
1259-0090	The Draft EIS primarily relies on a comprehensive paper by Southall (Southall 2021) which is a compendium of several research studies to estimate likely PTS TTS and Exposure Ranges to marine mammals. While this is a reasonable approach it does not completely address the urgent and priority concerns pertaining to ALL marine mammals in the project area and its vicinity. Southall (2021) DOES NOT address baleen whales and the DEIS not addressing this category specifically and relying on supplementary information is a glaring omission. Southall (2021) summarizes some challenges and limitations which are produced below:·Mysticetes and odontocetes should be considered separately given their different life history strategies. Mysticetes are known to be capital breeders accumulating energy on feeding grounds and transferring energy to calves in breeding grounds whereas odontocetes are generally considered income breeders with less discrete feeding and breeding periods occurring throughout the year. Given that anthropogenic activities generally focus on specific habitats within an animal's home range (e.g. feeding or breeding grounds) this may affect their ability to compensate for disturbances. Toothed whales and baleen whales show varying levels of sensitivity to mid-frequency impulsive noise sources (i.e. active sonar pile driving) with observed responses ranging from displacement to avoidance behavior (animals moving rapidly away from the source) decreased vocal activity and disruption in foraging patterns.	The Draft EIS does not rely primarily on Southall et al. 2021. This paper reviews several research studies to estimate the severity of behavioral reactions of several species of marine mammals to a variety of anthropogenic activities. It does not estimate likely PTS, TTS, and exposure ranges to marine mammals. To understand the potential exposure ranges, the Draft EIS relied on underwater noise modeling as outlined in Appendix J. The Southall et al. 2021 paper was used to supplement the existing understanding of behavioral reactions of marine mammals to several in-water activities. Other marine mammal behavioral research studies were also used and are referenced throughout the EIS. In addition, the EIS does separate out the potential effects on mysticetes and odontocetes, with odontocetes being classified as MFC and HFC and mysticetes being classified as LFC.
1259-0091	Acoustic masking. Acoustic masking can occur if the frequencies of the activity overlap with the communication frequencies used by marine mammals. Acoustic or auditory masking is a growing and serious threat to marine mammals (Erbe et al. 2016) and studies are increasingly focusing on how acoustic masking can affect reproduction in marine mammals (Nabi et al. 2018). [Footnote 69: Ghulam Nabi et al. The possible effects of anthropogenic acoustic pollution on marine mammals' reproduction: an emerging threat to animal	Impacts of masking are discussed in Sections 3.15.3 and 3.15.5. Please refer to the BA for a more detailed discussion on the impacts of masking on listed species.

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	extinction 25 Environmental Science and Pollution Research 19338-345 (2018) DOI: 10.1007/s11356-018-2208-7.] Low-frequency cetaceans (LFC) and pinnipeds are more likely to experience acoustic masking than MFC and HFC; however the impacts are not discussed and could be serious. Underwater sonar activities were observed to result in decompression sickness and fatalities in beaked whales. [Footnote 70: Acoustic Pollution and Marine Mammals Nature (2014) https://www.nature.com/scitable/spotlight/acoustic- pollution-and-marine-mammals-8914464/.] Impacts of acoustic masking are not given due consideration in DEIS. The highly endangered North Atlantic right whale could also be subject to increasing threats from noise pollution which has not been discussed thoroughly in the Draft EIS.	

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O.6.15 Navigation and Vessel Traffic

Table O.6.15-1 Responses to Comments on Navigation and Vessel Traffic

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1118-0001	The American Waterways Operators (AWO) has long advocated for the creation of a 9 nautical mile safety fairway to protect longstanding towing vessel transit routes. We have worked with the Coast Guard to identify the width and location of these routes through the Atlantic Coast Port Access Route Study (ACPARS) process and urged the Coast Guard to expedite its rulemaking to establish Atlantic Coast fairways based on the ACPARS recommendations. Throughout this rulemaking process the towing industry has observed that once BOEM has made decisions pertaining to the size and siting of offshore wind areas it is difficult to impossible for the Coast Guard to deconflict established lease areas from traditional maritime navigation routes. As a result the Coast Guard's advance notice of proposed rulemaking to establish Atlantic Coast Fairways published in June 2020 did not allot sufficient space for towing vessels on coastwise voyages to transit safely past the wind farms. We understand that the Coast Guard is working on a revised rulemaking that it intends to publish later this year. Without knowing what precisely this revised proposal will recommend for the width of the fairways it is difficult for navigation industry stakeholders to recommend additional mitigation measures beyond what BOEM has included in the DEIS. [Bold: We therefore ask that BOEM (1) work closely with the Coast Guard to mitigate any conflicts between the Ocean Wind WEA and the Coast Guard's revised fairway proposal and (2) give industry stakeholders an opportunity to provide further comment on the expected impacts of the Ocean Wind lease areas after the public has seen the forthcoming Coast Guard revisions to its fairway proposal.]	Discussion of the Port Access Route Study has been added to Final EIS Appendix F (*Planned Activities Scenario*) and Final EIS Section 3.16.3.1. BOEM coordinated with USCG as a cooperating agency during development of the EIS and has reviewed and referenced the USCG Port Access Route Studies within the EIS.
1118-0001	AWO generally agrees with BOEM that the Ocean Wind lease areas covered by this DEIS will have less direct impact than the surrounding lease areas at least for towing vessel traffic. Oceangoing towing vessels will not transit through the windfarms as other types of vessels might and so AWO has no comment on BOEM's proposals regarding the placement of turbines within the Ocean Wind space. We are concerned however that this DEIS acknowledges the impact this WEA will have on maritime traffic overall but makes no apparent effort to mitigate any of those impacts. For instance BOEM acknowledges the impact the Ocean Wind area will have on fishing vessel traffic and yet has rejected a proposed alternative that would create a buffer area for fishing vessels to transit between Ocean Wind 1 and Atlantic Shores South. AWO	Alternative C would create a separation between WTGs in the Ocean Wind 1 and Atlantic Shores South lease areas to provide a clear visual distinction between the separate projects and provide for sufficient maneuvering space for both surface and aerial (helicopter) navigation. No change has been made to the Final EIS in response to the comment.

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	does not presume to comment on what safety accommodations are appropriate for fishing vessels but for BOEM to acknowledge significant maritime impacts and yet to propose no resulting safety mitigations is frustrating and undermines the spirit of collaboration that is essential to protecting navigation and facilitating the growth of wind energy. We stress this point here because we understand and indeed BOEM has acknowledged that the WEAs surrounding Ocean Wind will have an even greater impact on navigation safety especially for towing vessels. It is imperative for BOEM to work with the Coast Guard and the navigation community to address these conflicts and to take measures necessary to ensure the safety of maritime transportation.	
0837-0008	In the Resource category of Navigation and Vessel Traffic BOEM acknowledges that Alternatives A through E will have a major impact. To equate the No Action Alternative with Alternatives A through E BOEM used the Alternative Combined with Other Foreseeable Impacts to elevate the No Action Alternative to a major impact. This conclusion is untenable based on BOEM's report on vessel traffic attributed to the Project in the span of one year which includes approximately 1539 vessel trips during construction and installation 3392 vessel trips per year during operations and maintenance and approximately the same number of vessel trips per year during decommissioning as during construction and installation. [Footnote 9: BOEM. Ocean Wind: Draft EIS 2-15]. In order to achieve the predetermined major impact in the No Action Alternative column BOEM eliminated the instant Project from the equation but [Italics: included] three other wind farm projects. "Under the No Action Alternative three offshore wind projects in the analysis area Ocean Wind 2 Atlantic Shores South and Atlantic Shores North would generate vessel traffic during construction. Only one of these projects Atlantic Shores South has a published COP with estimated vessel trip numbers. The Atlantic Shores South project may generate a maximum of 51 vessels at any given time during construction (Atlantic Shores 2021). For the other two projects BOEM assumed vessel traffic would be similar to that of the Proposed Action: between 20 and 65 vessels operating simultaneously during construction depending upon the activity (COP Volume I Section 6.1 pp. 110-111 and 115-117; Ocean Wind 2022). Atlantic Shores South is estimated to be under construction between 2025 and 2027 and Ocean Wind 2 and Atlantic Shores North are estimated to be under construction between 2026 and 2030. In 2026-2027 when all three projects would be under construction at the same time a maximum of 181 vessels could be operating simultaneously." [Footnote 10: BOEM. Ocean Wind: Draft EIS 3-16]. This interpretation of BOEM's No Action	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. A detailed description of BOEM’s methodology for assessing impacts is provided in Section 1.6 of the Final EIS.

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	Alternative specifically the elimination of Ocean Wind 1 but [Italics: inclusion] of three other wind farm projects directly conflicts with the terminology No Action Alternative and is a misrepresentation of the facts.	
0984-0023	3.16 Navigation and Vessel Traffic. The definition of a shipping lane is "an official route that ships must follow when they sail from one place to another". Changing the name to "transit lanes" does not give BOEM or the Coast Guard the authority to change the historic safety regulation and rules associated with shipping lanes. The United States standard requirements of fixed structure in and around shipping lanes in the Gulf of Mexico should be consistent with the Atlantic. "No structure may be placed within two Nautical miles of any shipping lane". That goes for transit lanes also. The developer wanting to maximize the development site for electric generation should not be at the cost of life and property. The standards for placement of structures to the proximity of shipping lanes should be consistent in all waters.	Section 3.16 of the Draft EIS does not identify transit lanes as part of the Proposed Action or any of the action alternatives. Vessels would not be prohibited from transiting through the Lease Area if the Project is constructed, but no transit lanes are specified under any action alternative. Alternative C would create a separation between WTGs in the Ocean Wind 1 and Atlantic Shores South lease areas to provide a clear visual distinction between the separate projects and provide for sufficient maneuvering space for both surface and aerial (helicopter) navigation. The Draft EIS does not identify a transit lane in the Ocean Wind 1 Lease Area and no change has been made to the Final EIS in response to the comment.
0984-0052	Since Draft Publication of the Draft EIS Both cooperating agencies BOEM and USCG admit that the rushed process of assessment of shipping lanes (transit lanes) will require continued consultations over the length of the project along with further assessments on other alternatives as it relates to navigational safety and (what other aspects?). BOEM and USCG are cognitive of the failed outreach and the loss of life that has already occurred because of not addressing shipping lanes before the installation of the first turbines in USA waters. The EIS should also address the increased mortality rate based on the configuration.	The NSRA marine risk analysis modeled the frequency of non-Project vessel accidents that could result from installation of the Proposed Action wind farm structures. The model estimates frequencies for marine accidents accounting for Project- and location-specific environmental, traffic, and operational parameters. The Draft EIS discloses that increased navigational complexity associated with navigating through WTGs in the Lease Area could increase the risk of allision or collision and resultant injury or loss of life. Increased risk of collision or allision pertains to risks for vessels transiting the Lease Area, and

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		does not correlate to increased risks within shipping lanes. The comment does not provide new information that would result in a revision to the findings of the Draft EIS and no change has been made in the Final EIS in response to the comment.
1086-0016	Vessel Traffic. For generations fishermen have relied on unobstructed pathways between their fishing grounds and ports. Ocean Wind 1 in addition to several other wind farms planned immediately offshore of Cape May County pose significant risks to captains that include traffic and congestion in and around ports congestion of fishing grounds and traffic through the wind farm. Fishermen have major concerns about transit in and out of wind farms and protocols on ingress and egress from various points along the coast. The Construction and Operation Plan cites that construction would involve roughly 3847 vessel trips during construction and installation and over 1100 annual trips for operation and maintenance. In addition construction activities would require anywhere from 20-65 simultaneous vessels stationary or transiting within the Ocean Wind 1 area and local ports. This traffic could negatively affect fishermen by delaying offloading requiring crews to search for new fishing grounds and disturbing existing fishing grounds during transit. Navigational Safety. Another area of major concern is navigational safety especially under low-visibility and high-seas conditions created by weather. Some vessel operators have stated that they would be forced to fish elsewhere due to safety issues while navigating through the array. Other vessel operators have said they would not transit the wind farm at all while some said that they would not transit the wind farm during poor weather conditions. Radar and communications will also be degraded within the turbine array. This issue is only likely to grow as thousands of turbines are installed along the Eastern Seaboard.	The NSRA conducted a robust analysis of all vessel traffic around the Project area. It is acknowledged that, due to AIS carriage requirements, fishing vessels are not fully captured in the data and the analysis assumes that this category is underrepresented; therefore, a reasonable maximum number of transits of non-AIS commercial fishing vessels was added to the base-case model. Catch-analysis summaries show that commercial fishing vessels encompass 19.6% of vessel traffic in the geographic analysis area but do not indicate significant commercial fishing occurring within the Project area, with the possible exception of surfclam. While vessel traffic is likely to increase during construction and O&M, the traffic is likely to be spread out among several different ports and across time, not all at once, so as to cause minimal disruption to the fishing vessel fleet. All components of the wind farm will be properly marked and navigation charts updated as required. Proper seamanship practices will reduce any risk to mariners, vessels, or equipment. In accordance with proposed mitigations (GEN-16), prior to the start of operations, Ocean Wind will implement a Navigational Safety and Training program that addresses navigational safety by providing eligible

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		commercial, charter, and for-hire fishing vessels operating in and near the Wind Farm Area with reimbursement for new radar equipment or training courses. Navigation equipment will include Pulse Compression Radar Systems or AIS transceivers. Professional training and experiential learning for fishermen may include a captain course, license upgrade, radar course, or rules-of-the-road refresher training.
1222-0003	[Bold: Transit:] The plot below is a heat map of surfclam and quahog vessels in transit through the Ocean Wind lease area. As can be seen from this heat map most all the clam vessel traffic through the Ocean Wind lease area is coming from or going to a single point; that being Atlantic City. Most of the traffic is transiting in a North and South direction or in a Northwest and Southeast direction. Two things are clear comparing the transit heatmaps with the Ocean Wind 1 layout options: (1st) The layout options for Ocean Wind 1 do not safely accommodate transiting in a North or South direction through the lease the line of sight through the WEA in these directions is narrow. Vessels will likely avoid the lease area altogether when approaching from the north or south and must pass by to the west of the lease as opposed to transiting through; (2nd) There is enough traffic transiting Northwest or Southeast across the northeast portion of the lease to warrant providing room to transit between the Ocean Wind and Atlantic Shores wind energy areas. There needs to be room for transit between the Ocean Wind and Atlantic Shores wind energy areas of at least 2.44nm like what was provided between other NY Bight leases where transit was known to occur to accommodate transit in all reasonably foreseen weather conditions. The setbacks suggested by the DEIS will be inadequate in inclement weather and forcing fishing vessels to transit around Atlantic Shores to the north or Ocean Wind to the south is simply not acceptable. Reasonable accommodations must be made for transit between these two leases for the sake of safety and to mitigating transit time and distance. [See original comment for images pulled from Draft Environmental Impact Statement]	The predominant orientation of transit was considered during the development of Alternative C, which creates an 0.81-nm buffer between Ocean Wind 1 and Atlantic Shores South. Section 3.16 of the Draft EIS does not identify transit lanes as part of the Proposed Action or any of the action alternatives. Vessels would not be prohibited from transiting through the Lease Area if the Project is constructed, but no transit lanes are specified under any action alternative. Alternative C would create a separation between WTGs in the Ocean Wind 1 and Atlantic Shores South lease areas to provide a clear visual distinction between the separate projects and provide for sufficient maneuvering space for both surface and aerial (helicopter) navigation. The Draft EIS does not identify a transit lane in the Ocean Wind 1 Lease Area and no change has been made to the Final EIS in response to the comment.
1259-0150	xii. Navigation and Vessel Traffic (3.16) Clean Ocean Action is deeply concerned about the negative impacts that the Ocean Wind 1 project will have on navigation and vessel traffic. It will clearly lead to unsafe conditions at sea-potentially endangering human life-while simultaneously exacerbating the	The nearest established anchorage is Big Stone Beach Anchorage Ground, 38 nm (70 kilometers) from the Project. USCG has proposed the establishment of three

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	nation's ongoing supply chain issues. If approved Ocean Wind 1 would have significant negative impacts on navigation and vessel traffic off the NJ coast. The first type of these impacts that the Draft EIS considers are those on anchoring. To start the document describes the harmful effects that Ocean Wind 1 would pose to anchoring of both small and large vessels. "Small commercial or recreational vessels anchoring in the offshore wind lease areas may have issues with anchors failing to hold near foundations and any scour protection" the document observes. [Footnote 130: DEIS at 3.16-8.] Nevertheless it concludes that "it is unlikely that offshore wind activities would affect vessel-anchoring activities" because of "the small size of the geographic analysis area compared to the remaining area of open ocean as well as the low likelihood of that any anchoring risk would occur in an emergency scenario[.]" [Footnote 131: Id. at 3.16-8.] This conclusion cannot be justified by the information that precedes it and the underlying reasoning is inherently flawed. The analysis cannot presume that the small size of the geographic analysis area compared to the open ocean will necessarily translate into a low likelihood of anchoring risk in an emergency scenario as this does not take into account the pre-existing frequency risk of emergency scenarios within the geographic analysis area nor the degree to which the presence of turbines and related infrastructure in the geographic analysis area may increase the risk of emergency scenarios occurring at the site.	new anchorage areas in the vicinity of the Cape Henlopen to Delaware Traffic Lane to provide additional usable grounds to support port demands and enhance navigational safety in the area (84 *Federal Register* 65727). If established, proposed anchorage areas notionally referred to as Anchorage B – Breakwater Anchorage and Anchorage C – Cape Henlopen would be slightly closer to the Project area than Big Stone Beach Anchorage Ground. The Project is not anticipated to affect routine vessel anchorage operations within the existing anchorage areas or the additional proposed anchorage grounds (COP Volume III, Appendix M, NSRA, p. 96; Ocean Wind 2023). Smaller vessels anchoring in the Wind Farm Area may have issues with anchors failing to hold near foundations and any associated scour protection, or, alternately, where the anchors may become snagged and potentially lost. During construction, installation, and decommissioning operations, smaller recreational and fishing vessels would most likely not transit the Wind Farm Area and therefore not anchor within the Project area. Consequently, any potential impacts from smaller vessels anchoring within the Wind Farm Area would primarily occur during the O&M phase. If BOEM approves the COP, Ocean Wind would be required to develop a CBRA (refer to COP Volume I, Section 6.1.1.5; Ocean Wind 2023) that will incorporate relevant information including seabed conditions and risks associated with fishing gear and vessel anchors to determine target burial depth. In context of

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		reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the anchoring impacts from the cumulative impacts of the Proposed Action, which would be short term and minor due to the small size of the offshore wind lease areas in the geographic analysis area compared to the remaining area of open ocean, as well as the low likelihood that any anchoring risk would occur in an emergency scenario. In addition, the establishment of the anchorage areas described above would limit the potential impacts on routine anchorage operations across the geographic analysis area. No change has been made to the Final EIS in response to the comment.
1259-0151	Furthermore with respect to deep-draft vessels the Draft EIS indicates that "any risk [...] would come from anchoring in an emergency scenario specifically near the Delaware Bay TSS or in the approach to New York Harbor." [Footnote 132: Id. at 3.16-8.] In the event of a vessel accidentally dropping anchor on export cables associated with Ocean Wind 1 the consequences could include "damage to the export cable damage to the vessel anchor or anchor chain and risks associated with an anchor contacting an electrified cable." [Footnote 133: Id. at 3.16-8.] The safety risk that such an encounter would pose to all individuals aboard the vessel to which the anchor is attached would be significant and a damaged export cable could prove to be both environmentally harmful and expensive for ratepayers. However the Draft EIS lacks any analysis concerning such a scenario or steps that Ocean Wind 1 will take to prevent it from taking place.	Design parameters for the Proposed Action exclude the routing of cables through an anchorage or lightering area. In the event an anchor does make contact with a buried export cable, impacts could include damage to the export cable and potential damage to the vessel anchor or anchor chain. Depending upon the extent of the damage to the export cable, the risks associated with an anchor contacting an electrified cable can pose issues to Project equipment (an overload and shut-down of converter or transformer stations) but is not anticipated to cause electrical shock to the ship involved because seawater is a good conductor of electricity (Sharples 2011:111). If the export cable is damaged to the point of requiring repair, there could be impacts associated with additional vessel activity to conduct

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		damage assessment and repair. Secondary impacts would be repercussions on the vessel operator's liability and insurance. Combined with the low likelihood that any anchoring risk would occur in an emergency scenario, impacts on navigation and vessel traffic would be minor, localized, and temporary to short term. No change has been made to the Final EIS in response to the comment.
1259-0152	In a similar vein the Draft EIS states that anchoring-related risks from Ocean Wind 1 will be avoided in light of "[o]ffshore wind developers [being] expected to coordinate with the maritime community and USCG to avoid laying export cables through any traditional or designated lightering/anchorage areas." [Footnote 134: Id. at 3.16-7.] This avoidance plan is woefully inadequate. At the very least BOEM must exercise the legal authority at its disposal to ensure that such coordination between Ocean Wind 1 the maritime community and USCG is [Italics: required] rather than merely [Italics: expected].	USCG is a cooperating agency and has been a robust participant in the planning and development of the Project. As previously discussed, if BOEM approves the COP, Ocean Wind would be required to develop a CBRA with the end result of implementing appropriate mitigating measures to ensure the safety of maritime stakeholders. Moreover, as indicated in the EIS, the design parameters for the Proposed Action exclude the routing of cables through an anchorage or lightering area. No change has been made to the Final EIS in response to the comment.
1259-0153	Human safety may likewise be imperiled by the structures and traffic associated with Ocean Wind 1. Turbines from the project for example pose navigational hazards to vessels transitioning in and around the Ocean Wind 1 lease area particularly by interfering with marine vessel radars and making it more difficult to see other vessels in the area. These risks will only be exacerbated by the reef effect that is anticipated around the turbine foundation which will likely lead to additional activity from recreational fishing vessels. Plus in addition to the increased risk of collisions and spills posed by the presence of "slow-moving (or stationary) installation or maintenance vessels" [Footnote 135: Id. at 3.16-16.] the Draft EIS identifies a variety of harms likely to result from higher vessel traffic levels that will necessarily flow from the presence of vessels associated with Ocean Wind 1. The increased congestion and navigational complexity "could result in crew fatigue damage to vessels injuries to crews engagement of	The Draft EIS discloses these impacts; therefore, no revision to the Final EIS is warranted.

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	USCG SAR and vessel fuel spills." [Footnote 136: Id. at 3.16-9.] Modeling cited in the Draft EIS even predicts that authorizing Ocean Wind 1 will cause accident frequency to increase by 0.403 accidents per year. [Footnote 137: Id. at 3.16-17.]	
1259-0154	Separate from the risk that Ocean Wind 1 will pose to human safety the navigational and vessel traffic implications of the project are particularly objectionable in light of the anticipated impact that it will have on port utilization. Specifically the Draft EIS concedes "[O]ffshore wind construction activities may result in competition for scarce berthing space and port services potentially causing short- to medium-term adverse impacts on commercial shipping." [Footnote 138: Id. at 3.16-8.] This increased competition for scarce berthing space and port services it must be noted would not be occurring in a vacuum. To the contrary this dynamic would unfold against a backdrop of historically severe supply chain issues and skyrocketing inflation across the nation. Given the importance of the ports of New Jersey and New York to the U.S. economy particularly by virtue of the volume of ships and cargo that they already handle Ocean Wind 1 exacerbating competition for berthing space and port services in the area could increase shipping costs thereby raising the cost of goods and exacerbating inflation nationwide. In sum Ocean Wind 1 would negatively impact our region with respect to navigation and vessel traffic. On top of the radar interference from turbines which may potentially imperil search and rescue missions Ocean Wind 1 will lead to an influx of vessels swarming the area to construct operate and maintain the turbines. The increased abundance and density of vessels in the area will not only lead to more accidents at sea but also more competition at port for limited resources such as berthing space as fuel during a time when inflation and supply chain issues are historically severe. In light of these impacts BOEM should not allow the project to move forward with the characteristics-including the scale-identified in the Draft EIS.	The Draft EIS discloses these impacts; therefore, no revision to the Final EIS is warranted.
1272-0005, & -0006	There are many examples of the gigantic mistakes made by BOEM. One is their lack of understanding the need for transit zones… The classic example for the fishing industry is off of Atlantic City NJ where Ocean Wind and Atlantic Shores are connected to each other. There is a fleet of large clam boats that operate out of Atlantic City. The two leases cover more than 50 miles south to north along the NJ shore. If the COPs for those two leases allow the two leases' holders to have their turbines within one NM of each other or less and those Atlantic City vessels want to fish east of those leases they will be forces to transit through a very narrow lane to get through the two wind farms. The	BOEM cannot establish transit lanes. USCG prefers lines of orientations, which will encourage traffic dispersal. Both leases aligned their WTGs with fishing transit in the area. Ocean Wind and Atlantic Shores consulted with USCG to come to a mutually agreeable setback from the lease boundary. The buffer distance between the WTGs of both

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	afterthought of BOEM was to have one line of turbines on each side of the intersection of the two leases be removed to open a two mile transit zone. There is a problem the lease are connects with a line that runs Northwest and south east which means the transit lane is much longer and for the most part goes in the wrong direction. BOAM could have put the bounders of each lease running due east so the vessels could steam through the two wind farms with the shortest distance. With the proposed separation zone any between the two leases vessel working east of Atlantic city when a storm comes up will need to decide to go north around the Atlantic Shore lease or steam south to the transit zone which is south of Atlantic. Depending on the storm the vessel captain has few chooses and no good options. Getting caught in a bad storm with high seas fog and in the dark most captains will not attempt to steam through the farms therefore depending on their situation the vessel would have to steam either north or south for about 30 miles and then steam back inside in wind farms for another 30 miles to get to home port. So these vessels and their crews are at great risk so the developers can have a few more turbines in their array. BOEM must require the developers of Ocean Wind 1 and Atlantic Shore to take out one row of turbines on each side of their common boundary to create a transit zone of about 2 NM. The transit zone is the wrong place but is better that nothing. If BOEM had required the fishing industry's request that required the turbines to be 2 NM apart in both directions transit zones would not have been an issue.	projects will be greater than 1,500 meters (0.8 nm) in the interest of facilitating navigational safety and SAR operations. This alternative (Alternative C-2) will be included as part of the Proposed Action preferred alternative (Alternative A). No change has been made to the Final EIS in response to the comment.

O.6.16 Other Uses (Marine Minerals, Military Use, Aviation)

Table O.6.16-1 Responses to Comments on Other Uses (Marine Minerals, Military Use, Aviation)

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0007-0005	Further there are many key issues for which the DEIS states that project design changes may happen re mitigation information/needed studies are not available or that inputs from key government agencies are still required. For example in Section 3.17 of the DEIS re radar systems "BOEM assumes that project proponents would conduct an independent radar analysis and coordinate with FAA to identify potential impacts and any mitigation measures specific to aeronautical military and weather radar systems." That analysis has not yet been done.	The text highlighted in this comment is from Section 3.17.3.2, *Cumulative Impacts of the No Action Alternative*, which describes potential impacts from other offshore wind projects in the region, not including the Ocean Wind 1 Project. BOEM assumes that for these offshore wind projects, lessees will conduct independent radar analysis and coordinate with the FAA. Ocean Wind has committed to continuing to coordinate with the FAA, DOD, NOAA, and BOEM to assess and mitigate impacts on radar operations. Ocean Wind has completed a line-of-sight study (Ocean Wind 1 COP, Volume II, Section 2.3.7) to determine the scope of radar impacts. Additionally, Ocean Wind has coordinated with the North American Aerospace Defense Command, which reviewed the COP and identified minor but acceptable impacts on its radar operations.
0175-0011	Coast Guard Search & Rescue efforts will be hindered resulting in possible loss of lives	Impacts on USCG SAR efforts, including how the increase in navigational complexity due to WTGs may affect searches, are described in Section 3.17.5, *Impacts of the Proposed Action on Other Uses (Marine Minerals, Military Use, Aviation)*.
0984-0024	3.17 Other Uses National security should be the utmost concern of our federal government. The displacement of our underwater at sea activities by the sale of this and other development sites is a [Bold: Major Impact.] The reduction of space to conduct at sea drills to produce the best military in the world is a [Bold: Major Impact.] The declaration of at sea monuments around the world to offset the loss of waters for at sea military efforts is a [Bold: Major Impact] on other blue water economy industries. To pinpoint where our military is working by reducing the areas they can conduct operations is a [Bold: Major Impact] to this nations national security. This lease site enables foreign countries to spy on and interrupt our electrical grid is a Major Impact. For national security reasons it is understood that the details of the [Bold: Major Impacts] are not described in detail but it does not excuse the EIS from informing the public of the precarious situation the	The Military Aviation and Installation Assurance Siting Clearinghouse, responsible for evaluating potential risks of new energy projects to national security and DOD missions, completed a review of the COP on 10/20/2021. It determined that the Ocean Wind 1 Project would result in minimal impacts on DOD's mission. As a result, the Proposed Action would result in minor adverse impacts on military and national security uses other than USCG SAR operations.

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	development of this and other sites is placing the country in militarily.	
0984-0048	The Coast Guard has eliminated potential uses within the leased area. It is military concerns that dictate many of the exclusion sites pre-determined. The impacts of this site will have a great impact on many air and sea operations that can not be provided in the EIS but are dictating the feasibility of the application	Impacts on military uses, including USCG, within the Lease Area are evaluated in Section 3.17.5, *Impacts of the Proposed Action on Other Uses (Marine Minerals, Military Use, Aviation)*. Coordination with the Military Aviation and Installation Assurance Siting Clearinghouse, responsible for evaluating potential risks of new energy projects to national security and DOD missions, found that the Proposed Action would result in minor adverse impacts on military and national security uses other than USCG SAR operations.
0222-0009	[Bold: Potential impacts on scientific research and surveys would generally be major] particularly for [Bold: NOAA surveys supporting commercial fisheries and protected-species] research programs. The presence of structures would [Bold: exclude certain areas] within the Project area occupied by Project components (e.g. WTG foundations cable routes) [Bold: from potential vessel and aerial sampling.]	Impacts on scientific research and surveys, including how the increase in navigational complexity due to WTGs may affect surveys, are described in Section 3.17.5, *Impacts of the Proposed Action on Other Uses (Marine Minerals, Military Use, Aviation)*.
1243-0003	Another overlooked impact from WEAs on commercial fisheries is that the de facto development of marine protected areas along the East coast due to the clustering of wind turbines in many additional WEAs planned will also negatively impact many standardized NMFS fishery independent surveys that are critical components to the stock assessments of the Federally managed marine resources in the Mid-Atlantic and New England region. The displacement of sampling stations and other modifications that must be made to these surveys because of the existing WEAs will introduces elements of scientific uncertainty that in fisheries management necessitates more precautionary management. Both the MAFMC's and the NEFMC's Scientific and Statistical Committees' (SSC) determination of Overfishing Limits Allowable Biological Catch and Annual Catch Limits aka "quotas” in any given year will decrease as scientific uncertainty increases in the stock assessments of the resources because sampling will be compromised with the creation of WEAs.	Analysis of the impacts of the Project on scientific research and surveys, including those that contribute to stock assessments in the Mid-Atlantic and New England regions, is included in Section 3.17.5, *Impacts of the Proposed Action on Other Uses (Marine Minerals, Military Use, Aviation)*. BOEM is working with NOAA to mitigate potential impacts of the Project on NOAA scientific research and surveys.

O.6.17 Recreation and Tourism

Table O.6.17-1 Responses to Comments on Recreation and Tourism

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0011-0003	Visual impacts of turbines in the Proposed Project on Tourism should be considered "major" instead of "moderate" and a new study is needed to determine potential economic costs. No Final EIS should be issued for any project until that study is available. BOEM states under the topic Recreation and Tourism on 3.18 - 22 "Overall the impacts of the Proposed Action are anticipated to be moderate and minor beneficial". The turbines will be 15 miles off Atlantic City are 906' tall and will be "theoretically visible to a viewer at the ocean surface or at beach elevations at distances up to 39.6 miles with clear-day conditions". BOEM quotes a University of Delaware study 3.18-8 "evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 miles from the viewer would have negligible impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018). The study participants viewed visual simulations of WTGs in clear hazy and nighttime conditions (without ADLS)". Below is a copy of the chart quoted from the UD study. The University of Delaware study did its survey by showing panning photomontages on a computer screen of 579' tall turbines respondents were also provided instructions on the distance to the screen from which they should view the images and were asked to view the project at three distances offshore - near medium and far. After each distance was viewed respondents were asked whether the presence of the wind power project would have affected their beach experience/enjoyment -- making it worse somewhat worse neither worse nor better somewhat better or better. If they responded worse or somewhat worse they were then asked a certainty-response question. They used the response to this question to construct certainty-adjusted data. Note no such certainty adjustment was used for those who favored wind turbines. Results from nighttime views were never released. The survey group also included about 35% of respondents who never actually visited the beach. In March 2021 one of the authors (Parsons) stated in a Delaware Today Magazine interview the study is no longer applicable because turbines used today are so much larger. However even with the studies problems it has some use. The figure below shows at 10 miles 29% found the view worse	At an eye level of 5.5 feet (1.7 meters) above sea level, the Delaware study's 579-foot (176.5-meter) WTGs would be visible out to 32.4 miles (52.1 kilometers). The 906-foot (276-meter) Ocean Wind WTGs would be visible out to 39.6 miles (63.7 kilometers). Greater eye-level heights would increase the visible distance in both cases. At Ocean Wind's distance from the nearest beach of 15.3 miles (24.6 kilometers), the upper 476 feet (145.1 meters) of the Delaware study's 579-foot (176.5-meter) WTG would be visible to viewers. At this distance, the upper 803 feet (meters) of Ocean Wind WTGs would be visible. Therefore, in both the 2018 Parsons and Firestone study and Ocean Wind's cases, the WTGs' hubs, nacelles, navigation lights, and rotor blades would be visible to viewers on the nearest beach. The taller Ocean Wind WTGs would result in increased numbers of WTGs visible in the wind farm. Such additional WTGs would be seen as lower than/below the tops of the forward row of WTGs and would be increasingly obscured by those intervening in the view. The wind farm would be perceived as a mass of WTGs, rather than as individual WTGs. Additional information clarifying the difference in WTG heights between the studies used and those proposed for Ocean Wind 1 Project was included in the Final EIS. BOEM has determined that impacts on

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	while only 10% found it better for a 19% difference choosing worse. At 7 miles 38% found the view worse compared to 7% favorable a 31% difference. In looking at the cumulative impacts of immediately adjacent planned offshore wind projects Ocean Wind 2 is only 8.9 miles from the beach Atlantic Shores South is 8.8 miles and Atlantic Shores North is 9.1 miles. So ignoring the taller towers in the Ocean Wind 1 project we see perhaps 25% of tourists will find the cumulative impact worse.	recreation and tourism from the presence of structures would be moderate because affected activities or communities would likely have to adjust somewhat to account for disruptions due to the Project. This impact level reflects survey results suggesting a range of visitor experience related to views of offshore wind farms, with some respondents reporting their beach experience would be worsened, while other respondents reported that their experience would be improved or took a neutral position (would neither improve nor worsen their experience). The cumulative impacts of the Proposed Action in combination with planned offshore wind projects in the region are described in Section 3.18.5.1, *Cumulative Impacts of the Proposed Action.* BOEM determined that cumulative impacts on recreation and tourism would also be moderate.
0011-0003	The impact of taller towers can be approximated by assuming the towers are 1.56 times closer (the ratio of 579' tall towers to 906' tall towers). That suggests the adjacent projects will have the impacts of turbines 5 miles off the coast in the UD study and the proposed Ocean Wind project would be equivalent to about 10 miles off the coast. The proposed project then should be considered to have a major impact on tourism. BOEM also referenced a 2017 visual preference study conducted by North Carolina State University that evaluated the impact of offshore wind facilities on vacation rental prices. "The study found that nighttime views of aviation hazard lighting (without ADLS) for WTGs close to shore (5 to 8 miles) would adversely affect the rental price of properties with ocean views (Lutzeyer et al. 2017). It did not specifically address the relationship between lighting nighttime views and tourism for WTGs 15 or more miles (24.1 or more kilometers) from shore. More than 95 percent of the WTG positions likely to be present based on anticipated offshore wind lease area build-out in the geographic analysis area would be more than 15 miles from coastal locations with views of the WTGs". The study by Lutzeyer et.al. (2017) "The Amenity Costs of Offshore Wind	See response to comment 0011-0003 above. Additional analysis of impacts on the vacation rental market was added to the Final EIS. Impacts on vacation rentals and visitor preferences would be lower than described in the Lutzeyer et al. 2017 study for nighttime views because Ocean Wind 1 would implement ADLS. The ADLS would reduce the duration of the FAA hazard lighting system lighting to a total of 1 hour 19 minutes and 17 seconds per year, compared to standard continuous FAA hazard lighting analyzed in the Lutzeyer et al. 2017 study. As described in Section 3.20.5, *Impacts of the Proposed Action on Scenic and Visual Resources*, the limited timeframe of ADLS-activated lighting would reduce impacts from major to moderate.

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	Farms: Evidence from a Choice Experiment"3 was quite a contrast to the UD study. The Lutzeyer study worked with beach home rental companies and surveyed only people who had recently rented a house on or near the beach. The study found 38 percent of beach renters would likely not come back to a beach with daytime visible turbines regardless of the distance as shown in the study quote below with visualizations showing turbines from 5 miles to 18 miles from shore (not the 8 mile limit stated in the DEIS). In addition others would return only with a rental discount depending on the distance. Overall the willingness to accept estimates for the Never View class imply that these respondents would likely exit the local rental market if turbines were present rather than make intensive margin tradeoffs among rental price and characteristics of the viewshed. The Lutzeyer study also showed nighttime visualizations of red flashing aircraft warning lights and respondents stated even higher rates of objection with 54 percent not likely to return to a beach with nighttime visible turbines. The visualizations showed 5 to 7 MW turbines about the same size as the UD study. Again this study confirms visible turbines in the propose project will have a major impact on tourism.	
0995-0001	I oppose Ocean Wind I because of the negative visual impact will have on tourism and because the consideration of this in the DEIS impact is flawed. The DEIS references the 2018 Parson and Firestone study when assessing visual impact. On page 8 Parsons and Firestone say they surveyed peoples' reaction to turbines that are 574 feet tall. However according to the DEIS the wind turbines will be 906 feet tall that 157% bigger. The DEIS also references the North Carolina State study (Lutzeyer et al. 2017). Page 3 of Lutzeyer states their studies are based on turbines that are 500 feet tall and page 8 says they showed images of 5 MW turbines. However the turbines proposed in the DEIS are 12MW and 906 feet tall. An evaluation of adverse impact is inherently a subjective effort of balancing available information. It is critical that the information used is relevant and used properly. There is evidence in the DEIS that the information is not used properly. For example page 412 of the DEIS report repeats the finding from page 8 of Parsons that the distance where opinions are 50/50 is 15 miles. Obviously 15 miles is different for a 574' turbine than it is for a 906' turbine. The DEIS makes no provision for this. The DEIS simply makes the Parson's conclusion part of the record for the DEIS. Therefore the DEIS conclusions about tourism are invalid because they were based on studies of different technology that what is being proposed because there is no evidence that provisions were made	Please see the response to comment 0011-0003.

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	to consider these differences and because there is evidence (the 50/50 example) that the DEIS incorrectly used the information. Ocean Wind I is a massive bait and switch and the DEIS should be rejected. Excerpt from Parsons and Firestone 2018."The stated-preference survey covered 1725 beachgoers in a sample drawn from GfK's Knowledge Panelto be representative of the beachgoing population on the East Coast. An expanded version of the data includes non-beachgoers and their attitudes and preferences as well. Using an internet-based survey respondents were shown visual simulations of a wind power project at different distances from shore and in different conditions (clear hazy nighttime) and then were asked if the projects might affect their beach experience and/or cause them to change their trip plans. All simulated projects had 100 turbines: each turbine was a 6 megawatt (MW) machine with a rotor diameter of 492 feet so that when a blade was at the apex the turbine was 574 feet high. The turbines were spaced 8 rotor diameters (0.75 miles) apart in a 10by 10 configuration."Break even point from DEIS page 412"At 15 miles (24.1 kilometers) the percentage of respondents who reported that their beach experience would be worsened by the visibility of WTGs was about the same as the percentage of those who reported that their experience would be improved" Excerpt from Lutzeyer et al. 2017 "To understand the potential visual impact of an offshore wind farm it is important to recognize that the current vintage of offshore wind turbine extends over 500 feet above the water - approximately the height of a fifty story building. "and" Our images depict 5-megawatt (MW) turbines which were thought to be the most likely turbines for offshore deployment at the time of our survey. "	
1071-0004	The critical flaw in the analysis is a University of Delaware study (Parsons and Firestone 2018). This 2018 paper is often referred to when assessing the impacts of offshore windmill farms on beach tourism when the wind farms are viewed from varying distances. Based on this 2018 paper the DEIS utilizes a 15 mile distance as a common distance of support for the decisions and impact analysis. This Parsons 2018 study found that windmills 15 miles from the viewer would only have a negligible impact on businesses dependent on recreation and tourism activity. From the Parsons report "The dominant reason reported for why an offshore wind power project would have made a beach experience worse was the visual disruption of the seascape." However citing these data is a significant deficiency in the DEIS. The flaw lies in the fact that this 2018 Parsons and Firestone paper was based on imaging of 100 windmills each 170 meter high (tip of blade) in a	Please see the response to comment 0011-0003.

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	10x10 configuration at varying distances and assessing their impact on beach-goer behavior. In fact almost all of the studies cited in this document were primarily completed with windmills that are approximately half the size of the ones contemplated for Ocean Wind and other projects.	
1071-0007	The Ocean Wind proposal is for windmills that are almost double the size studied in the Parsons and Firestone 2018 paper (approximately 300 meters) therefore the conclusions reached should utilize different data points which are readily available in this same paper. Trigonometry allows for this analysis. The formula is very simple…. The apparent height of an object on the horizon is equal to actual height divided by distance. Said another way a 300 meter windmill viewed from 15 miles appears approximately the same size as a 150 meter windmill viewed from 7.5 miles. Using that same Parsons and Firestone 2018 paper. There is a radically different outcome when one accounts for an almost 300 meter windmill 15 miles from shore. No longer would Ocean Wind have a negligible impact on the local community. In this case the 2018 Parsons report states that 38% of respondents said their experience would be worse and it is further estimated that Ocean Wind proposal would result in a 20% trip reduction to impacted communities. Again this data is all available in that exact same 2018 Parsons report. The counter-argument could be made that using the 7.5 mile dataset overstates the negative impact as it does not account for viewing from a distance and how atmospheric conditions impact views from 15 miles away. However a rebuttal to this argument is that photosimulations underestimate the viewshed impact (see Palmer 2022 Landscape and Urban Planning September 2022 "Deconstructing viewshed analysis makes it possible to construct a useful visual impact map for wind projects") where he stated "These studies found that photographs or realistic photosimulations underrepresented visual prominence." Palmer also referred to the work of Takacs and Goulden 2019 and Palmer and Sullivan 2020 which also report the underestimate of impact of photosimulations. Additionally the cumulative number of windmills is far greater than that used in the Parsons and Firestone 2018 paper. The massing of windmills will have a greater negative impact than a smaller array of windmills.	Please see the response to comment 0011-0003.
1071-0008	From page 3.10-8 of the DEIS "Up to 574 WTGs with a maximum blade tip height of 1049 feet (320 meters) above mean sea level (AMSL) would be added within the analysis area for cumulative visual effects."Citing that same Palmer 2022 peer-reviewed paper "Those who prepare wind energy VIAs (visual impact assessments) seem in general agreement that visual impacts	Please see the response to comment 0011-0003.

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	result from three objective factors: distance zone or the effect of distance on how a turbine is perceived; exposure or the amount of the turbine that is visible; and extent or the number of turbines that are visible (Palmer 2022). Also "Turbine visual prominence is a function of distance and turbine exposure" and "Project visual impact is a function of Turbine Visual Prominence and the number of visual turbines" The impact of the 100 windmill grid cited in the Parsons and Firestone paper underestimates the negative impact on viewshed that a much larger windmill grid would have as outlined in the DEIS. Utilizing the 7.5 mile dataset from the Parsons and Firestone 2018 paper the estimate of 20 percent project trip reduction is a fair estimate of the impact that Ocean Wind will have on the southern New Jersey beach communities.	
TRANS-0066-000	The first was that there is a study a study quoted done in 2018 I think by some folks at the University of Delaware about the visual impact of the wind turbines sort of they showed people simulations of wind turbines that were approximately 580 feet tall and ask them what they thought whether it would be negative whether they would come back to that beach and then sort of the summarized that report they said there was about 15 miles kind of the point of indifference and it wasn't too bad. But you know also in the same EIS you know it says that the wind turbines that are contemplated for Ocean Wind 1080 feet long. So by admission the part of the EIS discussing the visual impact is inaccurate because the study they are relying on they used wind turbines probably just about a little over half the size of the ones that are actually going to be used so that's sort of point one.	Please see the response to comment 0011-0003.
0111-0001	On page 3.17-7 it states the maximum blade tip height could be 1049 feet. But the Firestone and Parsons 2018 study that stated the point of indifference visually is 15 miles from the shore used simulations with wind turbines of a height of 574 feet. Are there plans to get a revised study where the simulations shown have blades reaching as high as 1000 feet in the sky? If not the section regarding the visual impact is flawed.	Please see the response to comment 0011-0003. The Ocean Wind 1 PDE includes a maximum blade tip height of 906 feet (276 meters) AMSL; however, one or more of the other foreseeable offshore wind projects in the region has a maximum blade tip height of 1,049 feet (320 meters) AMSL. This taller WTG is considered in the cumulative analysis for both Section 3.18, *Recreation and Tourism*, and Section 3.20, *Scenic and Visual Resources*.
1071-0006	The erroneous conclusions reached in the DEIS included among others the following:1. From page 3.18-8 of the Draft Environmental Impact Statement	Please see the response to comment 0011-

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	"A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 miles from the viewer would have negligible impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018)."2. From page 3.18-20 of the DEIS "Beaches with views of WTGs could gain trips from the estimated 2.5 percent of beach visitors for whom viewing the WTGs would be a positive result offsetting some lost trips from visitors who consider views of WTGs to be negative (Parsons and Firestone 2018)."3. From page 3.18-22 of the DEIS "The main drivers for this impact rating are the minor visual impacts associated with the presence of structures and lighting…"	0003.
1071-0009	Another peer reviewed and published paper from University of Manchester published in Marine Policy Journal in 2017 paints a very dire picture. That paper states that 36% of respondents said they would not visit a beach where windmills were in the viewshed. In fact 63% said they would not come to that beach as often or at all. Still another further study (also peer reviewed and published) and cited by Parsons and Firestone. (Lutzeyer et al. 2017). found that 55 percent of existing customers would not re-rent their most recent vacation property if wind turbines were placed offshore.These impacts bleed over into the economic and societal impacts as recreation and tourism are the primary drivers of the economy along the Jersey shore with scenery playing a vital role in drawing in tourist dollars.	Please see the response to comment 0011-0003. Additional analysis of impacts on the vacation rental market was added to the Final EIS.
1071-0005	Additionally BOEM is not following their own guidance. From the BOEM report "Assessment of Seascape Landscape and Visual Impacts of Offshore Wind Energy Developments on the Outer Continental Shelf of the United States" (OCS Study BOEM 2021-032). "Current heights for proposed offshore wind energy facilities far exceed those observed in the studies discussed above and the results of these studies while relevant cannot be considered to apply to turbines currently used or proposed for offshore wind projects. It can be assumed that at a given distance larger turbines would create larger visual contrasts and up to some limit would be visible at longer distances."	Please see the response to comment 0011-0003.
0011-0004	In Appendix D "Analysis of incomplete or unavailable information" D.1.15 BOEM states "BOEM has determined that incomplete and unavailable resource information for recreation and tourism or for other resources on which the analysis of recreation and tourism impacts rely was either not relevant to reasonably foreseeable significant adverse impacts was not essential to a reasoned choice among alternatives alternative data or methods could be used to predict potential impacts and provided the best	Please see the response to comment 0011-0003. Additional information was included in the recreation and tourism analysis to account for the differences in height between the turbines included in the referenced studies and those

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	available information or the overall costs of obtaining the information were exorbitant or the means to do so were unknown. Therefore the information provided in the EIS is sufficient to support sound scientific judgments and informed decision-making related to the proposed uses of the onshore and offshore portions of the geographic analysis area". In fact all the currently available studies on the impact of visible turbines on tourism are out-of-date as the turbine size has increased dramatically. Existing studies used turbine heights of 579' to 600'. The proposed project uses 906'. The Kitty Hawk North COP uses turbines 1042' tall. A new study is needed that focuses on the economic impact of taller turbines on tourism similar to the NC State study. We note BOEM paid the University of Delaware only $350000 for its study a small price considering over $100 billion may be invested on planned offshore wind projects.	proposed as part of the Project.
0111-0002	On page 3.18-17 it states "Ocean Wind has committed to voluntarily implement ADLS....". Are there any teeth to their commitment? Why is it voluntary? Why didn't BOEM make it a requirement? Also is there another installation in the world of an ADLS on hundreds of offshore wind turbines or will this be a first?	Ocean Wind included a series of mitigation and monitoring measures (APMs) in the COP, including implementing ADLS. If BOEM decides to approve the COP or approve the COP with conditions, Ocean Wind would be required to certify compliance with these mitigation and monitoring measures under 30 CFR 285.633. ADLS has been used successfully on onshore wind turbines and will be used in the Vineyard Wind 1 and South Fork Wind Farm projects.
0210-0005	Most people will choose to take their beach vacation somewhere else rather than choosing a shoreline with hundreds of wind turbines in their view. This departure of tourists from the South Jersey coastline will significantly affect the tourism and restaurant industry in addition to the real estate and the family-owned business that line this beautiful coast. For your consideration I have attached an article discussing a survey done on the shores of North Carolina. [See original comment for Offshore Wind Turbines Will Drown North Carolina's Tourism] This survey asked tourists if they would continue to vacation at the North Carolina beaches if the proposed wind turbines were installed there. Fifty-four percent said they would not rent along that shoreline at all and would vacation somewhere else. Over the course of several years the economic impact of this would be multi millions of dollars lost to the North Carolina beach tourism industry. I ask you to please read	Additional analysis of impacts on the vacation rental market was added to the Final EIS.

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	the attachment which will go into greater detail. It is relevant to New Jersey in that the Jersey Shore towns are a major source of tourism dollars as well.	
0837-0009	According to N.J. Division of Travel and Tourism the travel sector is one of the largest employment drivers and revenue generating industries in the State. Tourism Economics (TE) prepared a study for VisitNJ the official tourism website for the State of New Jersey entitled the [Italics: Economic Impact of Tourism in New Jersey 2021]. [Footnote 11: Tourism Economics (TE). 2021. Economic Impact of Tourism in New Jersey 2021. Available: https://visitnj.org/sites/default/files/Economic_Impact_of_Tourism_in_New_Jersey_2021_Final.pdf?tag=itinerary. accessed: August 2022.] TE is an Oxford Economics company with a singular objective to combine the understanding of the travel sector with proven economic tools. TE has a regional headquarters in Philadelphia and Oxford with offices in Belfast Buenos Aires Dubai Frankfurt. This company is the world's foremost independent global advisory firm on two hundred countries one hundred industrial sectors and over 3000 cities. The study conducted by TE covered a timeframe from 2017 through 2021. It was concluded that "the travel sector in New Jersey is an integral part of the State. Visitors generate significant economic benefits to households businesses and government alike and represent a critical drive of New Jersey's future." [Footnote 12: TE. Tourism in New Jersey 2.] In 2021 visitors spent $37.3 billion in New Jersey recovering nearly half of the pandemic losses of 2020. Visitors grew to 96.6 million after a decline to 84.6 million in 2020. Visitor spending in New Jersey supported 270566 jobs and $18.8 billion in state GDP in 2021.In addition to direct tourism industries such as lodging recreation food services and retail TE incorporated the economic impact of indirect and induced forms of income that included spending wages employment federal state and local taxes. Considering the totality of this impact in terms of employment New Jersey tourism supported 430000 jobs in 2021 which represents 8.1% of all jobs in the state or one out of every twelve jobs. In reference to fiscal (tax) impacts visitor spending generated $10 billion in government revenue. The coastal counties of New Jersey Atlantic Cape May Monmouth and Ocean accounted for 48.6% of state and local tax receipts. This equates to a savings of $1400 per New Jersey household. Rebound visitors to the coastal areas led to near pre-pandemic levels while other counties remained significantly below.TE's study provides a comprehensive overview that indisputably recognizes tourism as the lifeblood of New Jersey. The statistical data from 2017 through 2021 establishes a definitive baseline for	The Final EIS sections have been reorganized to clarify that the No Action Alternative includes ongoing activities, including ongoing offshore wind projects, and the cumulative analysis of the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind and planned offshore wind projects. Information was added to the Final EIS to further describe tourism to New Jersey during 2021.

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	BOEM to utilize before Alternative Impacts and Alternative Combined with Other Foreseeable Impacts are introduced. TE's estimate for a significant increase in visitors to New Jersey should be included in the Foreseeable Impacts which escalate from 2022 through 2025 when an anticipated 124.3 million visitors are expected in the State. According to BOEM's Table the No Action Alternative combined with Foreseeable Impacts equates to a moderate to minor beneficial impact the same results as Alternatives A through E. This conclusion is difficult to reconcile when considering the studies compiled by TE a neutral third party and the details of this Project and future offshore wind projects in New Jersey. For instance BOEM cites the aforementioned vessel trips (1539 vessel trips during construction; 3392 vessel trips per year during operations and maintenance; 1539 vessel trips per year during decommissioning) 175 miles of underground offshore cable a 50 foot wide construction corridor for cable [Italics: onshore] and a 30 foot permanent easement [Italics: beyond] the 50 foot construction corridor. BOEM presented a diagram with the designated cable route for the BL England plan. The corridor for the cable will run 30 blocks through the heart of the island of Ocean City. Offshore cable will be installed along 60% of Ocean City's beachfront. According to the cable route land designated as Green Acres will be confiscated at a state park on the island. Indeed a reconciliation to suggest that the No Action Alternative is comparable to Alternatives A through F is a formidable task. For this reason BOEM was forced to misrepresent facts by integrating other proposed offshore wind projects into the Foreseeable Impacts. This skewed version of the No Action Alternative is another example of the methodology utilized by BOEM to arrive at a preordained conclusion. The noted frequency of this strategy runs counter to society's accepted moral code of values and has the impact of undermining public trust.	
0967-0001	Broadly we would like to reiterate our strong recommendation also expressed in our comments on the NOI that impacts to the charter/for-hire sector and private recreational anglers be considered or at least presented jointly rather than separately under the "3.9: Commercial Fisheries and For-Hire Recreational Fishing" and "3.18: Recreation and Tourism" sections of the DEIS respectively. Charter/for-hire and private recreational anglers fish similar areas target the same species use the same gear and are subject to management under the same authorities. For fishermen fishery managers and other interested parties struggling to provide constructivefeedback on a document of this magnitude separating the expected impacts of alternatives	While there is overlap in the types of impacts described in Section 3.9, C*ommercial Fisheries and For-Hire Recreational Fishing*, and Section 3.18, *Recreation and Tourism*, for offshore recreational anglers, Section 3.18 also addresses impacts on other recreational activities and the impacts on tourism as a whole. The impacts described in both sections are consistent with one another.

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	to these two groups by over 200 pages in the document only further complicates the process.	
0984-0026	3.18 Recreation and TourismThe suggestion that the recreational fishing industry will benefit from the additional artificial sites is one of the systemic raciest components contained in the EIS and within BOEM as a whole. The site will have a negative biological inventory affect. The site that had provided a source of seafood will be removed economically.The study that shows an increase in tourism is a farce promoted by the wind industry through the funding of the study referenced. The industry paid for people to stay at the bed and breakfasts before going out fishing around the Rhode Islands at sea development site. The area around the site that they fished was already EFH for Black Seabass prior to development. I guess a argument can be made that there will be an increase in the amount of environmental activists going into the industrial at sea wind energy development sites to look at all the dead seabirds floating around and to protest the sites existence. The proactive protesting and forceable intentional destruction of the towers propagated by the lack of police enforcement currently being seen in the United States would suggest that the development sites may become exclusion zones. This will remove any viability to tourism and recreation creating a [Bold: Major Impact.]	Evidence from the Block Island Wind Farm indicates that there is an increase in recreational fishing near WTGs as a result of the fish aggregation and reef effects of the turbines. As described in Section 3.9.5.2, while impacts on commercial fishing activities would vary by fishery, it is estimated that the majority of operations would be able to adjust to account for disruptions due to impacts.
1071-0010	In Cape May County alone over 60% of employment is related to tourism. The location and size of this project will have a devastating impact on the seasonal tourism of the Jersey Shore and employment in the area. This reduction in trips and related tourism dollars would irreparably harm the tourist economy of the Jersey Shore where employment is primarily dependent on tourism. Based on these scientific papers already cited in the report the negative impact to Ocean City NJ alone would be well over $100 million annually if the current proposed installation moves forward.	Information was added to the Final EIS about the economic impacts of a potential decrease in tourism.
1071-0011	The DEIS spent a lot of time focusing on fishing and boating tourists which is a small fraction of the tourist dollar and economy of the Jersey shore. The DEIS should spend as much time or more on beach going tourists who are the main drivers of the local economy.	Analysis of the potential impacts of the Proposed Action on beach visits, including overnight stays, is included in Section 3.18.5, *Impacts of the Proposed Action on Recreation and Tourism*.
1086-0001	Cape May County is home to nearly 100000 full-time residents and welcomes over 8.2 million summertime visitors generating over $36 billion in visitor spending. [Footnote 1: 2021 Economic Impact of Tourism in Cape May County [Embedded Hyperlink Text (https://capemaycountynj.gov/DocumentCenter/View/8234/2021-CMC-	Comment noted.

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	Chamber-Economic-Impact-of-Tourism)]] Cape May County is also home to some of the most desirable real estate in America that has been built around prized natural landscapes that provide bountiful seafood stocks and expansive 360-degree views of the Atlantic Ocean and open marshland. [Footnote 2: Stone Harbor Ranked Among Most Expensive Real Estate Markets in U.S. [Embedded Hyperlink Text (https://philadelphia.cbslocal.com/2013/11/07/stone-harbor-ranked-among-most-expensive-real-estate-markets-in-u-s/)]] Tourism and commercial fishing are Cape May County's two primary sources of economic revenue with tourism supporting over 393000 Cape May County jobs or roughly 7% of the jobs in the entire State of New Jersey.1 In addition the Port of Cape May is the largest in New Jersey and the second largest along the Eastern Seaboard ranking in the top 20 in landings and value in the nation. In 2020 the fishing industry both commercial and recreational supported approximately 27000 jobs. Both the tourism and fishing industries are at significant risk as a result of the Ocean Wind 1 offshore wind project. In addition the County has major concerns about impacts to the local ecosystem including fisheries marine mammals benthic habitats and birds each of which play an integral role in the Jersey Shore economy. Many traditions such as fishing sailing bird whale and dolphin watching have been practiced for centuries. Exceptional views of the ocean and coastal landscape have driven extensive real estate development which is a vital source of tax revenue for local communities and the State of New Jersey. Ocean Wind 1 threatens critical environmental cultural and scenic resources that have made the Jersey Shore what it is today.	
1086-0019	Tourism. Cape May County's economy rests heavily on tourism which is extremely fragile worldwide due to natural and manmade disasters taking a toll on the economy of local counties states and countries. Tourism is the largest industry in the County generating nearly $7 billion in direct tourism spending annually. In fact nearly 1 in every 5 dollars spent in New Jersey is spent in Cape May County with tourism expenditures outpacing all other counties in the state in the food and beverage retail and recreation sectors. [Footnote 30: Cape May County Department of Tourism [Embedded Hyperlink Text (https://capemaycountynj.gov/DocumentCenter/View/10037/2022-Cape-May-County-Tourism-Book-Final)]] Cape May County tourism generated $615 million in state and local taxes and another $16 million in occupancy taxes. More than 63% of the County's total jobs are linked to the tourism industry. Rentals dominate the lodging sector with $2.4	Information was added to the Final EIS to analyze potential impacts of the Proposed Action on vacation rentals.

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	billion generated in rental income in 2021. The summer resident population grows eight-fold compared to the winter resident population with an annual visitor base of over 10 million people. The overwhelming reason people visit and buy properties in Cape May County is our beaches. The County is concerned that Ocean Wind 1 will diminish property values rental prices and the cultural value of the Jersey Shore that will have long-lasting economic impacts.	
1212-0001a	We provide these comments in the hope that the Bureau of Ocean Energy Management (BOEM) will change course with regard to these ill-conceived projects and the inadequate economic review accompanying them. We therefore strongly oppose the project as currently proposed as the visual pollution of the turbines will have a negative effect on shore rentals. VRJS is a local NJ based company that advertises and markets over 2200 vacation rentals along the Jersey Shore from Long Beach Island to Wildwood. Over the last 4 years we have helped arrange over 100000 "stays" for the owners who advertise with us. The Ocean Wind Projects as currently proposed with the wind turbines visible from shore WILL have a negative impact on tourism. Not only is it common sense but there are a number of studies and surveys of persons shown images of turbines including several sponsored by the BOEM that have concluded significant reductions in rental and tourism revenues and property values will occur from visible turbines. I bring you attention to the following studies: New Jersey Global Insight Report 2008 North Carolina State University Study 2017BOEM/University of Delaware Study 2018BOEM Viewshed Analysis. 2015 New York State Turbine Exclusion Distance 2018. Of these studies mentioned above the North Carolina study found that 55 percent of those surveyed would not re-rent that property if turbines were visible regardless of the degree of visibility or any rental discount offered. It also found that the negative reaction to wind turbines was primarily due to the offshore distance as opposed to the number of turbines. So even just a few visible turbines WILL have a negative effect on tourism. What does this equate to? New Jersey visitor spending in 2019 was 46.4 Billion which contributed over 5 Billion in taxes to the State of NJ and 540500 jobs making it the 6th largest employer in the state (Source: NJ Economic impact of Tourism in NJ 2019) with lodging being the #1 revenue sector. Breaking out the 4 shore counties from the above figures the Jersey Shore contributes 22.3 Billion to the overall tourism economy or about half. If the North Carolina study is correct that 55% of shore vacationers would not return that would equal a 12.3 Billion dollar ANNUAL	Information was added to the Final EIS to analyze potential impacts of the Proposed Action on vacation rentals. BOEM has determined that impacts on recreation and tourism from the presence of structures would be moderate because affected activities or communities would likely have to adjust somewhat to account for disruptions due to the Project. This impact level reflects survey results suggesting a range of visitor experience related to views of offshore wind farms, with some respondents reporting their beach experience would be worsened, while other respondents reported that their experience would be improved or took a neutral position (would neither improve nor worsen their experience). The cumulative impacts of the Proposed Action in combination with planned offshore wind projects in the region are described in Section 3.18.5.1, *Cumulative Impacts of the Proposed Action.* BOEM determined that cumulative impacts on recreation and tourism would also be moderate.

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	loss in tourism revenue and a 1.4 Billion dollar loss of annual tax revenue for the state of New Jersey! We cannot afford or accept this!	
1212-0001b	It has come to our attention that there IS a BOEM screened and approved lease area 30 - 57 miles off shore that is bigger and has more wind capacity. I am referencing the "Hudson South" call area. Locating the wind farm in this area a minimum of 30 miles off shore and even with the bigger 12MW turbines will solve the visual pollution that the current lease area emits thus saving our Tourism economy which is so important to the state. We strongly urge you to slow this project down and consider relocation of both the Ocean Wind AND the Atlantic Shores projects to the Hudson South area. It's just common sense NOT to have those turbines visible from the shore! To us Jersey folks the Jersey Shore is our Grand Canyon! If you have never seen a sunrise on our shore I encourage you to get up early one morning and watch one. Our pristine ocean landscape will become industrialized completely ruining the natural unobscured view to the horizon. If our horizon becomes picketed with rows and rows of wind turbines this pristine sight will forever be ruined. I am sure you wouldn't approve wind turbines on the rim of the Grand Canyon. Please don't ruin our Jersey Shore with them either. Please evaluate moving them further out so they can't be seen from shore to the Hudson South Call area. - Vacation Rentals Jersey Shore LLC	In the Draft EIS (Chapter 2, Table 2-3), BOEM considered, but dismissed from further consideration, alternatives for alternate locations for the wind energy facility outside of the Lease Area. BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Lease Area. This alternative would effectively be the same as selecting the No Action Alternative.
1278-0021	Sport divers are also fishermen (spearfishing) and the NJCD&C is concerned with the impact of this industrialization of the ocean on fish and how it impacts recreational and commercial fishermen. Generally fish are attracted to structure similar to shipwrecks and artificial reefs. How the buried electrical cable will affect the fish and lobsters appears to be uncertain or unknown especially with the concentrated inter-array cables in the WTG area.	Based on findings at Block Island Wind Farm, the turbines for the Project are expected to have a reef effect and cause fish aggregation similar that of to shipwrecks or artificial reefs. As described in Section 3.13.3.2, a few studies have documented that the presence of direct current cables and domestic electrical power cables result in subtle changes in lobster activity (e.g., broader search areas, subtle effects on positioning, and a tendency to cluster near the EMF source) and only occur when lobsters were within the EMF. More information on the impacts of EMF on fish and invertebrates is included in Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*.

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0984-0076	The one item that became evident during beach replenishment was the flosem that carries the bacteria into bathing areas closing down beaches. The impact of sediment deposition will have a [Bold: major impact] to the shore tourism industry. Beach closures will be part of the everyday beach experience since normal maintenance will be consistent for decades. There is plenty of science that describes the relationship between sediment drift and beach closings due to fecal coliform. The applicant has chosen not to include this impact in the EIS. The health and safety of the other sea users should take president over the establishment of nascent industry. The applicant states in the application that there will be long term impacts from sediment deposition. The use of non-native sediments will entice the development and growth of non-native species. The impacts to the foundation of the eco- system in the estuaries and tidal waters will stagnate growth of an already fragile eco-system for this major impact and others mentioned the EIS should be rejected as incomplete.	The use of nonnative sediments at landfall locations is not anticipated. There are multiple mitigation and monitoring measures included in Appendix H, *Mitigation and Monitoring*, that focus on ensuring that sediment dispersion is minimized during construction including GEN-06, GEN-11, and GEO-02.

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O.6.18 Sea Turtles

Table O.6.18-1 Responses to Comments on Sea Turtles

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1259-0156	xiii. Sea Turtles (3.19). The analysis of impacts to Sea Turtles are is included in Appendix G and not in the main body of the Draft EIS as " these impacts are no greater than minor adverse impacts" and impacts of most concern are discussed in the main body of the Draft EIS (Section G.1 DEIS). This is an incomplete and premature assessment to conclude as all impacts to sea turtles including cumulative impacts arising from this project and other potential projects in the region have not been investigated thoroughly. This has been ably supported in a 2020 report by the Sea Turtle Working Group to New York State Energy Research and Development Authority (NYSERDA 2020) which acknowledged the following: Substantial data gaps at spatial and temporal level in our understanding of sea turtle populations and distributions in wind energy areas· Substantial data gaps in our understanding of the potential effects posed by Offshore wind (OSW) development to sea turtles· Need for multiple approaches to understand the cumulative impacts of OSW development on sea turtles· Need to prioritize research to fill gaps in baseline data on sea turtle distributions abundance habitat use and movements above stressor-specific investigations of effects to turtles such as artificial reef effects entanglement vessel strike or EMF. This included an emphasis on understanding the environmental drivers of sea turtle presence and movements· Need to focus in the immediate term (e.g. within the next five years) on improving our understanding of the potential effects of OSW on sea turtles as development proceeds including the above-listed stressors as well as potential effects from cabling landfall near sea turtle nesting beaches. [Footnote 139: G. Gitschlag et al. Sea Turtle Workgroup Report for the State of the Science Workshop on Wildlife and Offshore Wind Energy 2020: Cumulative Impacts. Report to the New York State Energy Research and Development Authority (NYSERDA) (2021) https://www.nyetwg.com/2020-workgroups.]	EIS Appendix D, *Analysis of Incomplete and Unavailable Information*, Section D.1.16, *Sea Turtles*, acknowledges that there is incomplete information on the distribution and abundance of sea turtle species that occur in the Atlantic OCS and the Lease Area. Section D.1.16 also acknowledges that some uncertainty exists about the effects of certain IPFs on sea turtles and their habitats and that the effects of EMF on sea turtles are not completely understood. As discussed in Section D.1.16, BOEM considered the level of effort required to address the uncertainties described above for sea turtles and determined that the methods necessary to do so are lacking or the associated costs would be exorbitant. Therefore, where appropriate, BOEM inferred conclusions about the likelihood of potential biologically significant impacts from available information for similar species and situations to inform the analysis in light of this incomplete or unavailable information. These methods are described in greater detail in Section 3.19, *Sea Turtles*, and in the BA submitted to NMFS (BOEM 2022). Therefore, the analysis provided is sufficient to support sound scientific judgments and informed decision-making about the proposed Project with respect to its impacts on sea turtles.
1259-0157 & -0158	The Research and Monitoring Initiative (RMI) established by NJDEP in collaboration with NJ Board of Public Utilities (BPUs) describes its goal as follows: "To pursue a rigorous scientific research approach to uphold the State's mandate to protect and responsibly manage New Jersey's coastal and marine resources while supporting the State's Offshore Wind Economic	See response to 1259-0156. BOEM does not concur that data gaps would result in a different impact conclusion for sea turtles than presented in EIS Section 3.19.

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	Development Act Executive Order 8?and Executive Order 92 and the and the Energy Master Plan which respond to climate change and protect our environment for future generations. [Footnote 140: https://www.nj.gov/dep/offshorewind/rmi.html.] In 2021 the RMI identified sea turtles as one of the highest priorities for research and monitoring during the pre-construction phase to address the following knowledge gap about the species: 1. Collate existing data for sea turtle movement distributions and habitat use patterns; conduct beach surveys where possible (i.e. how do these animals use the space?) 2. Conduct tagging on rehabilitated/released sea turtles. [Footnote 141: https://nj.gov/dep/offshorewind/docs/erwg-slides-20211220.pdf] In a recent quarterly update meeting of the New Jersey Department of Environmental Protection ("NJDEP") Offshore Wind Environmental Resources Working Group which was attended by a COA staff member the status of this research priority is still not addressed. With so many concerns and data gaps yet to be addressed the Draft EIS's conclusion that impacts of the Proposed Action or its Alternatives range from negligible to minor as well as minor beneficial cannot be true and needs to be investigated thoroughly. The sea turtle geographic analysis area encompasses two large marine ecosystems (LMEs) namely the Northeast US OCS and the Southeast US OCS to capture most of the movement range of sea turtles and their likely occurrence in the Project area. Impact factors to sea turtles include accidental releases including marine debris vessel strikes EMF noise and climate change all of which can be assessed more thoroughly and specifically by way of a Pilot Project instead of a full-blown industrial expansion in the geographical analysis area.	
1259-0159	Section 3.19 of the Draft EIS discusses potential impacts on sea turtles from the Ocean Wind 1 including alternatives and ongoing and planned activities in the sea turtle geographic analysis area. [Footnote 142: DEIS at Figure 3.19-1.] The geographic analysis area does not include all areas that could be transited by Project vessels including vessel transits from Europe. This is a serious limitation because impact producing factors (IPFs) for sea turtles describe impacts from vessel strikes and vessel noise. [Footnote 143: Id. at 3.19.3.1.] Vessel strikes are also an increasing concern for sea turtles. For example the percentage of loggerhead strandings attributed to vessel strikes has increased from approximately 10% in the 1980s to a record high of 20.5% in 2004. [Footnote 144: NMFS and USFWS 2007.] Sea turtles cannot reliably avoid being struck by vessels exceeding two (2) knots and typical	Vessel traffic effects on sea turtles involving transits from Europe were analyzed in Section 3.3.5.6 of the NMFS BA and are incorporated by reference into Section 3.19 of the EIS. ESA consultation with NMFS is ongoing and findings of the Biological Opinion were incorporated into the Final EIS.

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	vessel speeds in the geographic analysis area may exceed ten (10) knots. [Footnote 145: Hazel et al. 2007.] Increased vessel traffic could result in sea turtle injury or mortality. Excluding the European estimate the Draft EIS states that the Proposed Action would generate approximately 3847 vessel trips just during the construction and installation phase.	
1259-0160 & -0161	Description of the Affected Environment for Sea Turtles (3.19.1). According to BOEM (2019) sea turtles that occur on the Atlantic OCS may migrate the entire eastern seaboard therefore all activities occurring in their migratory range have the potential to contribute impacts. Four species of sea turtles are known to occur in or near the Ocean Wind Project area all of which are protected under the federal Endangered Species Act (16 USC 1531 et seq.) These include the leatherback sea turtle (Dermochelys coriacea) loggerhead sea turtle (Caretta caretta) Kemp's ridley sea turtle (Lepidochelys kempii) and green sea turtle (Chelonia mydas). [Footnote 146: DEIS at Section 3.19.1 Table 3.19-1.] There is potential for the four primary sea turtle species identified above to seasonally inhabit offshore waters in the Project area in the spring (March-May) summer (June-August) and fall (September-November) including the area of direct effects during the winter months (December-February). Water temperature is a primary factor influencing sea turtle distribution; sea turtles typically occur in the coastal waters off New Jersey when water temperatures exceed 59°F. [Footnote 147: NJDEP 2010.] However not all sea turtles leave the area during winter and there are occasional strandings of sea turtles that become incapacitated or "cold-stunned" at temperatures below 50°F. [Footnote 148: Id. citing Mrosovsky 1980.] In peak summer months loggerhead turtles' density in the Project Area is estimated to be 26.799 animals per 100 Km2. [Footnote 149: DEIS at Table 3.19-2.] MARCO's data portal shows above average populations of leatherback and loggerhead sea turtles in summer. [Footnote 150: MARCO Mid-Atlantic Ocean Data Portal (last accessed Aug. 22 2022) https://portal.midatlanticocean.org/visualize/#x=-74.40&y=39.13&z=10&logo=true&controls=true&dls%5B%5D=true&dls%5B%5D=0.5&dls%5B%5D=60&dls%5B%5D=true&dls%5B%5D=0.5&dls%5B%5D=4027&dls%5B%5D=true&dls%5B%5D=0.5&dls%5B%5D=4041&ls%5B%5D=true&dls%5B%5D=0.8&dls%5B%5D=3312&basemap=nautical&themes%5Bids%5D%5B%5D=2&t ab=legend&legends=false&layers=true.] Estimating the distribution and relative density of satellite-tagged loggerhead sea turtles using geostatistical mixed effect models reconfirm their	The comment cites the statements and findings presented in Section 3.19 of the Draft EIS and BOEM concurs that all four species of sea turtles occur in the geographic analysis area for sea turtles. The commenter's concluding statement that impacts are oversimplified in the EIS is not supported and there are no specific challenges to data, methods, or findings of the Draft EIS analysis for BOEM to consider.

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	abundance and show that both leatherback and loggerhead directly lie within the project boundaries in summer. [Footnote 151: Marine Ecology Progress Series 586: 217-232).] The highest likelihood of occurrence for Kemp's Ridley sea turtle is in coastal nearshore areas adjacent to Ocean City and Barnegat Bay where the offshore export cable is anticipated to make landfall as they seek protected shallow-water habitats. The Draft EIS acknowledges the following challenges related to sea turtles. Yet the impacts are oversimplified inaccurately without any supporting scientific evidence.	
1259-0162 & -0163	Without a thorough analysis of the Impact Producing Factors in near term short term and long-term including cumulative impacts and impacts from climate change the Draft EIS fails to account for all adverse impacts to sea turtles from the Project and simplifies the impacts to be either minor or incremental to the impacts arising from No Action Alternatives. The geographic analysis area is likely estimated to undergo the following activities from other offshore wind projects (Section 3.19.3.2 DEIS)· Installation of 3109 WTG and OSS foundations· Installation of 4988 miles (8027 kilometers) of offshore export cable and 5309 miles (8544 kilometers) of inter-array cable· Disturbance of 27126 acres (110 km2) of seabed for WTG foundations and scour protection cable emplacement and anchoring· Storage of 5300 gallons (19041 liters) of diesel fuel oils lubricants and coolant per WTG. With all of this in mind it is imperative to consider that loggerhead turtles live in three ecosystems: (i) terrestrial zone - the nesting beach where oviposition embryonic development hatching and hatchling transit to the sea occur; (ii) the neritic zone -the nearshore marine environment (from the water surface to the sea floor) where water depths do not exceed 200 m; and (iii) the oceanic zone - the vast open-ocean environment (from the water surface to the sea floor) where water depths are greater than 200 m. Threat analysis matrix for such endangered species must include all life stages occurring in those ecosystems. [Footnote 153: Bolten et al. 2021.]	The impacts of climate change are analyzed as an ongoing activity in Final EIS Section 3.19.3, and cumulative impacts of the Proposed Action in combination with other ongoing and planned activities are analyzed in Final EIS Section 3.19.5.1. As described in Section 3.4, *Definition of Impact Levels*, all Chapter 3 resource sections consider the duration of impacts that are characterized as short term, long term, or permanent. The Final EIS analyzes impacts associated with all construction, O&M, and decommissioning activities described in Ocean Wind 1's COP including offshore construction of WTGs and OSS, offshore cable laying, cable laying in state waters and nearshore, construction of cable landfalls, and construction of onshore export cables and substations, which correspond to the commenter's terminology of terrestrial zone, neritic zone, and oceanic zone.
1259-0164	Accidental Releases. According to the Draft EIS "Accidental releases from other offshore wind activities would likely result in minor impacts for sea turtles and are unlikely to result in population-level effects although consequences to individuals would be detectable and measurable." [Footnote 154: DEIS at 3.19-12.] The document continues "In context of reasonably foreseeable trends the Proposed Action would contribute an undetectable increment to the combined accidental release impacts on sea turtles from ongoing and planned activities including offshore wind which are expected to be minor." [Footnote 155: Id. at 3.19-23.] The risk of accidental	BOEM concurs that there is risk of accidental release from offshore wind activities and that there is low risk of a high-volume release of fuels, oils, lubricants, and coolants as described in EIS Section 3.19. Accidental releases have lower potential impacts on sea turtles due to their low probability of occurrence and relatively limited spatial extent. As such, while the impacts of large spills could

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	releases exists during all phases of the Project and it is unclear how these impacts could only be minor or unlikely to cause population level effects. According to the planned activities scenario provided in Table F2-3 of the Draft EIS there would be a low risk of a leak of fluids from any single one of approximately 2946 WTGs each with approximately 5300 gallons (19041 liters) of diesel fuel oils lubricants and coolant stored. The Draft EIS estimates that a release of 128000 gallons is likely to occur no more often than once per 1000 years and a release of 2000 gallons or less is likely to occur every 5 to 20 years using a BOEM modeling reference. [Footnote 156: See Adriana C. Bejarano et al. Environmental Risks Fate and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf Bur. Ocean Energy Mgmt. (2013) https://espis.boem.gov/final%20reports/5330.pdf.]	be significant, a large spill is unlikely to result from construction, O&M, and decommissioning of offshore wind facilities.
1259-0167	Section 3.19.5 acknowledges that accidental release of trash and debris may occur from Project vessels during construction operations and decommissioning. BOEM assumes operator compliance with federal and international requirements for managing shipboard trash but in the event the stakes are high in the event that an operator fails to comply. Sea turtle ingestion of debris including plastics can be fatal and it is well known that marine debris is a serious problem that is adversely affecting the marine ecosystem. Plastic pollution in our oceans may therefore soon exceed estimated safe concentrations for many pelagic species. [Footnote 158: Egger et al 2022. https://www.nature.com/articles/s41598-022-17742-7.] The Draft EIS should further analyze this specific concern rather than assume operator compliance.	EIS Section 3.19 acknowledges the threat that marine pollution poses related to the ingestion of trash and debris by sea turtles. However, it is not reasonable to assume that operators would disregard regulatory requirements and intentionally discharge trash and debris overboard. Therefore, BOEM maintains that accidental releases would likely be small and localized events with minor impacts for sea turtle populations.
1259-0168, & -0169	Potential Interactions Between Sea Turtles and Electromagnetic Fields (EMF). The Draft EIS states that EMFs produced by cables have the potential to affect sea turtle migration because they are known to possess geomagnetic sensitivity and use cues from Earth's magnetic field for orientation navigation and migration. [Footnote 159: DEIS at 3.19.3.2 3.19-12.] Loggerhead sea turtles which are present on both the Atlantic and Pacific Coasts use magnetosensitivity to navigate during their migration and then reorient to return home. [Footnote 160: See U.S. Offshore Wind Synthesis of Environmental Effects Research Electromagnetic Field Effects on Marine Life (2022) https://tethys.pnnl.gov/sites/default/files/summaries/SEER-Educational-Research-Brief- Electromagnetic-Field-Effects-on-Marine-Life.pdf.] A 2021 Report prepared for NJDEP (Bilinski 2021) highlights how the	EIS Appendix D, *Analysis of Incomplete and Unavailable Information*, Section D.1.16, *Sea Turtles*, acknowledges that the effects of EMF on sea turtles are not completely understood. However, the available relevant information is summarized in the BOEM-sponsored report by Normandeau et al. (2011). Although the thresholds for EMF disturbing various sea turtle behaviors are not known, the evidence suggests that impacts may only occur on hatchlings over short distances, and no adverse effects on sea turtles have been documented to occur from the numerous

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	navigation behavior of sea turtles is related to interactions between ocean circulation and dynamics in the geomagnetic field. [Footnote 161: See Joseph Bilinski Review of the Impacts to Marine Fauna from Electromagnetic Frequencies (EMF) Generated by Energy Transmitted through Undersea Electric Transmission Cables N.J. Dept. Envmtl. Prot. (2021) https://www.nj.gov/dep/offshorewind/docs/njdep-marine-fauna-review-impacts-from-emf.pdf.] The report describes that results-to-date based on scientific evidence remain inconclusive on the actual impacts (positive or negative) of submarine cables and associated EMFs on marine life including sea turtles and warrant further study. Sea turtles have a detection threshold of magnetosensitivity and behavioral responses to field intensities ranging from 0.0047 to 4000 microteslas for loggerhead turtles and 29.3 to 200 microteslas for green turtles with other species likely similar due to anatomical behavioral and life history similarities. [Footnote 162: Normandeau et al. 2011.] In the planned activities scenario up to 4988 miles (8027 kilometers) of offshore export cable and 5309 miles (8544 kilometers) of inter-array cable would be added in the geographic analysis area for sea turtles producing EMFs in the vicinity of each cable during operations (Appendix F Table F2-1). Submarine power cables in the geographic analysis area for sea turtles are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF from cable operation to low levels. The details are not clearly described. Juvenile and adult sea turtles may detect the EMF over relatively small areas near cables (e.g. when resting on the bottom or foraging on benthic organisms near cables or concrete mattresses). [Bold: The impacts on sea turtles from EMFs generated by underwater cables is presently unknown] but anthropogenic magnetic fields can and do influence migratory deviations. [Footnote 163: See Peter A. Klimley et al. A call to assess the impacts of electromagnetic fields from subsea cables on the movement ecology of marine migrants Conservation Science and Practice (2021) https://conbio.onlinelibrary.wiley.com/doi/pdf/10.1111/csp2.436.]	submarine power cables around the world. BOEM considered the level of effort required to address the uncertainties described above for sea turtles and determined that the methods necessary to do so are lacking or the associated costs would be exorbitant. Therefore, where appropriate, BOEM inferred conclusions about the likelihood of potential biologically significant impacts from available information for similar species and situations to inform the analysis in light of this incomplete or unavailable information. These methods are described in greater detail in Section 3.19, *Sea Turtles*, and in the BA submitted to NMFS (BOEM 2022). Therefore, the analysis provided is sufficient to support sound scientific judgments and informed decision-making about the proposed Project with respect to its impacts on sea turtles. The cable burial details of each offshore wind project are described in the COP for each project, but are anticipated to be similar to the proposed Ocean Wind 1 Project that has a target burial depth of 4 to 6 feet (1.2 to 1.8 meters) below the stable seabed (see Final EIS Section 2.1.2.2.3).
1259-0171	Noise [Bold: Per] the Draft EIS underwater noise will be caused by impact pile driving (installation of WTGs and OSS) vibratory pile driving (installation and removal of cofferdams) HRG surveys detonations of UXO vessel traffic aircraft cable laying or trenching and turbine operation (other offshore wind activities without proposed action Sec. 3.19.3.2 3.19-14). Section 3.19.5 of the Draft EIS acknowledges that underwater noise generated by Ocean Wind 1 may result in potential adverse effects on sea turtles in the Project area	Data regarding sea turtle hearing abilities are summarized in EIS Table 3.19-4. In the absence of NMFS acoustic thresholds, the U.S. Navy has adopted acoustic thresholds for the onset of PTS, TTS, and behavioral disruptions for sea turtles as presented in Finneran et al. (2017) (and shown in Table

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	including PTS TTS or behavioral disturbance. Given the high energy levels of offshore wind energy survey and installation noise sources it can be concluded that sea turtles could be affected by associated noise. The Draft EIS also mentions the following serious limitations pertaining to underwater noise:· The lack of available empirical data on noise threshold levels that impact sea turtles upon exposure;·Limited data pertaining to behavioral responses of sea turtles and the absence of specific data pertaining to sounds generated from offshore wind activities; and· Lack of regulatory noise threshold criteria for sea turtles. Despite these huge data gaps and the potential harm to a highly endangered species from the Project the Draft EIS erroneously and presumptively concludes that the impacts of noise on sea turtles from other offshore wind activities would be minor. The planned activities scenario involves the construction of 3 109 WTG and OSS foundations that would result in acute chronic and persistent noise during all phases of the Project and would cause potential harm at the species and population level as well as cumulative impacts. However the Draft EIS additionally concludes without evidence that in the context of foreseeable trends which are undefined as such the combined noise impacts on sea turtles from ongoing and planned activities including offshore wind are expected to be minor. The Draft EIS is deficient in this regard as well.	3.19-5). Section 3.19.5 concludes that underwater noise generated by impact installation of monopiles and pin piles, vibratory installation and removal of sheet piles for cofferdams, detonations of UXO, vessel activity, and WTG operation would increase sound levels in the marine receiving environment and may result in potential adverse effects on sea turtles in the Project area including PTS, TTS, or behavioral disturbance. EIS Section D.1.16 acknowledges some uncertainty regarding the cumulative acoustic impacts associated with pile-driving activities and whether sea turtles affected by construction activities would resume normal feeding, migrating, or breeding behaviors once daily pile-driving activities cease, or if secondary impacts would continue. However, as noted in response to previous comments, BOEM has determined that the analysis provided is sufficient to support sound scientific judgments and informed decision-making about the proposed Project with respect to its impacts on sea turtles (see EIS Section D.1.16 for additional explanation).
1259-0172, & -0173	The scientific community's knowledge of the impacts of sound on sea turtles lags behind other animals such as whales and dolphins. [Footnote 164: Office of Protected Resources Sea Turtles in a Sea of Sound Natl. Oceanic and Atmospheric Admin. (June 12 2022) https://www.fisheries.noaa.gov/feature-story/sea-turtles-sea-sound.] Data gaps abound with respect to sea turtle interactions. It is important to first understand how they perceive and respond to anthropogenic sounds if methods to reduce potential impacts are to be developed. assessment procedures and subsequent regulatory and mitigation measures are often	Detailed discussion of the underwater acoustic and exposure modeling conducted for the Ocean Wind 1 Project can be found in the NMFS BA for the Ocean Wind 1 Project, COP Appendix R-2 posted to BOEM's website,[1] and Ocean Wind's Letter of Authorization Application.[2] BOEM has initiated consultation with NMFS for ESA-listed sea turtles and has incorporated findings of the Biological Opinion

[1] The Ocean Wind 1 COP is available at: https://www.boem.gov/ocean-wind-1-construction-and-operations-plan.
[2] Ocean Wind 1's Letter of Authorization Application is available at: https://www.fisheries.noaa.gov/action/incidental-take-authorization-ocean-wind-lcc-construction-ocean-wind-1-wind-energy-facility.

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	severely limited in their relevance and efficacy due to the absence of data. [Footnote 165: See A.N. Popper et al. Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI SpringerBriefs in Oceanography (2014) DOI: 10.1007/978-3-319-06659-2_1.] Where is the documentation which determined the effects of the project noise would only be minor or incremental? The ANSI technical guidance on sound exposure for fish and sea turtles highlights a collaborative effort among various multidisciplinary international and national experts. Was this consulted in this assessment in the Draft EIS?	into the Final EIS.
1259-0174	The Draft EIS says that effects of different sized monopile diameter would change the level of impact but does not describe how it would impact sea turtles. Further discussion and analysis is warranted.	EIS Appendix J reports acoustic modeling results for 8- to 11-meter-diameter tapered monopiles and 2.44-meter-diameter pin piles, which cover a wide range of potential pile diameters.
1259-0175	The Draft EIS uses Block Island Wind Farm ("BIWF") as the primary reference to conclude that effects of Ocean Wind 1 will be similar in nature to what was observed during the construction of BIWF. As stated in these comments and also during the virtual public hearing sessions hosted by BOEM on Ocean Wind 1 this project varies considerably from BIWF and relying on BIWF alone will result in incomplete analysis of impacts to sea turtles. This is especially true because Ocean Wind 1 will include as many as 98 monopile foundations and other structures dramatically different in scope and scale than the jacket-frame turbines at BIWF. Also the sedimentation caused by turbulence from currents moving around the monopole were not present in Block Island example.	BOEM does not concur that the EIS findings for the Ocean Wind 1 Project rely primarily on studies sourced to the Block Island Wind Farm. Although some relevant studies related to Block Island Wind Farm are cited in the Ocean Wind 1 EIS, there are hundreds of additional citations referenced in EIS Chapter 3 sections and consultation documents to support EIS impact conclusions.
0984-0027a	Sea turtles are susceptible to EMFs. Similar to the marine mammal impacts Sea turtles will be corralled into the shipping lanes and experience an increased mortality rate creating a scenario of a [Bold: major impact on the threatened species. Intentional discharge of fuel oil and hazmat as the industrial energy site ages will have a Major Impact on the turtles. The [Bold: Major Impact] on turtles will result in long term and permanent impacts including auditory injuries stress disturbance harassment and behavior responses. The noice from current marine uses should not be discussed and used as a consideration within the EIS. The applicant and the [Bold: Major Impacts] must stand alone as a prior non existent impact. The use of oil and gas platforms interactions as a suggestion that the turtles will use the stationary wind platforms is a negligent comparison and an intentional	BOEM does not concur that sea turtles would be “corralled into the shipping lanes” or that offshore wind developers would intentionally discharge fuels, oils, and hazardous materials into the environment. BOEM’s assessment of noise effects on sea turtles is described in detail in Section 3.3.5.1 of the NMFS BA and summarized in EIS Section 3.19, *Sea Turtles*. Final EIS Section 3.19.5 analyzes impacts of the Proposed Action alone and Section 3.19.5.1 analyzes the cumulative impacts of the Proposed Action in combination with other

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	falsification of the truth. The EMFs from exposed wires as reported scientifically will be a deterrent for the turtles from coming to the stations to rest or feed.	ongoing and planned activities in the geographic analysis area. BOEM does not expect the presence of exposed wires at offshore wind structures.
0984-0027b	The consideration of increased mortality rate from ghost recreational fishing gear on the cables is not included in the EIS. Currently there is a device used around the world to remove fishing line to reduce the turtle mortality rate from recreational fishing line lost on the cables. The omission of this fact is with criminal intent to mislead the public and the prosecution of the writers of this EIS should be started immediately for falsifying a public document of environmental Impacts on threatened and endangered species. Potential major impacts of other marine users should not be used to justify the creation of use by a nascent industry who wishes to create environmental degradation. The applicant will have [Bold: Major Impacts] on sea turtles.	Final EIS Section 3.19.3.1 identifies the threat to sea turtles from their unintended capture in fishing gear, which can result in drowning or cause injuries that lead to injury and mortality (e.g., swallowing hooks) under the gear utilization IPF. Based on the information, analysis, and findings on the EIS, BOEM determined that impacts of the Proposed Action and action alternative on sea turtles would be negligible to minor and potentially minor beneficial.
0984-0027c	The co-existence of the sea turtle with the offshore wind industry is questionable at best. The secondary impacts threatens the very existence of some species. I would side with the turtle and ask that the development be denied especially since the turtle will be here long after the stationary wind industry. Conclusions The proposed project will have potentially permanent [Bold: Major impacts] on sea turtles. The presence of structures pile driving and EMFs will all have [Bold: major impacts] that will be permanent when considering the cumulative impact. The secondary impacts of corralling intentional poisoning harassment and starvation by the Industrial energy Development zones will have a significant biological impact. The application to develop the site due to the [Bold: Major Impacts] to the turtles should be denied.	Final EIS Section 3.19.5 describes BOEM's assessment of impacts of the proposed Ocean Wind 1 Project on sea turtles due to presence of structures, underwater noise (including from pile driving), and EMF. Based on the information, analysis, and findings on the EIS, BOEM determined that impacts of the Proposed Action and action alternatives on sea turtles would be negligible to minor and potentially minor beneficial. BOEM does not concur that corralling, intentional poisoning, or starvation are anticipated effects. Low-level behavioral exposures could occur and these effects are described in more detail in the NMFS BA for the Ocean Wind 1 Project.
0984-0108, & -0109	Sea turtle are susceptible to EMFs. Similar to the marine mammal impacts Sea turtles will be corralled into the shipping lanes and experience an increased mortality rate creating a scenario of a permanent Major Impact on the threatened species. Intentional discharge of fuel oil and hazmat at the anticipated impact as the industrial energy site ages will have a permanent Major Impact. The Major Impact on turtles will result in long term and permanent Major Impacts including auditory injuries stress disturbance harassment and behavior responses. The noice from current marine uses	See responses to 0984-0027a, b, and c.

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	should not be part of this EIS. The EIS and the Major Impacts must stand alone. The use of oil and gas platforms interactions as a suggestion that the turtles will use the stationary wind platforms is a negligent comparison and an intentional falsification of the truth. The EMFs from exposed wires as previously reported scientifically will be a deterrent for the turtles from coming to the stations to rest or feed. The consideration of increased mortality rate from ghost fishing gear on the WTGs is instantiated. The applicants use of other marine users potential impacts with marine life to justify their own environmental degradation should not be considered. The applicant will have permanent Major Impacts on sea turtles. The co-existence of the sea turtle with the offshore wind industry is questionable at best. The secondary impacts threatens the very existence of some species. I would side with the turtle and ask that the permit be denied especially since the turtle will be here long after the stationary wind industry. The proposed project will have potentially permanent adverse Major Impacts on sea turtles. The presence of structures pile driving and EMFs will all have adverse impacts that will be permanent when considering the cumulative impact. The secondary impacts of corralling intentional poisoning harassment and starvation by the Industrial energy Development zones will have a significant biological impact. The EIS should be rejected as a means for further development of the nascent Industrial wind energy system by the developer.	
TRANS-0069-0003	Moving on there are numerous scientific deficiencies in the DEIS. Limited studies have been done and results are not yet available for current limited studies yet projects in leased areas are forging ahead and permits being granted without knowing the consequences. Scientists and state officials have admitted to numerous deficiencies in information and data gaps about the impacts of offshore wind on marine life. Studies being used in DEIS are outdated and more than a majority of identified short term studies in this region have not even started yet. For example for sea turtles.	As noted in response to comments 1259-0156 through -0175, BOEM's analysis of incomplete and unavailable Information and the basis for BOEM's determination that the analysis provided is sufficient to support sound scientific judgments and informed decision-making about the proposed Project is described in EIS Appendix D generally and in Section D.1.16 for sea turtles specifically.

O.6.19 Scenic and Visual Resources

Table O.6.19-1 Responses to Comments on Scenic and Visual Resources

Comment No.	Comment	Response
0011-0003	Not referenced by BOEM in the DEIS is a 2015 BOEM study about a viewshed analysis it did for the New York Outer Continental Shelf Area (Renewable Energy Viewshed Analysis and Visual Simulation for the New York Outer Continental Shelf Call Area: Compendium Report OCS Study BOEM 2015-044)4. It simulated the visual impact of one hundred and fifty-two 6.2 MW wind turbines from 16 observation points in New York and New Jersey. The simulation most relevant to LBI is the Jones Beach observation point because the turbine array was roughly parallel to that shore. The closest point of the turbine array to Jones Beach was 15 miles the same distance as the Proposed Project. The study ranked the visible impact on a scale from 1 to 6. The visual impact from Jones Beach scored a 6 its highest rating. A 6 rating was defined as; "Dominates the view because the study subject fills most of the field for views in its general direction. Strong contrast in form line color texture luminance or motion may contribute to view dominance". Since the height of a 6.2 MW turbine is two-thirds that of the proposed project turbines that visual impact would be equivalent to the project turbines at 23 miles. So the proposed project would still register a major visual impact based on the BOEM study. We note based on this study officials in New York and BOEM determined that the proposed offshore wind turbine lease area off the Hamptons is too close and ruins the serene ocean viewshed and created a 20 mile exclusion zone. They also noted it is a threat to navigation fishing and endangered marine mammals. The Fairway lease area sat as close as 12 miles off the Long Island coast near the Hamptons.	BOEM released its guidance for assessing visual impacts in April 2021: *Assessment of Seascape, Landscape, and Visual Impacts of Offshore Wind Energy Developments on the Outer Continental Shelf of the United States* (BOEM 2021). Impact assessments involve a valid and reliable range of valid measures involving comparisons of wind farm noticeability, horizontal and vertical FOVs, visual contrasts, size and scale, and view prominence. Based on applicable onshore to offshore wind farm distances, consideration of variable meteorological conditions result in valid and reliable levels of visibility and effects. Consideration of these factors affirms minor to major impacts on seascape and landscape resources and viewer experiences from KOPs within the geographic analysis area (see Final EIS Section 3.20 and Appendix M).
0111-0003	the study on the visual impact is flawed since it doesn't contemplate the impact of lights flashing throughout the night.	The Ocean Wind ADLS limits navigation lighting to the times when aircraft are present. Analysis of visual impacts from KOP-13 and KOP-23 in Appendix M specifically consider nighttime visibility.
0111-0004	What are the requirements for maritime lighting at the base of the wind turbines? This is not addressed in the EIS. This is a material omission.	Per USCG requirements, the mid-tower light is 256 feet (78 meters) above sea level, the yellow tower base reaches 50 feet (15 meters) above highest astronomical tide, and the landing deck is at sea level. Chapter

Comment No.	Comment	Response
		2, Section 2.1.2.2.3, of the Draft EIS noted that WTGs and OSS would be lit and marked in accordance with USCG lighting standards. Clarification of mid-tower lighting per USCG requirements has been added to Section 3.20.5.
0175-0005	At distances of 12 miles or closer the form of the WTG may be the dominant visual element	This comment is consistent with EIS Section 3.20 and Appendix M analyses and disclosures.
0175-0006	At a Distance of 15.3 to 28 Miles Visual Susceptibility is High That would include from Brigantine south to Sea Isle PLUS Galloway and Upper Townships With Major Impacts including the Atlantic City Beachfront - Nighttime	The high susceptibility of these locations is based on their intrinsic value to the public and may not translate to visual contrasts and prominence of the wind farm and associated impact levels. In the case of the Atlantic City Beachfront-Nighttime, the COP VIA simulation of nighttime lighting indicates strong contrast and a higher level of prominence.
0175-0012	Wind Turbines will be Highly Visible along the Barrier Islands	The visibility of the WTGs would be variable throughout the days and nights, depending on current meteorological, sunlight, and moonlight conditions. In views seaward from the Barrier Islands, based on wind farm distance, there would be periods of moderate, low, and no visibility.
0212-0002	When I heard about this wind farm project I was really curious to know just how prominent the wind-turbines would be from the shore. I watched the simulation videos on the Bureau of Ocean Energy Management web site and I looked at the simulated pictures in the Ocean Wind Project Overview Document. The wind-turbines depicted were pretty small. But were the simulations accurate in their depiction? Would those 900' towers really look that small from shore and what about from a beach front mansion?	The COP VIA and cumulative project simulations are based on valid and reliable methods. The distance-based comparison of the perceived size of a typical onshore cell tower with the perceived size of an Ocean Wind offshore turbine is as follows: a 100-foot (30.5-meter)-tall microwave tower seen at 1.7 miles (2.7 kilometers) distance would be perceived as the same height and occupy the same vertical portion of the view (0.64-degree vertical in the overall 55-

Comment No.	Comment	Response
		degree vertical FOV) as a 906-foot (276.1-meter)-tall Ocean Wind WTG seen at 15.3 miles (24.6 kilometers) distance.
0212-0003	I created a spreadsheet to calculate just how big a 906 foot turbine would appear from various vantage points along the coast. To my pleasure the BOEM simulations appear accurate. At the point on land closest to the towers between Ocean City and Atlantic City where the towers are roughly 15 miles offshore standing on the beach holding my arm outstretched and using my thumb and index finger spread apart to measure the height of the towers they will be less than a 1/4" tall and the blades will sweep up another 1/4 inch high. So less than a total 1/2" tall that's it. If I climb to the second story of a beach front mansion the towers and blades grow to appear almost an inch tall. About the same height as a fishing boat passing by. Visible but not obtrusive. Back on the beach and moving 6 or 7 miles up from AC or down the coast from OC and the towers shrink to half the size they appeared in OC or AC. Another 6 or 7 miles and they are half that half size again essentially invisible. And these calculations don't address actual visibility of the towers just their apparent height on a PERFECTLY clear day with no humidity no haze no clouds no atmospheric distortion just perfect visibility. How often do you look at the weather app on your phone and see it say there is 15 miles or more of visibility? Not very often. In reality much of the time the towers will be largely or completely obscured by typical atmospheric conditions.	Comment noted.
0390-0003	The proposed turbines will dramatically alter the landscape and character of the area both in the immediate locality and from important vantage points such as Ocean City's Music Pier.	Comment noted. The visibility of the WTGs will be variable, depending on current meteorological, moonlight, and sunlight conditions. In views seaward from the shoreline and Ocean City’s Music Pier there will be periods of high, moderate, low, and no visibility.
0433-0001	The BOEM must address how the hundreds of planned Wind Turbines will appear at night and how that will affect the environment. Will these Wind Turbine require lighting at night? Could these lights disturb the environment and cause damages? Who is liable for these damages? Could these lights disturb birds and endangered mammals? Please refer to their published video of the Wind Turbines appearance from the shoreline where the BOEM doesn't address to the public what they may look like at night.	The COP VIA includes nighttime view simulations. The Ocean Wind ADLS would limit nighttime lighting to those times when nighttime aircraft are present, which would significantly reduce potential impacts on birds and mammals. It is estimated that lights would be activated for only 10.9 hours over a 1-year period.

Comment No.	Comment	Response
0658-0002	Deceptive Industrial Developers' Renditions of Visual Impact at 9 mi is egregious conflict with BOEM Visibility Studies off NY's Long Island concluding that turbines 15 mi off beaches have "dominant' visual effect. [See original attachment for photo]. (Photo above is closer to reality on LBI.) Massively visible filed of turbines. Fully illuminated & visible day & night. Destroying the natural beauty of our coastline.	The visibility of the WTGs will be variable, depending on current meteorological, moonlight, and sunlight conditions. In views seaward, there will be periods of high, moderate, low, and no visibility. The COP VIA includes nighttime view simulations. The Ocean Wind ADLS will limit lighting to those times when aircraft are present.
1071-0003	Additionally the photo simulations in the DEIS are not utilizing the current standard practice for viewshed analysis.	The photo simulations do utilize the current standard practice and the viewshed analyses are based on the valid and reliable ArcGIS algorithm.
1071-0012	I respectfully request that the written draft report be amended to reflect the true impact of 300 meter windmills as shown in the multiple scientific papers (peer-reviewed) already referenced in the document and referenced above. The photosimulation analysis to assess the visual impact of Ocean Wind is inadequate and utilized outdated methods. The simulations primarily utilized a 50mm focal length when it should have used a 75mm focal length. The 50 mm focal length understates the impact that the windmills will have on the viewshed. This is discussed in the peer-reviewed "Visual Prominence as Perceived in Photographs and In-Situ" (Palmer and Sullivan Journal of Digital Landscape Architecture 2020) "… the visual prominence ratings made in-situ are higher than for the ratings of the simulations and as-built photographs taken with the 50 mm EFL. However with a 75 mm EFL this difference diminished to a level that is not statistically significant." (Palmer and Sullivan 2020). Palmer and Sullivan 2020 go further as to state "…we feel it should become standard practice that the photosimulations are peer reviewed for technical accuracy and proper presentation instructions and related information. If they are found inadequate by peer review the simulations should be removed from the record and the permitting process stopped until corrected." Other have also stated that 75mm should be used for example. Takacs and Goulden 2019 questioned the validity of using standard photographic simulations to investigate the experience of viewing wind turbines and in response to this The Landscape Institute (2019) now recommends using a 75 mm equivalent focal length lens for wind turbine simulations.	The photo-simulations were prepared following accepted professional and accepted industry practices.
1071-0013	All photosimulations were completed in 2022 and were all at 50mm focal length.	The photo-simulations were prepared

Comment No.	Comment	Response
	This is not in accordance with current standard practice which was in effect at the time these photosimulations were completed. Additionally it has been proven in peer reviewed articles that 50mm photosimulations understate the impact that windmills will have on the viewshed. I respectfully request that all simulations be updated to the current accepted practice of 75mm focal length and these photosimulations be peer reviewed for technical accuracy and be recirculated for review by the public.	following accepted professional and accepted industry practices.
1071-0015	Finally for 3.20 I cannot fathom how the no action alternative has a "minor to moderate negative impact" that conclusion should be revisited. Doing nothing by its nature will not have a moderate impact on scenic views. The baseline "no action" alternative for 3.20 should be changed to green and negligible as all the events described are transitory in nature.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. Ongoing activities include constructed and permitted offshore wind projects. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Reasonably foreseeable future actions include the build-out of executed renewable energy lease areas. A detailed description of BOEM’s methodology for assessing impacts is provided in Section 1.6 of the Final EIS.
1125-0013	While this level of detail presented in the DEIS may be useful to some reviewers it tends to lose two key facts. First as stated on the top of page 3.20-14 "Typical meteorological conditions limit visibility of the Wind Farm Area from inland and the coast on 77% of days and provide clear visibility on 23 percent of days (1 in every 4 to 5 days) (Atlantic Shores2021)". The paragraph continues to note that "Therefore affected environment and VIAs of the Project are based on clear-day and clear-night visibility." The analysis is therefore focused on conditions which occur on only I day in 4 or 5. This should be clearly stated as should the fact that under typical conditions (atmospheric haze precipitation fog) the Wind Farm Area will not be visible from shore. The issue of nighttime visibility/aircraft warning lights is addressed on page 3.20-17 but the reader needs a keen eye to learn that the use of an ADLS limits night time illumination to 11 hours per year (or approximately one quarter of one percent of night time hours).	The EIS discloses that the visibility of the WTGs will be variable, depending on current meteorological, moonlight, and sunlight conditions. In views seaward, there will be periods of high, moderate, low, and no visibility. In addition, as noted in the comment, the EIS discloses that use of ADLS would limit nighttime activation of aircraft warning lights.
1275-0008	[Bold: Visualization]: will you update your assessment of visual and psychological impacts to the public due to the changes in view using the actual dimensions and lighting of these offshore wind structures? The visualization	Ocean Wind’s COP VIA contains a visual simulation of the Ocean Wind 1 wind farm from Stone Harbor. Though not referred to

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	done looking Northeast from Stone Harbor which does not include Ocean 1 for example shows the view of the wind farms. It looks like the emerald city. Gone is the open water on the horizon. That will certainly have a psychological impact which I am not sure has been thoroughly vetted.	as "psychological impacts," Draft EIS Section 3.20 and Appendix M do discuss the impacts of the Proposed Action in terms of viewer experience.
1275-0009	[Bold: Lighting]: what will the lights look like from land from Ocean 1 and other farms in the region?	Ocean Wind's COP VIA contains visual simulations of the turbines' lighting at night. See simulation V13, Atlantic City Beachfront (Night), and V23, Stone Harbor Beach Access (Night).
TRANS-0005-0002	My husband and I are not opposed to wind energy however 900 foot turbines 98 of them with Ocean Wind 1 placed 15 miles off the coast and three substations will produce a dominant impact on the beach view. I use the word dominant impact because this is actually what BOEM your organization concluded in an earlier study with -- when assessing 600 foot turbines produced dominant impact 15 miles offshore. In fact the fairway lease area which was planned for 12 miles off the coast near the Hamptons was determined to be too closed posing a threat to navigation fishing and marine mammals by New York and BOEM. What makes Ocean City New Jersey different.	BOEM released its guidance for assessing visual impacts in April 2021: *Assessment of Seascape, Landscape, and Visual Impacts of Offshore Wind Energy Developments on the Outer Continental Shelf of the United States* (BOEM 2021). EIS Section 3.20 and Appendix M address the noticeability and impact levels of the Ocean Wind turbines in accordance with BOEM 2021. The analyses and disclosures include the turbines' features in view at applicable distances, percentages of views occupied, visual contrast ratings, size, prominence, and impacts.
TRANS-0038-0005	My first concern is that the wind turbine are planned to be placed 15 miles or so outside of Atlantic City for the Ocean Wind 1. Likely they will be visible from Brigantine to Stone Harbor possibly, North Wildwood and even Angle Sea.	EIS Section 3.20 and Appendix M and COP VIA analyses concur with visibility from these locations.
TRANS-0066-0002	Point two is regarding the ADSL which for everybody who is on the phone who maybe is not aware this is the automated lighting system because due to FAA regulations these wind turbines need to be lighted up you have multiple lights on them so they will be easily visible for nighttime from the shore and for aircraft nearby. Now according to the EIS the developers here have said that they are committing to put in a system that will use a radar detection such that the lights won't be on unless they are -- there is an aircraft nearby which would be actually pretty rare but the issue is that they are not -- they don't have to do it and there is no requirement so we have the prospect now of having hundreds of wind turbines out in the ocean with flashing like Christmas trees throughout the night. There is no commitment that they don't have to -- that they have to put in this	Ocean Wind has committed to installation of the ADLS.

Comment No.	Comment	Response
	radar system. And the other thing is I have done a little bit of research and I asked at the Orsted meeting in Ocean City last year nobody can seem to tell us where an ADSL system has been used on this size of project on the wind turbines anywhere in the world. So it will be a first to see if it actually can work so obviously that's a potential problem an as well.	

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O.6.20 Water Quality

Table O.6.20-1 Responses to Comments on Water Quality

Comment No.	Comment	Response
0984-0029	3.21 Water Quality The two [Bold: Major Impact] Issues with water quality is the creation of flotsam that carries the bacteria to the swimming areas closing beaches. Creating a financial hardship for residents whom are minorities whom are in a food desert. Second is the change of salinity within the Industrial wind development areas that affect the reproduction of sea life creating a secondary effect on seabirds and marine mammals. These Major Impacts on water quality should have been included in the EIS.	The accidental releases IPF, which would include materials such as flotsam (usually defined as marine debris associated with vessels in the marine environment) is addressed in Draft EIS Section 3.21.3.2 and Section 3.21.5. The adverse effect of water quality impacts on aquatic resources are addressed in other sections of the Draft EIS (e.g., benthic resources; finfish, invertebrates, and EFH; marine mammals). The Draft EIS water quality section focuses on the potential chemical and physical impacts on surface waters from construction and operation of the Project.
1192-0005	Finally the DEIS completely ignores the most important part of any construction project: Green Infrastructure and the Stormwater Management Plan. Instead the Oyster Creek site discharges runoff to Barnegat Bay using an existing outlet and has designed two basins which under the new stormwater regulations neither of these are applicable.	As stated in Draft EIS Section 3.21, Ocean Wind would need to comply with all federal and state requirements to avoid and minimize impacts on water quality. Ocean Wind will be required to obtain the applicable New Jersey Pollutant Discharge Elimination System permits for runoff and stormwater management during construction and operations (including at substations) to ensure water quality standards are not exceeded. As part of this permitting process, Ocean Wind could incorporate green infrastructure design into the onshore Project components. Ocean Wind would not be able to use an existing outlet that discharges surface water not meeting water quality standards.
1192-0007	Two ways to address these threats is to adopt Low Impact Development and use ecosystem services to keep the water [Italics: in situ] (where it falls). Ecosystem	See response to comment 1192-0005. Ocean Wind could incorporate low-impact

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	services are nature-based processes that mitigate imperviousness and stormwater by using Low Impact Development and Green Infrastructure. The existing project proposals neglect to address the importance of these services.	development and green infrastructure into onshore Project components during the New Jersey Pollutant Discharge Elimination System permitting process. Ocean Wind would still need to ensure that stormwater discharge meets water quality standards regardless of the stormwater management methods Ocean Wind chooses to design/implement.
1192-0009	This is a group with the USACE that works with ecosystem services to mimic nature in restoring the environment. EWN [Footnote 13: The U.S. Army Corps of Engineers (USACE) Engineering With Nature® (EWN) Initiative enables more sustainable delivery of economic social and environmental benefits associated with infrastructure. https://ewn.erdc.dren.mil/?page_id=7] encourages the use of Green Infrastructure and the Beneficial Reuse of Dredge Materials. It would be significant for all the Wind projects to adopt a similar program in interactions with nature especially in Barnegat Bay.	Under CWA Section 404, Ocean Wind and any future offshore wind project proponents would need to work with USACE on any mitigation requirements (that could include compensation or restoration) related to impacts on wetlands and other waters of the United States. Should USACE incorporate Engineering with Nature principles and practices into the permitting process to achieve the mitigation requirements, then Ocean Wind would need to incorporate those measures into the Project.
1192-0017	The drainage plan reuses an existing outlet from the decommissioned Nuclear Power Plant and has two basins.[See original comment for image of drainage plan]Under the new stormwater regulations neither of these are applicable. Moreover any area in the Pinelands Preserve should follow the higher standards found in the rules of the Pinelands Commission (Appendix C). [Footnote 17: Appendix B] NJ Stormwater Rules are the minimum expected - it is ok to go for the gold standard but that is not what is proposed. Some ideas of what this means follows. Since 2006 there existed important rule amendments in the Pinelands that required the use of smaller distributed BMPs including: LID site design and limited site disturbance to save the trees. Currently the applicant's stormwater design includes two large ponds. In addition since the total volume of stormwater must be infiltrated; and no direct discharge of runoff of wetlands wetlands transition areas or surface water bodies will be permitted the current level of imperviousness will have to change the approved design standards. Below is excerpts from a power point on the new Stormwater Rules by the NJ Pinelands Commission: In the Pinelands new or reconstructed projects must meet the goals of the new	As stated in Draft EIS Section 3.14.1, the entirety of the Onshore Project area is outside of the state-designated Pinelands Area and, therefore, not subject to the rules of the State of New Jersey Pineland Commission’s Pinelands Comprehensive Management Plan (including stormwater requirements of the plan). BOEM notes that portions of the export cable corridors are still within the federally designated Pinelands National Reserve. Despite the onshore Project components not being subject to the state’s Pinelands Comprehensive Management Plan and its stormwater requirements (as detailed in the comment), Ocean Wind would still be

Comment No.	Comment	Response
	stormwater management rules that is to use green infrastructure (GI) to create hydrologically functional landscapes to maintain or reproduce the natural cycle for the developed area. [Footnote 18: https://www.nj.gov/pinelands/home/presentations/Feb_9_2022_Pinelands_Speaker_Series_Stormwater_Management.pdf]The longstanding Pinelands Stormwater regulations is that stormwater management required for all "Major Development" (disturbance greater than 5000 sf):· Volume Control: All major development must retain and infiltration rainfall from the net increase in impervious surfaces from the 10-year storm of 24-hour duration - that is approximately 5 inches plus rainfall. This rule ensures that almost all stormwater is recharged to the Kirkwood Cohansey Aquifer.· Runoff Rate Control: Rate of runoff generated on the parcel by the by the 2- 10- & 100-year storm of 24 hours duration shall not increase post development. This rule ensures that flooding is minimized. Since 2006 important rule amendments required the use of smaller distributed BMPs including· Low Impact Development Site Design· Limited Site Disturbance to save the trees. The [Italics: new] policy goals for the Pinelands amended stormwater will harmonize Pinelands & NJDEP stormwater rules in a manner best suited for the Pineland Area minimize impact of increased stormwater runoff due to climate change - which is likely to bring more intense storm events and strengthen and enhance stormwater management in the Pinelands Area while establishing reasonable requirements for home builders and developers.[Italics: Effective March 2021] NJDEP requires GI to manage stormwater. The recently adopted Pinelands stormwater rule follows suit.· This manages stormwater close to the source.· Store stormwater runoff for reuse (in a rain barrel).· Treat stormwater through infiltration into the subsoil or through filtration by vegetation or soil.[Italics: In the Pinelands Area] there is a stricter treatment standard for nitrogen removal.· For new major development requires reduction of total nitrogen load in stormwater runoff from the water quality storm by a minimum of 65% including permanent lawn and turf areas intended for human use. This protects surface water from algal blooms low DO and invasive species resulting from nutrient inputs. To attain and demonstrate 65% removal of Nitrogen from stormwater runoff use a series of GI best management practices (BMPs) - bioretention basin infiltration basin or vegetative filter.· Using Soil as a treatment medium.· Soil as a treatment medium - removal of positively charged pollutants. Note: Neither sandy soils nor loam (silty/clayey) soils are effective in removing NO3. This is where plants play a major role via nutrient uptake.Exceptions and Mitigation. If stormwater management requirements cannot be met on- site based on NJDEP standards applicants may request:· A municipal variance (for private development)· An exception from the Pineland Commission (for public development)· Variance and exceptions may	required to comply with all federal, state, and local requirements for the management and discharge of stormwater. If BOEM approves the Project, Ocean Wind would need to obtain the applicable New Jersey Pollutant Discharge Elimination System permits to ensure water quality standards are not exceeded. Ocean Wind would not be able to use an existing outlet that discharges surface water not meeting water quality standards.

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	only be granted from the on-site design and performance standard for green infrastructure groundwater recharge runoff quality and runoff quantity.· No decrease in the total volume of stormwater required to be infiltrated will be permitted.· No variance or exception may be granted from the CMP's prohibition on direct discharge of runoff of wetlands wetlands transition areas or surface water bodies. Off-site Mitigation Requirements. If a variance or exception is approved an off-site mitigation project must also be identified and approved.· Variance or exception can only be granted for the portion of the standard that cannot be met onsite. That is if only half of the required volume can be retained and infiltrated onsite and the remaining volume obligation may then be retained and infiltrated off-site.· All mitigation projects must be in the same HUC-14 drainage area as the proposed development. Sites in the larger HUC-11 drainage area may be approved if necessary.· All mitigation projects must be in the Pineland Area.· The same requirements will be applied to all public and private development.[Underlined: Recommendations:]· Explain building in a wetland area cutting down trees taking parkland.· Explain how these sites are not in the FEMA Hazard area. Building in wetlands indicates lower areas which will flood quicker.· Provide location of the Save Trees in Island Beach State Park and Lacey Township in the same HUC.· Compare the preferred site with other alternatives to find the least impacted.	
1259-0093	iv. Water Quality (3.21)BOEM anticipates the impacts on water quality resulting from Ocean Wind 1 will be minor.[Footnote 71: DEIS at 3.21-5.1.] However this conclusion is not adequately substantiated by the Draft EIS. To start this offshore wind energy development project and its geographical analysis area lie predominantly in Atlantic County and Cape May Counties in the vicinity of Pine Barrens and a large Wildlife Management Area. Any onshore activity related to the project will impact these sensitive and valued ecosystems as well as a variety of inland waterways and the impacts thereof need to be fully investigated.	The comment does not indicate how BOEM's conclusions are not adequately substantiated or specifically how impacts on inland waterways need to be fully investigated. BOEM has described the water quality affected environment, including all the impaired waterbodies designated under CWA Section 303(d) (see Draft EIS Section 3.21.1, and Appendix I, Figure I.4). As stated in response to comment 1192-0017, the Onshore Project area is outside of the state-designated Pinelands Area and, therefore, not subject to the rules of the State of New Jersey Pineland Commission's Pinelands Comprehensive Management Plan (including stormwater requirements of the plan). Furthermore, the

Comment No.	Comment	Response
		Onshore Project area is outside of any National Wildlife Refuge, including the Edwin B. Forsythe and Cape May national wildlife refuges.
1259-0095	Additionally the water quality geographic analysis area overlaps with most but not all of the Atlantic Shores South (OCS-A 0499) Atlantic Shores North (OCS-A 0549) and the Ocean Wind 2 (OCS-A 0532) lease areas. Together these projects will include as many as 468 WTGs and construction activities will occur for years with possible overlap between each project in terms of timing. The magnitude of water quality impacts must be considered from this perspective in all thoroughness without making simpler assumptions that the Draft EIS describes.	BOEM acknowledges the other future offshore wind development in the water quality geographic analysis area, including Atlantic Shores North, Atlantic Shores South, and Ocean Wind 2 (see Draft EIS Section 3.21.3.2), and incorporates elements of those projects in the analysis. For example, the accidental releases IPF discussion in Draft EIS Section 3.21.3.2 states, "This EIS estimates that up to approximately 1,527,193 gallons of coolants, 2,121,777 gallons of oils, and 471,492 gallons of diesel fuel could be stored within WTG foundations and the OSS within the water quality geographic analysis area," and then goes on to provide an analysis. These gallons of petrochemicals are the combined amounts specific to Atlantic Shores North, Atlantic Shores South, and Ocean Wind 2.
1259-0099	The proposed project includes waterways being monitored by NJDEP annually for water quality parameters. Many sites in the project area are impaired and non-attaining for Dissolved Oxygen including Barnegat Bay Manahawkin Bay Upper and Lower Little Egg Harbor. Nearly all water quality assessment units of Barnegat Bay and associated tidal tributaries in the geographic analysis area are listed as 303(D) impaired and do not meet one or more of the designated uses - fish consumption ecological function recreation arising from pathogen exceedances turbidity oxygen depletion and organic contaminants including PCBs and pesticides. It is well known that New Jersey's Waterways suffer from varying degrees of impairment. The most recent 2018/2020 New Jersey Integrated Water Quality Assessment Report reconfirms that the Atlantic Coastal region which includes the onshore Project area does not fully support the designated uses and is largely impaired for water quality. [Footnote 73: https://www.state.nj.us/dep/wms/bears/assessment-report20182020.html.]	Draft EIS Section 3.21.1, and Appendix I, Figure I.4, disclose all impaired surface waters (as designated under CWA Section 303(d)) in the water quality geographic analysis area.

Comment No.	Comment	Response
	Barnegat Bay is heavily impaired for nutrients and other pollutants including pathogens.	
1259-0101	In the interest of brevity immediately below are several more points that BOEM fails to address to evaluate impacts to water quality in the Draft EIS:1. Potential microclimate effects of wind turbines - Wind turbulence behind turbines and its likely impacts on water quality.	The Draft EIS covers the effects from the presence of wind turbines on water quality under the presence of structures IPF in Sections 3.21.3.2 and 3.21.5.
1259-0102	2. Enhanced vertical mixing from turbulence created by turbine rotors increases night time surface air temperature by 0.5 degrees while lowering daytime temperatures by 2-3 degrees. Potential impacts on water temperature must be included in a full and fair analysis of Ocean Wind 1's environmental impacts.	The Draft EIS covers the effects from the presence of wind turbines on water quality under the presence of structures IPF in Sections 3.21.3.2 and 3.21.5; the analysis includes effects on water temperature. The analysis is based on extensive modeling BOEM conducted in the mid-Atlantic Bight—*Hydrodynamic Modeling, Particle Tracking and Agent-Based Modeling of Larvae in the U.S. Mid-Atlantic Bight*—cited as BOEM 2021c. Details can be found in the report here: https://espis.boem.gov/final%20reports/BOEM_2021-049.pdf.
1259-0104	4. Building arrays of offshore wind turbines off the Mid-Atlantic states could have effects on the annual cycle of ocean water temperatures that are critical to the region's fish and shellfish habitat. In addition to impacts on the Atlantic cold pool and the high regional fishery productivity that it supports heat absorbed by Ocean Wind 1's steel monopoles will warm the surface water and water column including local benthic areas and this may extend to cumulative effects from the heat dissipated by the entire 98-turbine array. [Footnote 75: See Travis Miles et al Could federal wind farms influence continental shelf oceanography and alter associated ecological processes? A literature review. SCEMFIS (2020) https://scemfis.org/wp- content/uploads/2021/01/ColdPoolReview.pdf.] This would have significant and serious impacts on the ecosystem including cumulative impacts.	Impacts from the presence of wind turbines on aquatic resources, including the Atlantic cold pool, are addressed in Draft EIS Section 3.6, *Benthic Resources*, and Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat,* specifically the presence of structures IPF analysis for both the Proposed Action and offshore wind (not including the Proposed Action) sections.
1259-0105	5.Similarly the EIS needs to include a more thorough analysis of the potential impacts of extreme weather events on Ocean Wind 1.6.The turbines' presence may lead to changes in the surrounding wind speed and surface stress of the water in the turbines' wake which may lead to increased turbulence and heat fluxes. [Footnote 76: See S. Afsharian and P.A. Taylor On the Potential Impact of Lake Erie Wind Farms on Water Temperatures and Mixed Layer Depths: Some	BOEM conducted a model offshore Rhode Island and Massachusetts that evaluated ocean processes in the presence of wind turbines during two extreme weather events, including a hurricane. A brief summary of the results has been added to

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	Preliminary Modeling Using COHERENS 124 J. Geophysical Rsch.: Oceans 1736- 49 (2019) https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2018JC014577.] The turbines' effects on near-surface wind speeds and the warming of near- surface water temperature has even been documented in the context of extreme weather events [Footnote 77: See Tsung-Yu Lee et al. Impacts of offshore wind farms on the atmospheric environment over Taiwan Strait during an extreme weather typhoon event 12 Scientific Reports 823 (2022) https://www.nature.com/articles/s41598-022-04807-w.pdf.] but no such interactions are analyzed in the Draft EIS.	Final EIS Section 3.21.3.2 and Section 3.21.5. The full report (BOEM 2016) and results can be found here: https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/NE-Ocean-Forecast-Model-Final-Report.pdf.
1259-0170	Cable emplacement. New undersea cables required to bring electricity generated from other offshore WTGs onshore would affect seafloor (32356 acres) and this disturbance would cause increases in suspended sediment (DEIS Appendix F Table F2-2) both of which could have more serious impacts than what is stated in the Draft EIS. According to the Draft EIS the impacts from these cable emplacement methods are variable but typically include suspension of seabed sediments that vary in extent and intensity depending on the project and site-specific conditions. The Draft EIS states the following:· These impacts would be spatially and temporally localized· Suspended sediment concentrations due to jet plow would be within the range of natural variability· Potential impacts to sea turtles from construction activities would be due to increased turbidity and short term (1-6 hours)· Sea turtles would be expected to swim away from the sediment plume and return to the area once turbidity has returned to background levels.· [Bold: It is expected that mitigation measures would be implemented to minimize and reduce the potential for adverse effects from water quality changes on sea turtles.]· Dredging for sand wave clearance may be necessary in places to ensure cable burial below mobile seabed sediments which could result in additional impacts on sea turtles related to impingement entrainment and capture associated with mechanical and hydraulic dredging techniques.· [Bold: Given the available information the risk of injury or mortality of individual sea turtles resulting from dredging necessary to support other offshore wind projects would be minor and population-level effects are unlikely to occur.] The Draft EIS vastly simplifies the impacts from turbidity and makes a lot of assumptions related to avoidance and overlooks elevated mortality risks from dredging and cable emplacement activities.	The comment does not indicate specifically how BOEM vastly simplified turbidity impacts and overlooked sea turtle mortality risk or how the Draft EIS is deficient on this topic, so BOEM cannot provide a detailed response. However, the Draft EIS addresses Project-related turbidity and its potential impact in Sections 3.6, 3.13, 3.15, 3.19, and 3.21. The NMFS BA further addresses turbidity impacts on federally listed aquatic species, including sea turtles.
1259-0176	Sediment grain size effects are stated to be minor and refers to evaluation studies done in Massachusetts Rhode Island and Virginia. Were any local studies such as the seabed characterization of New Jersey's middle and outer shelf [Footnote 166:	BOEM currently does not have a site-specific sediment dispersion model for Ocean Wind, but the EIS includes

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	See John A. Goff et al. Seabed characterization on the New Jersey middle and outer shelf: correlatability and spatial variability of seafloor sediment properties 209 Marine Geology 147 (2004) https://www.sciencedirect.com/science/article/abs/pii/S0025322704001677.] evaluated for purposes of the Ocean Wind 1 EIS?	information on sediment dispersion for three other offshore wind projects with conditions representative of the Wind Farm Area. BOEM notes that Ocean Wind is currently in the early stages of a site-specific sediment dispersion model for the Ocean Wind 2 project, which would partially cover this Project. This information will be included in the Final EIS if the results of the Ocean Wind 2 model are available prior to the time of document issuance.
1267-0003	Appendix G Section 3.21 page 18 understates the issues of ground water. The Kirkwood-Cohansey aquifer is the sole-source aquifer for the public supply wells which currently do not serve all of the properties along the proposed export cable route. The un-served properties are provided water from shallow wells along the proposed route that are in an unconfined aquifer. The Dewatering will adversely impact individual drinking water supplies unless the discharge is collected and trucked or piped to a safe discharge location. In crossing the barrier islands the groundwater will be encountered at a depth from 12 to 36 inches. An issue in Ocean City the Storm water collection system is not designed with capacity to convey dewatering flows along with rainfall events. Figure 2-3 of the draft EIS includes two landfalls that follow routes that travel along West Avenue in Ocean City. The West Avenue right-of-way is 100 feet wide with the existing utilities that include sanitary sewer collection mains two sanitary force mains underground telephone conduits water supply mains a High Pressure Gas main storm water pipe crossings and the former West Jersey Railroad bed. The construction along West Avenue will encounter Known Historic Fill and pass by Known Contaminated Sites as well as a Public Water Supply Well and an elementary school. This creates significant concerns regarding dewatering operation.	See comment 1203-0012 from NJDEP on dewatering regulatory requirements and permitting for the Project. If BOEM approves the Project, and Ocean Wind decides to construct the Project, Ocean Wind would be required to obtain all applicable federal and New Jersey state permits for dewatering activities to ensure the protection of surface and groundwater. Ocean Wind would be required to implement the terms and conditions of the applicable permits.
TRANS-0004-0005	Coming to water quality the DEIS assumes erroneously that the no action alternative combined with all planned activities would result in minor temporary impacts and are not anticipated to exceed the water quality standards this is just not correct. It is well-known that New Jersey's waterways actually suffer from varying degrees of impairment and the most recent integrated water quality assessment report from 2018-2020 confirms this fact. The Atlantic coastal region which includes the onshore project area is part of that impairment and does not fully support the designated uses. Barnegat Bay is heavily impacted with nutrients	The comment does not indicate specifically why BOEM’s conclusions are erroneous. BOEM has described the water quality affected environment, including all the impaired waterbodies designated under CWA Section 303(d), and the water uses are non-attaining (see Draft EIS Section 3.21.1 and Appendix I, Figure I.4). As

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	and other pollutants including pathogens. Any additional contamination from accidental spills would impact upstream creatures changing weather patterns warming temperatures the thermocline of the Atlantic Continental shelf and the impact to these ecosystems from large offshore wind farms have not been addressed.	stated in Section 3.21.1, nearly all water quality assessment units of Barnegat Bay and associated tidal tributaries in the geographic analysis area are listed as 303(d) impaired. Ocean Wind would need to ensure that any action that would affect surface waters, including those listed as impaired under Section 303(d) (e.g., Barnegat Bay), would not result in exceedances of water quality standards and would comply with any existing total maximum daily load requirements for any waters designated as impaired under CWA Section 303(d). All future projects (wind or non-wind projects) with the potential to affect surface waters would need to comply with federal and state requirements to avoid and minimize impacts on water quality.
1259-0096	Furthermore according to the Draft EIS there will be increased vessel activity in the region during construction activities for Ocean Wind 1 that will continue through 2023. Risks and occurrence of surface water exposure to contaminants during routine vessel use and also potential accidental spills are quite high. Increased vessel traffic also increases the risk of collisions and consequent chemical spills. More specifically the Draft EIS estimates that up to approximately 1527193 gallons of coolants 2121777 gallons of oils and 471492 gallons of diesel fuel could be stored within wind turbine foundations at Ocean Wind 1 and the offshore substation within the water quality geographic analysis area. Other chemicals including grease paints and sulfur hexafluoride will also be used at the offshore wind projects and black and gray water may be stored in sump tanks on facilities. The Draft EIS describes a modeling study that was conducted to determine the likelihood and effects of a chemical spill at offshore wind facilities and concludes that revealed the most likely type of spill (i.e. non-routine event) to occur is from the WTGs at a volume of 90 to 440 gallons (341 to 1666 liters) at a rate of one time in 1 to 5 years or a diesel fuel spill of up to 2000 gallons (7571 liters) at a rate of one time in 91 years. The modeling effort was conducted based on information collected from multiple companies and projects and would therefore apply to the	The modeling study referenced in the comment and cited in the Draft EIS (as Bejarano et al. 2013) was a BOEM-commissioned study developed by three consulting companies with expertise in modeling the risk, fate, and effects of chemicals associated with wind turbines. Seven different models were thoroughly reviewed and evaluated, with two of the models determined to provide the most comprehensive capabilities of spill impact assessment. The report was technically reviewed by BOEM and was approved for publication by BOEM. BOEM believes the modeling effort and results are the best available information BOEM has to address potential spills related to offshore wind projects.

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	other projects in the water quality geographic analysis area. However it is not clear from the Draft EIS whether these studies are peer-reviewed comparisons were made with other offshore wind installations elsewhere or the estimates from this study were compared with those from the oil and gas platforms. In brief the EIS for Ocean Wind 1 has not established the accuracy of this study strongly enough to rely on it in foregoing further analysis regarding the impact of oil spills from this offshore wind energy development project on water quality.	
1259-0165	In the next five years (2022-2027) as per Table F2-Appendix F of the Draft EIS more than 300 WTG (312) foundations will be installed including 101 WTG foundations from this Project. More than 850000 gallons of coolant fluids and more than 800000 gallons each of coolant fluids and total oils and lubricants will be used in these WTGs. Bejarano et al. 2013 predicted spill scenarios using a selected number of chemicals at three areas (call area in North Carolina as well as two WEAs in MD and RI/MA). The incident rates were roughly grouped into five categories of probability - very high high medium low and very low (Table 3.22) that varied from 1 in every month to one in 1000 years. The highest release probabilities (1 time per month) were in the North Carolina Call Area resulting from vessel collisions causing small releases of up to several hundred gallons while at all Call Area/WEAs the probability of catastrophic spills (all oils totaling 129000 gallons and all chemicals totaling 29000 gallons) would be very low (1 time in ≥1000 years). Why did the Draft EIS only pick the very conservative estimate of 1 event in 1000 years? This is an extremely conservative estimate and does not examine all risks - from Wind Turbine Generators and Electric Service Platform and all scenarios including natural disaster vessel traffic and simple human error. [Footnote 157: https://meridian.allenpress.com/iosc/article/2014/1/869/197950/Potential-Impacts-from-a-Worst-Case-Discharge-from.] Moreover how did the Draft EIS arrive at this conclusion: "The likelihood of a spill occurring from multiple WTGs and OSS at the same time is very low and therefore the potential impacts from a spill larger than 2000 gallons are largely discountable"?	The Draft EIS states there would be a catastrophic spill one time in 1,000 or more years because that is what the modeling effort produced for a result. As stated in the modeling report (Bejarano et al. 2013), the probabilities in the modeling report were derived using a series of conservative assumptions (e.g., allision analysis, assumption of a complete release in the event of a catastrophic event), leading to a potential over-estimation of release probabilities. The full report can be found here: https://espis.boem.gov/final%20reports/5330.pdf. Regarding the comment on the likelihood of releases from WTGs and OSS occurring at the same time, BOEM believes it is reasonable to assume that all WTGs and OSS would not fail and release all petrochemicals in the water at the same time, which would be considered discountable (i.e., extremely unlikely to occur).
1259-0166	The Draft EIS does not appear to address the following data gaps and challenges identified in Bejarano et al. (2013). For instance: 1. What are the types of chemicals and oils used? New products continue to be developed and need to be included in the modeling scenarios?2. What information is available on toxicity data for these chemicals?	As stated in Draft EIS Section 3.21, petrochemicals used include coolants, oils, and diesel fuel. Other chemicals include grease, paints, and sulfur hexafluoride. The Bejarano et al. (2013) modeling provides the specific types of coolants, oils, and fuels for offshore wind facilities, including petroleum distillate oils (mineral

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		oil, diesel, hydraulic fluids, lubricating oils, gear oils, motor oils); biodegradable ester oil (e.g., vegetable oil, biodiesel, and commercial product dielectric fluid MIDEL@ 7131); electrolytes (sulfuric acids); and anti-freezers (ethylene or propylene glycol). Toxicity from spills of petrochemicals in the offshore environment on the biological environment are addressed in those Draft EIS sections that cover aquatic biological resources (e.g., marine mammals, birds, sea turtles).

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O.6.21 Wetlands and Waters of the U.S.

Table O.6.21-1 Responses to Comments on Wetlands and Waters of the U.S.

Comment No.	Comment	Response
0950-0002	We also urge you to ensure that impacts to sensitive habitats such as submerged aquatic vegetation wetlands and forests are avoided as much as possible and any unavoidable effects are mitigated.	Ocean Wind has proposed various measures to avoid and minimize impacts on sensitive areas and vegetation. The full list of measures Ocean Wind has committed to implementing are in EIS Appendix H.
0984-0030	3.22 Wetlands. The purposeful destruction of wetlands to avoid the expense of running cables through private lands is a monetary decision and should not be permitted. The destruction of wetlands is a [Bold: Major Impacts] that can be avoided. If the developer does not have the means to purchase the property to avoid the wetland destruction in the states parks and estuary they are not financially capable to handle the project as a whole and should have any and all permits rescinded for not meeting the financial requirements of the contract and for being in violation of the EO requirements of financial feasibility.	As stated throughout the EIS, Ocean Wind would locate the onshore export cable corridors within existing rights-of-way (e.g., existing public roads) or previously disturbed/developed lands to the extent practicable. This is one of Ocean Wind's stated avoidance and minimization measures (GEN-01) listed in EIS Appendix H. In addition, Ocean Wind has committed to using installation technologies, to the extent practicable, to minimize disturbance to wetlands (see measure GEN-08 in EIS Appendix H).
0984-0033	The Army Corps of Engineers (ACOE) assessment of impacts on rivers streams and estuaries in the Clean Water Act section 404/Rivers and Harbors Act of 1899 section 10 individual permit will also have to be denied. The delays within the United States standards for Offshore Wind have not been completed and the intent of BSEE to have the developers write their own standards for each individual development site undermines the public process.	The Section 404 and Section 10 permits are under the purview of USACE, and it will be USACE's decision in determining the issuance of the permits. Under CWA regulations, USACE can issue permits only if the Least Environmentally Damaging Practicable Alternative is identified for a project. USACE is a cooperating agency for the Ocean Wind EIS and would support USACE's NEPA process in issuing its permits.
1192-0030	Clarify the loss of wetlands on the Oyster Creek site. Two cables on the west side will impact the SAVs on either side of the "channel". Is that channel wide enough? Was there any consideration of channeling the cable on the land next to Route 9 and not in Barnegat Bay.	The channel on the west side of Island Beach State Park in Barnegat Bay is an area that has been previously dredged, resulting in deeper water than the surrounding water. This results in a near-absence of wetland because the water is too deep to be considered wetland, and an absence or low amounts of SAV (also because the water is too deep). While the Proposed Action under the PDE approach includes both the north and south crossings of Island Beach State Park depicted on Draft EIS Figure 3.22-2, there would be a small difference in wetland impact between

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		both crossings. While the southerly crossing would cross more wetlands compared to the northern crossing, impacts on the wetlands at the south crossing would be avoided via HDD. The north crossing (which would be the only crossing option under Alternative E) would result in some wetland impacts from trenching (the narrow band of wetland showing on Figure 3.22-2). BOEM did consider an alternative that would have traveled along U.S. Highway 9 and would have avoided crossing Barnegat Bay. The alternative, identified as *SAV Avoidance Alternative E-3*, would land at an existing parking lot in Ship Bottom, New Jersey, with the cable then following Route 72 and then U.S. Highway 9 to the Oyster Creek onshore substation. This alternative was dismissed from further considerations for the reasons explained in Draft EIS Table 2-3.
1259-0177	xiv. Wetlands (3.22) According to the calculations included in the Draft EIS allowing Ocean Wind 1 to move ahead with industrial-scale wind energy development at Lease Area OCS-A 0498 will substantially impact NJ's wetlands and by extension the many ecosystems and species that rely on them as well. Wetlands are important features in the landscape that provide numerous beneficial services or functions. [Footnote 167: DEIS at 3.22-3.] Some of these include protecting and improving water quality providing fish and wildlife habitats storing floodwaters providing aesthetic value ensuring biological productivity filtering pollutant loads and maintaining surface water flow during dry periods. [Footnote 168: Id.]	Draft EIS Section 3.22 addresses potential impacts on wetlands, including the functions wetlands provide.
1259-0178	Additionally the majority of the wetlands in the geographic analysis area are tidally influenced saline marshes which provide shelter food and nursery grounds for coastal fisheries species including shrimp crab and many finfish. [Footnote 169: Id.] Saline marshes also protect shorelines from erosion by creating a buffer against wave action and by trapping soils. [Footnote 170: Id.] In flood-prone areas saline marshes reduce the flow of flood waters and absorb rainwater. [Footnote 171: Id.] Tidal wetlands also serve as carbon sinks holding carbon that would otherwise be released into the atmosphere and contribute to climate change. [Footnote 172: Id.]	Draft EIS Section 3.22 addresses potential impacts on wetlands, including the functions wetlands provide.

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1259-0179	In and around New Jersey's iconic Barnegat Bay in particular wetlands provide flood protection during storm events and function to sequester a significant amount of the nitrogen and phosphorus loading to the bay. [Footnote 173: Id.] This is particularly important as the 2021 Comprehensive Conservation and Management Plan for Barnegat Bay observed that more than twenty-eight (28) percent of Barnegat Bay's salt marshes have been lost to development. [Footnote 174: Barnegat Bay Partnership 2021 Comprehensive Conservation and Management Plan for the Barnegat Bay-Little Egg Harbor Sanctuary 45 (2021) https://www.barnegatbaypartnership.org/wp-content/uploads/2021/10/BBP- CCMP-2021-for-web-FINAL.pdf.] Consequently DEP has affirmed the "significant importance" of stabilizing and restoring existing wetlands as well as preventing the loss of any more wetlands in and around Barnegat Bay. [Footnote 175: Phase Two: Moving Science into Action N.J. Dept. Enviro. Prot. (Feb. 2 2021) https://www.nj.gov/dep/barnegatbay/wetlands.html.]	The coalition is required to obtain a CWA Section 404 permit for any proposed filling of jurisdictional wetlands. Section 404 requires that all appropriate and practicable steps be taken first to avoid and minimize impacts on these resources; for unavoidable impacts, compensatory mitigation is required to replace the loss of wetland and associated functions. This permit and process would apply to all waters of Barnegat Bay and any wetland associated with Barnegat Bay.
1259-0180	Even though the Draft EIS acknowledges the unique importance of NJ's wetlands it nevertheless goes on to propose a variety of actions that if approved would irreparably harm acres upon acres of wetlands. To start the document states "Onshore construction activities would require heavy equipment use and HDD activities and potential spills could occur as a result of an inadvertent release from the machinery or during refueling activities." [Footnote 176: DEIS at 3.22-8.] Likewise the Draft EIS notes that water quality within wetlands may be affected by sedimentation from nearby exposed soils. The Draft EIS similarly anticipates significant disturbance of wooded wetland ecosystems from cable burial and maintenance activities. 4.98 acres of long-term disturbance will occur within wooded wetlands while roughly 0.53 acre of short-term wetland impacts could potentially occur as a result of cable burial at BL England. [Footnote 177: Id. at 3.22-8 3.22-9.] Additionally 20.04 acres of short- term and long-term impacts are projected to occur as a result of cable burial at Oyster Creek. As if this were not concerning enough these widespread disturbances are occurring in addition to the 150 acres of wetlands that Orsted is developing for a Wind Port in Lower Alloways Creek. [Footnote 178: Tom Johnson Wetlands no more. NJ redraws map to boost offshore wind project	Offshore wind projects span the offshore and onshore environment and commonly cover large geographic areas. It is difficult to design and construct such projects to completely avoid all sensitive resources, such as wetlands, given that the onshore environment is along the coast where wetlands and surface waters are prevalent. BOEM is required to disclose these potential impacts in the EIS, some of which are cited in this comment. However, under CWA Section 404, Ocean Wind is required to take all appropriate and practicable steps to first avoid and minimize impacts on wetlands; for unavoidable impacts, compensatory mitigation is required to replace the loss of wetland and associated functions. USACE cannot issue the Section 404 permit until the avoidance and minimization steps are demonstrated; for any unavoidable impacts that require compensatory mitigation, USACE must approve the compensatory mitigation to ensure there is no net loss of wetland functions. This process ensures that USACE issues the Section 404 permit for the Least Environmentally Damaging Practicable Alternative.

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	NJ Spotlight News (Mar. 25 2022) https://www.njspotlightnews.org/2022/03/wetlands-pseg-power-150-acres-reclassified-wind-port-project/.]	BOEM understands the concern with the Project's potential impact on wetlands resources but anticipates that the permitting process/requirements and the avoidance and mitigation measures proposed by Ocean Wind to minimize the impacts (see EIS Appendix H) would ensure the Project would avoid and minimize impacts on wetlands to the extent practicable.
1259-0182	In sum activities associated with Ocean Wind 1 will destroy fish and wildlife habitat in sensitive NJ wetlands while impeding natural water filtration and storage functions disrupting natural carbon sinks and paving the way for wave action to more quickly erode NJ shorelines. This is particularly troublesome with respect to Barnegat Bay where the proposed development will disrupt wetlands' ability to filter nitrogen and phosphorus. Moreover the Draft EIS analysis of Ocean Wind 1's effects on wetlands is incomplete because it does not provide any meaningful commitments regarding mitigation which will plainly be required.	See responses to comments 1259-0179 and 1259-0180. Ocean Wind would be required to provide compensatory mitigation for any wetlands that cannot be avoided or minimized as part of the Section 404 permitting process. The details of that mitigation would be part of the final Section 404 permit issued to Ocean Wind.
1259-0183	In addition to demonstrating the inadequacy of the Draft EIS's analysis Ocean Wind 1's expected impacts upon wetlands are a testament to the need for a pilot offshore wind energy project off the New Jersey coast before rushing straight into industrial-scale development. The implications for the Garden State's wetlands including those around Barnegat Bay are substantial and potentially irreversible. A pilot project would improve the quantity and quality of the data upon which industrial-scale OSW in the region can be more safely developed and also provide more time to determine how the impacts of Ocean Wind 1 and similar offshore wind projects can best be averted and mitigated over the long-term.	Draft EIS Section 3.22, *Wetlands*, focuses on the onshore environment where wetlands are found, so without a specific suggestion or details on a "pilot-scale project" for wetlands impacts, it is unclear what this would look like and the value it would have on the impact analysis for wetlands in the onshore environment. Wetland impact types and mechanisms from constructing and operating onshore electric cables and constructing substation facilities (as would be done for the Ocean Wind Project) are generally well understood and these facilities have been permitted and constructed throughout the United States. While BOEM acknowledges the sensitivity of wetlands, including wetlands associated with Barnegat Bay, there is nothing new or novel about constructing onshore electric cables and associated infrastructure (e.g., substations), and the potential effects these activities have on wetlands. In addition, and as stated in previous comment responses (1259-0182, 1259-0180, 1259-0179), under CWA Section 404, Ocean Wind is required to take all appropriate and practicable steps to

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		first avoid and minimize impacts on wetlands; for unavoidable impacts, compensatory mitigation is required to replace the loss of wetland and associated functions.
TRANS-0068-0002	Clean Ocean Action is also deeply concerned about a comment in section 3.22 of the DEIS where it says that Ocean Wind will identify compensatory mitigation based on the requirements of the Army Corps and the NJDEP Ocean Wind is coordinating wetlands mitigation options with State and Federal agencies and may identify a mix of banking and on site restoration depending on agency preference and availability. This comment is problematic for two reasons. First it is unacceptable that Ocean Wind 1 has not yet identified the concrete steps that it will undertake to mitigate the unavoidable permanent consequences of its activities. The information is critical to understanding the project's true overall impacts and Ocean Wind 1's wetlands mitigation plan must be submitted to public review and comment as a matter of transparency and insuring that it is as well informed as possible. Second Clean Ocean Action objects to the implication that Ocean Wind 1's wetlands mitigation efforts will largely be left to the developer and moreover will ultimately be limited by administrative capacity. The EIS must impose more oversight on Ocean Wind 1's plans for wetlands mitigation and the EIS must mandate that the wetlands mitigation plan must ultimately reflect the scientific needs of the impacted ecosystems rather than artificial constraints.	As part of the CWA Section 404 permit process, Ocean Wind needs to demonstrate specifically how it would first avoid and minimize impacts on wetlands, and, if needed, compensate for any wetland loss (see responses to comments 1259-0179 and 1259-0180). This process is ongoing concurrently with BOEM's NEPA process. BOEM notes that the EIS is not a permit document, although USACE (as a cooperating agency) will use BOEM's EIS to support its Section 404/Least Environmentally Damaging Practicable Alternative decision. BOEM is confident that the EIS will support USACE's decision because BOEM works closely with USACE to ensure USACE's concerns are addressed in the EIS. The details on mitigation will be part of the Section 404 permit and USACE will follow all of its regulatory requirements to ensure public review of the permit process and information. Based on the Public Notice issued by USACE for Ocean Wind's Section 404 permit application (NAP-2017-00135-84 [USACE 2022] found here: https://www.nap.usace.army.mil/Portals/39/docs/regulatory/publicnotices/Public-Notice-2017-00135-84-Amended.pdf), Ocean Wind proposes to purchase 2.05 acres of wetland credits from the Great Bay Wetland Mitigation Bank through Evergreen Environmental, LLC, the mitigation bank sponsor.
0941-0001	Under the Project Design Envelope (PDE) the applicant has estimated that onshore activities associated with Oyster Creek substation parcel and export cables will result in an estimated 4.98 acres of long-term disturbance in wooded wetlands primarily a change to herbaceous wetlands including 2.39 acres of Atlantic white cedar (Chamaecyparis thyoides). However because the impacts to wetlands are not broken down by the individual alternative cable routes (Table 3.22-3) it is impossible to determine	Per CWA Section 404, Ocean Wind is required to take all appropriate and practicable steps to first avoid and minimize impacts on jurisdictional wetlands, and, for those impacts that are unavoidable, provide compensatory mitigation to replace the loss of wetlands and associated functions. This is not required for the NEPA process but this process is ongoing concurrently with BOEM's NEPA process as part of Ocean Wind's

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	which routes would have the least long-term impact and therefore would be a preferred alternative. This is especially true for impacts to Atlantic white-cedar forest which is a particularly scarce coastal wetland type. While the applicant has indicated that wetland mitigation options are being coordinated with state and federal agencies (APM TCHF- 03) there are no details provided to allow for a determination of the appropriateness of the proposed mitigation.	Section 404 process with USACE. BOEM notes that the EIS is not a permit document, although USACE (as a cooperating agency) will use BOEM's EIS to support its Section 404/Least Environmentally Damaging Practicable Alternative decision. BOEM is confident that the EIS will support USACE's decision because BOEM works closely with USACE to ensure USACE's concerns are addressed in the EIS. Ocean Wind will identify compensatory mitigation based on the requirements of USACE and NJDEP as part of the Section 404 permitting process; this process includes a requirement for USACE/NJDEP to provide a public notice for Ocean Wind's Section 404 application. Based on the Public Notice issued by USACE for Ocean Wind's Section 404 permit application (NAP-2017-00135-84 [USACE 2022] found here: https://www.nap.usace.army.mil/Portals/39/docs/regulatory/publicnotices/Public-Notice-2017-00135-84-Amended.pdf), Ocean Wind proposes to purchase 2.05 acres of wetland credits from the Great Bay Wetland Mitigation Bank through Evergreen Environmental, LLC, the mitigation bank sponsor.

O.6.22 Mitigation and Monitoring

Table O.6.22-1 Responses to Comments on Appendix H (Mitigation and Monitoring)

Comment No.	Comment	Response
0024-0001	We encourage BOEM to encourage developers to add well-designed turbine foundation reef enhancement on top of the scour protection rock to enhance fishing and to improve fish stocks. We request from BOEM that an implementation of the "rigs to reef" program (just like in the Gulf of Mexico) to ensure that after decades of ecosystem enhancement these valuable reefs can be retained and locations shared with fishermen and divers.	BOEM does not require lessees to design and install reef enhancements, although the EIS notes the beneficial artificial reef effects that would result from the introduction of offshore structures.
0201-0002	In addition the report should provide guidance for the design of a monitoring and reporting system for the recording and reporting of actual impacts. The reports should be made public with results published and archived for reference as offshore wind development continues.	Monitoring and reporting requirements associated with APMs or agency-proposed mitigation are described in Appendix H.
1233-0001	As BOEM works toward issuing a final environmental impact statement (FEIS) for Ocean Wind 1 the conservancy wants to relay that we continue to [Bold: believe robust avoidance minimization mitigation and monitoring practices for wildlife offer the best path forward to meet energy goals and protect imperiled marine wildlife and habitat.] With these guideposts in mind we urge you to consider the following: Robust monitoring data collection and reporting is essential to evaluating impacts of offshore wind projects on marine coastal and avian wildlife. The FEIS should account for the limitations in the survey methods used to assess the project area for species present and Ocean Wind should employ pre- during and post-construction monitoring. An adaptive management approach to identifying appropriate mitigation should be generated from the ongoing knowledge gained by data collection and reporting. Alternative E-Submerged Aquatic Vegetation Avoidance which alters the route of offshore export cables through ecologically important eelgrass in Barnegat Bay which is considered essential fish habitat habitat area of particular concern and a Special Aquatic Site under the Clean Water Act is preferred. Ocean Wind should not employ 24-hour pile driving due to the increased prolonged exposure of vulnerable species to noise impacts from pile-driving activities and the limitations of detecting species in the clearance zones at night. BOEM and Ocean Wind should evaluate other turbine foundation options in particular quiet foundations to reduce noise impacts to vulnerable species and should provide that analysis to the public for their review	Ocean Wind and BOEM recognize that monitoring after construction may be necessary. For example, the lessee’s Avian and Bat Post-Construction Monitoring Framework, SAV Monitoring Plan, and SAV Preliminary Mitigation Plan propose post-construction monitoring. As part of monitoring plans, adaptive management may be required (i.e., new mitigation measures and monitoring may be required by BOEM if impacts deviate substantially from the impact analysis in the EIS). Specific mitigation for nighttime pile driving is included in Appendix H. Alternate foundation types that avoid the use of pile driving, such as gravity-based, suction bucket, or floating foundations, were considered but not carried forward for detailed analysis due to local site conditions as well as technical and supply chain considerations, as described in Chapter 2, Table 2-3.

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1259-0080	The DEIS also includes 3.15.9 which is a very brief section on proposed mitigation measures. A review of the impacts and the proposed mitigation measures clearly shows that despite using references and studies to model and estimate likely impacts of pile driving the DEIS does not adequately address the complex nature of the impacts on the various categories of marine mammals that inhabit the geographical analysis area nor does it thoroughly address the impacts to highly endangered North Atlantic Right Whale. This will cause significant harm.	EIS Section, 3.15, *Marine Mammals*, provides a summary of proposed mitigation measures for marine mammals. Additional detail on BOEM-proposed mitigation is included in EIS Appendix H and in BOEM's BA. Ocean Wind has also proposed many measures to avoid and minimize impacts on marine mammals, including pile-driving impacts as described in Appendix H and the BA. The Final EIS incorporates the results of BOEM's consultation with NMFS under the ESA and NMFS's Biological Opinion.
1259-0181	The Draft EIS's approach to the mitigation thereof also leaves much to be desired. Notably the document concludes that "compensatory mitigation would likely be necessary because of unavoidable permanent impacts" from Ocean Wind 1. [Footnote 179: DEIS at 3.22-11 12.] While the Draft EIS notes that such mitigation measures "would likely include a combination of onsite restoration of wetlands temporarily affected during construction and a wetland enhancement or mitigation banking credit purchase" the document provides no binding assurances about what the mitigation measures required by Ocean Wind 1 will entail. Instead the Draft EIS merely indicates that "Ocean Wind will identify compensatory mitigation based on the requirements of USACE and NJDEP. Ocean Wind is coordinating wetland mitigation options with state and federal agencies and may identify a mix of banking and onsite restoration depending on agency preference and availability." [Footnote 180: Id. at 3.22-9.] This is problematic for two reasons. First it is unacceptable that Ocean Wind 1 has not yet identified the concrete steps that it will undertake to mitigate the unavoidable permanent consequences of its activities. This information is critical to the Project's overall environmental impacts and Ocean Wind 1's wetlands mitigation plan must be subject to public review and comment as a matter of transparency and ensuring that interested parties are not only well-informed but also able to provide helpful input on aspects of the mitigation plan where appropriate. Second Clean Ocean Action objects to the implication that Ocean Wind 1's wetland mitigation efforts will largely be left to the developer and moreover will ultimately be unnecessarily limited by administrative discretion. The Final EIS must provide clearer commitments regarding Ocean Wind 1's wetlands mitigation plan and it is imperative that this wetlands mitigation plan ultimately reflects the scientific needs of the	Per CWA Section 404, Ocean Wind is required to take all appropriate and practicable steps to first avoid and minimize impacts on jurisdictional wetlands and, for those impacts that are unavoidable, provide compensatory mitigation to replace the loss of wetlands and associated functions. Details of wetland mitigation requirements will be determined as part of Ocean Wind's Section 404 permitting with USACE. BOEM notes that the EIS is not a permit document, although USACE (as a cooperating agency) will use BOEM's EIS to support its Section 404/Least Environmentally Damaging Practicable Alternative decision. Ocean Wind will identify compensatory mitigation based on the requirements of USACE and NJDEP as part of the Section 404 permitting process, which includes a requirement for USACE/NJDEP to provide a public notice for Ocean Wind's Section 404 application. Based on the Public Notice issued by the USACE for Ocean Wind's Section 404 permit application (NAP-2017-00135-84 [USACE 2022] found here: https://www.nap.usace.army.mil/Portals/39/

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	impacted ecosystems rather than artificial constraints.	docs/regulatory/publicnotices/Public-Notice-2017-00135-84-Amended.pdf), Ocean Wind proposes to purchase 2.05 acres of wetland credits from the Great Bay Wetland Mitigation Bank through Evergreen Environmental, LLC, the mitigation bank sponsor.
TRANS-0085-0001	I am the Water Outreach Specialist at Pinelands Preservation Alliance and we will be speaking on behalf of Pinelands Preservation Alliance. Pinelands Preservation Alliance encourages the Bureau of Ocean Energy Management the New Jersey Department of Environmental Protection and the developers of Ocean Wind 1 to be candid about the risk to the environment posed by horizontal directional drilling. We would like to see improved mitigation efforts in relation to the inadvertent returns that will occur during the construction of Ocean Wind 1. These inadvertent returns often occur in loose sandy soils as indicated in a fall 2021 report released by the New Jersey Department of Environmental Protection. We have seen drill fluid leak from natural gas pipeline projects in the Pinelands and in recent years using the horizontal directional drilling method causing harm to natural ecosystems within the Pinelands such as wetlands where 13 failures documented during drilling. Inadvertent returns will almost certainly occur during the construction of Ocean Wind 1. We would like to see a more accurate representation of the risks posed by practice -- by the practice of horizontal directional drilling in the final environmental impact statement and we would like to see more innovative techniques to avoid these risks posed by the technique of HDT to the wetlands and the natural environment overall more than what is currently in the draft environmental impact statement. Pinelands Preservation Alliance supports the environmentally responsible development of wind energy off the coast of New Jersey and believes it will provide many benefits to the environment economy and our national security.	Discussion of the risks of inadvertent returns has been added to Final EIS Section 3.6, *Benthic Resources*, and Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*. Additional descriptions of Ocean Wind's Inadvertent Return Plan, which will be implemented where HDD methods are used, were added to Final EIS Appendix H, Mitigation and Monitoring.
0941-0001	Monitoring and mitigation of critical bay resources. The applicant has proposed an array of site-specific monitoring programs for various aquatic biota but with the exception of submerged aquatic vegetation (SAV) all of the monitoring appears to be related to the "wind farm area" and the "offshore export cables" and nothing associated with the "inshore export cables." Monitoring and mitigation of several bay resources are a critical issue as two living resources impacted by the proposed project (i.e. eelgrass and hard clams) are identified as holistic ecosystem targets in the BBP's 2021 CCMP.	Ocean Wind has developed a SAV Preliminary Mitigation Plan that has been included as an APM in the Final EIS to reduce impacts on SAV. The lessee's mitigation and monitoring plan includes monitoring, restoration, and reporting requirements to reduce impacts on SAV. Ocean Wind's SAV Preliminary Mitigation

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	The applicant has committed to conduct a SAV survey of the proposed inshore export cable route (applicant proposed mitigation [APM] BENTH-03) and to avoid seagrass communities where practicable and restore any damage to these communities (APM GEN-02). Additionally the applicant has tentatively identified an alternative export cable route (Alternative E) that would substantially reduce seagrass impacts based on its estimates (Table 3.6-5). While additional surveys and the minimization of impacts are important we have several concerns. The first is in regards to the methodology used to determine seagrass impacts. As described in our comments on the Notice of Intent to Prepare an EIS (see our letter dated April 29 2021 to BOEM) seagrass surveys should be conducted in the late spring when numerous studies within the Barnegat Bay have documented seagrass beds are at their maximum density and extent. The current studies conducted by the applicant were undertaken during the end of the growing season which likely represents identifies only the minimum bed extent. Moreover within the DEIS no mention of a during-construction or post-construction monitoring plan for SAV has been made. Barnegat Bay contains the overwhelming majority of the eelgrass remaining in New Jersey's waters; moreover individual Barnegat Bay populations exhibit little genetic diversity (Campanella et al. 2010). For these reasons eelgrass beds have been identified in the BBP's 2021 CCMP as one of the bay's most critical habitats. Thus it seems important that the applicant develop a pre- during- and post - construction monitoring plan which includes adequate surveys throughout the lifetime of the project including anytime disturbance to the cable corridor occurs in proximity to eelgrass beds. And lastly with regard to SAV mitigation there are no details of what a SAV mitigation plan might entail. Eelgrass beds support populations of commercially recreationally and biologically important species; loss of SAV beds potentially has adverse impacts to other living resources within the bay. Thus development of a mitigation plan which includes losses from initial construction and any subsequent actions which disrupt SAV resources should be provided for the life of the wind project and not just for the first few years as is most often the case.	Plan proposes to conduct in-water surveys during the SAV growing season (May–October) starting in 2023 (pre-construction and post-construction) and continuing annually during post-construction monitoring (2024–2033).
1194-0002b	With these guideposts in mind we urge you to consider the following: BOEM and Ocean Wind should implement additional protective measures for the critically endangered North Atlantic right whale and other vulnerable marine species including but not limited to noise-mitigation technologies. Robust monitoring data collection and reporting is essential to evaluating impacts of	BOEM-proposed mitigation to reduce impacts on marine mammals, sea turtles, and fish, including impacts related to underwater noise, is outlined in EIS Appendix H, Table H-2 and in BOEM’s BA.

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	offshore wind projects on marine coastal and avian wildlife. The FEIS should account for the limitations in the survey methods used to assess the project area for species present and Ocean Wind should employ pre-construction construction and post-construction monitoring.	Ocean Wind has also proposed measures to avoid and minimize impacts on marine mammals from underwater noise and vessel strike, as described in Appendix H, Table H-1, the NMFS BA, and Ocean Wind's Protected Species Mitigation and Monitoring Plan included as Appendix AA to Ocean Wind's COP. The Final EIS incorporates the results of BOEM's consultation with NMFS under the ESA for ESA-listed marine mammals, sea turtles, and fish.
1241-0002a	3. [Italics: A requirement for Ørsted and Atlantic Shores to partner with the fishing industry and credible independent scientists to co-develop cooperative monitoring and research plans that are well coordinated between the two projects.] The environmental impacts of Ocean Wind will be cumulative to those of other projects for multiple fish stocks (and oceanographic processes) and these must be coordinated to maximize the utility of any data that is collected. To date RODA is not aware of any plans for the Ocean Wind project to coordinate cooperative research and monitoring plans with developers of geographically relevant lease areas including Atlantic Shores Offshore Wind Dominion Energy US Wind and permit holders for NY Bight OSW leases. Given the immediate adjacency of the Ocean Wind and Atlantic Shores Offshore Wind project areas and their strong importance to the clam fishery it is especially important for these projects to work together to provide relevant information for testing scientific hypotheses about the impacts of OSW to the clam resource and fishery. We strongly urge BOEM to require these developers to partner with the fishing industry and credible independent scientists to co-develop cooperative monitoring and research plans for the leases and ensure that each project's research is well coordinated with the other. This should be common practice for all wind development lease areas but particularly for abutting leases such as these. The lack of coordination between these two lease areas elucidates the need for a cumulative approach to analyses and mitigation measures beginning at the earliest stages of any project.	Comment noted.
1241-0002	II. [Bold: SCOPING AND FRAMING CONSIDERATIONS] A. [Bold: Fisheries Mitigation in NEPA Analysis]	BOEM considered, but did not analyze in detail, an alternative with a 2-nm by 2-nm wind turbine layout to provide safe access

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	This EIS should explicitly include [[Underlined: alternatives for analysis that serve to mitigate the project's impacts to fishing] including the five specific requests above and others raised during scoping in previous comment letters incorporated by reference above and listed on RODA's website. [Footnote 10: See https://rodafisheries.org/offshore-wind/.] Unfortunately as stated above none of the alternatives in the DEIS serve as mitigation measures and BOEM's practice to date has been to incorporate any mitigation measures under consideration as appendices or Record of Decision conditions rather than analyzing them fully as alternatives. Since the scoping period for this DEIS BOEM issued a new policy that has the effect of excluding alternatives from environmental review that would specifically reduce or mitigate fisheries impacts. The "Process for Identifying Alternatives for Environmental Reviews of Offshore Wind Construction and Operations Plans pursuant to the NEPA" [Footnote 11: See https://www.boem.gov/sites/default/files/documents/renewable-energy/BOEM%20COP%20EIS%20Alternatives-2022-06-22.pdf.] released in June 2022 standardizes the alternatives BOEM will consider during the NEPA process and clarifies BOEM's policy of considering only a narrow range of alternatives consistent with a developer's preferred project plans. [Footnote 12: This document was issued without any opportunity for the public to participate in or provide input on its development thus to our knowledge has not been the subject of any public comment.] Indeed it affords the terms of cost-competitive procurement agreements "more deference than a typical contract between two private for-profit entities" although such contracts are nearly entirely driven by profit and energy maximization and without environmental review. The document only references mitigation in the context of what should not be considered as a NEPA alternative; that is it suggests actions with "substantially similar effects" to other options should be considered outside of the range of alternatives. [Footnote 13: This statement contradicts NEPA's implementing regulations which specify the alternatives of an Environmental Analysis or Environmental Impact Statement must "include appropriate mitigation measures not already included in the proposed action or alternatives." 40 C.F.R. § 1502.14(e).] We urge BOEM to reconsider this policy. Specifically for the Ocean Wind and all other proposed OSW projects the agency should include alternatives for analysis in each of its environmental review documents describing specific fisheries mitigation solutions and afford these full neutral consideration. Stand-alone alternatives will more clearly inform public comment and allow better	for fishing vessels. Additional information regarding this analysis is provided in Chapter 2. *Alternatives*, and Appendix C, *Additional Analysis for Alternatives Dismissed*. A comprehensive list of mitigation measures is provided in Appendix H, *Mitigation and Monitoring*, and mitigation measures are analyzed in the relevant Chapter 3 resource section of the EIS. Alternatives screening criteria used for this EIS are provided in Appendix C. *Additional Analysis for Alternatives Dismissed*. Comments on BOEM's Process for Identifying Alternatives for Environmental Reviews of Offshore Wind Construction and Operations Plans pursuant to NEPA are outside the scope of this EIS.

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	evaluation of potential mutual benefits or tradeoffs. As a public agency BOEM's consideration of alternatives should include those that reasonably mitigate impacts to fishing whether or not a developer has voluntarily proposed to incorporate them in its Construction and Operations Plan (COP) and whether or not they could require reasonable modifications to private contracts. This is especially true as in the case of this Ocean Wind DEIS when highly affected members of the public have properly proposed specific fisheries mitigation alternatives for analysis and public input through the scoping process.	
1194-0002e	Ocean Wind should pursue opportunities to support healthy fisheries in and around the project site for the long term including but not limited to carefully designed reef-enhancement at turbine foundations and a decommissioning plan that considers preservation of the reefs expected to form at foundations over the project's lifespan. The FEIS should account for impacts on fisheries and engage fishing industry stakeholders at all possible opportunities.	BOEM does not require lessees to design and install reef enhancements, although the EIS notes the beneficial artificial reef effects that would result from the introduction of offshore structures.
1234-0002	[Bold: Environmental / Ecological Issues] By nature of their reliance on the ocean for their way of life fishermen must be good stewards of the environment. Any proposed opening of fishing grounds or increase in allowable catch requires years of intensive scientific study. This scientific work falls in part to the National Marine Fisheries Service and their annual trawl survey. This survey is the foundation for fish population estimates and the basis for quota allocation and stock assessment. The impact of this site and cumulative impact of others will limit the NMFS historic survey locations resulting in impacts to the data and the industry this science supports specifically the nations commercial and recreational sectors. [Bold: Cumulative impacts of these projects must be considered in this EIS!] BOEM through this document and working with the developers must ensure the NMFS Survey is fully funded going forward and must account for the mitigation to amend this historic scientific study. Without this mitigation the resulting survey and supporting data will result in additional uncertainty which will directly impact fish stocks and allocations to the State's and the commercial and recreational fishing industries relaying on these allocations. These natural resources are a common good and impacts on new development must address these historic uses.	BOEM has committed to working with NOAA to implement the Federal Survey Mitigation Strategy program (https://repository.library.noaa.gov/view/noaa/47925). As of May 2023, implementation is pending. As discussions between BOEM and NOAA on implementation of the program continue, specific details on appropriate mitigation measures will be added to the environmental analysis.
Compensatory Mitigation for Commercial Fishing		
1222-0004	It is quite important that offshore wind is developed in a manner that does not unnecessarily harm the Atlantic Surfclam industry. Any loss of access should be mitigated with stock enhancement efforts to protect the business that	Direct compensation for lost income was identified as a way to mitigate impacts from offshore wind projects on commercial and

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	currently depend on this area both directly and indirectly for revenue. The vessels fishing for Atlantic surfclams out of Atlantic City New Jersey will lose all meaningful access to the Ocean Wind I lease area that is eventually built out but will also lose access to all the other wind energy areas that overlap with surfclam habitat making mitigation very important for all wind lease areas. Financial contributions equal to the dockside value of the biomass that the surfclam fleet is losing access to should be made by Ocean Wind LLC towards stock enhancement for the Atlantic surfclam fishery. Stock enhancement using methods where clams are spawned in a hatchery grown in a nursery and disbursed in the ocean for future harvest by the commercial sector has the potential to mitigate both the loss of access that will be suffered by the Atlantic surfclam fleet due to offshore wind energy development as well as mitigate all the downstream losses that would be suffered by support businesses and the coastal communities. Stock enhancement has the potential to produce much better outcomes than displacing the fishery and then trying to financially compensate the harvesters and downstream service businesses impacted.	recreational fisheries and fishing in BOEM's draft guidance for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585. Establishment of a direct compensation program for fishermen affected by the Ocean Wind 1 Project has been proposed by Ocean Wind and analyzed in Section 3.9 of the Final EIS.
1234-0006	[Bold: Mitigation and Spacing] Also worth noting is the majority of fishing gear types will be unable to work in these arrays. Specifically gill net bottom trawls midwater trawls and clam and scallop dredges need at least a 2nm spacing between each array. This has been shared countless time and to date never been included in a design proposal. As such the DEIS/COP must consider a greater array spacing to allow commercial operation or assume these areas will be closed to most gear types fished in NJ commercially. Thus mitigation must be considered that includes the fact that these areas will be closed to commercial fishing. And this compensatory mitigation or impact fees fully offset these fisheries losses. Finally this mitigation funds must be identified and distributed by an independent source with no relationship or control by the developers.	Section 3.9 of the EIS states that, "Clam industry representatives (Atlantic surfclam and ocean quahog fisheries) state that their operations require a minimum distance of 2 nm (3.7 kilometers) between WTGs, in alignment with the bottom contours, for safe operations (BOEM 2021b; RODA 2021)." BOEM considered, but did not analyze in detail, an alternative with a 2-nm by 2-nm wind turbine layout to provide safe access for fishing vessels. Additional information regarding this analysis is provided in Chapter 2, *Alternatives*, and Appendix C, *Additional Analysis for Alternatives Dismissed*. Establishment of a direct compensation program for fishermen affected by the Ocean Wind 1 Project has been proposed by Ocean Wind and analyzed in Section 3.9 of the Final EIS.
TRANS-0073-0001	The chamber has been involved with the ocean wind project from its inception and is dedicated to insuring the success of this new industry as a supplement	BOEM's draft guidance for Mitigating Impacts to Commercial and Recreational

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	to and not at the expense of our existing and thriving fishing and tourism sectors. The successful coexistence of these three industries is the ideal but to see this come to a reality we must plan for any unforeseen and unintended consequence that could negatively impact any one of these areas. This is why the chamber is supporting Orsted's request to ask that BOEM develop a mitigation plan and compensation process that speaks to the very real concerns to the commercial and recreational fishing industries. Cape May County is a unique area where the ecosystem and the economy are firmly intertwined. As such the chamber supports renewable energy and any endeavor which seeks to protect and enhance both sides of this rare coin. The chamber has and will continue to speak up for our commercial and recreational fishing industries and we urge BOEM to be proactive in insuring that while we welcome the wind industry to our waters it is not the expense of another. This is why we are advocating for an approach to a mitigation and compensation process that is forward thinking innovative and fair to both industries. This is truly an opportunity for BOEM to set a pioneering standard that welcomes the new while not forgetting to protect the existing industry that is not only important for its economic impact but also for its product. No matter how thorough the planning process the final outcome always contains unknowns. That's why we ask that as BOEM finalizes the plan they develop mechanisms for mitigation and compensation that do not create undue hardship but instead show true support and care for the success and growth of our communities. Thank you.	Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585 discusses guidelines for mitigating fisheries impacts. Consistent with this draft guidance, Ocean Wind proposes three fisheries mitigation programs, which consist of a gear claim procedure to request reimbursement related to lost/damaged gear, direct compensation program for lost income, and the navigational safety fund for navigation equipment upgrades. Mitigation measures are listed in Appendix H of the EIS and analyzed in the respective Chapter 3 resource sections.
1228-0001	Some commercial fishermen also stand to have their usual operations greatly altered. Orsted has made strides to ease any transitional strain by implementing a Navigation Safety Fund and a Gear Loss Program; however I strongly recommend that BOEM create a loss mitigation strategy that accounts for any anticipated harm to our historic South Jersey fishing fleet.	Ocean Wind proposes three fisheries mitigation programs, which consist of a gear claim procedure to request reimbursement related to lost/damaged gear, direct compensation program for lost income, and the navigational safety fund for navigation equipment upgrades. BOEM’s draft guidance for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585 discusses guidelines for mitigating fisheries impacts.
1234-0001	BOEM and its federal partners must make clear that developers should set aside reserve funds based on transparent consistent and equitable scientific and economic impact estimates. We also believe BOEM should be involved in	BOEM’s draft guidance for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf

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	implementing regional mitigation plans that fully account for regional cumulative environmental and fishery business impacts from wind development.	Pursuant to 30 CFR 585 outlines guidelines for determining adequate reserve funds for compensation. Ocean Wind proposes a claims-based Direct Compensation Program for which Ocean Wind would use the annual average commercial landings values and for-hire revenue stated in the Final EIS as a baseline for commercial and for-hire fishing and would hold in reserve an amount determined by the formula set out in the BOEM’s draft guidance for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585 using the baseline amounts.
1241-0002	4. Italics: A full transparent equitable and science-based impact fee program.] RODA has submitted extensive comments on BOEM's Draft Guidance for Fisheries Mitigation including recommendations for equitable development and execution of compensatory mitigation. [Footnote 9: See http://rodafisheries.org/wp-content/uploads/2022/08/220822_BOEM-Fisheries-Mitigation.pdf.] We will not reiterate them here but BOEM must incorporate these transparent fair and science-based recommendations for any future possible project approval including Ocean Wind 1. While BOEM's fisheries mitigation guidance is still under development Ørsted must work with fishermen shoreside businesses economists and scientists to propose alternative compensation frameworks as an alternative for analysis and potential incorporation into Terms and Conditions if BOEM approves this project. Compensation should not be limited to landings values but also include value-added multiplier effects and shoreside and supporting infrastructure losses particularly given this project's proximity to key New Jersey fishing ports.	Section 3.9.9 of the Draft EIS analyzed a proposed measure for the compensation for lost fishing income. This measure would require Ocean Wind to implement a compensation program consistent with BOEM’s draft guidance for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585 or as modified in response to public comment. After publication of the Draft EIS, Ocean Wind updated its COP to include a Direct Compensation Program. Ocean Wind’s implementation of its Direct Compensation Program is analyzed in the Final EIS as part of the Proposed Action in Section 3.9.5.1. Section 3.9.9 of the Final EIS analyzes a mitigation measure that requires Ocean Wind’s Direct Compensation Program to include losses to shoreside business and requires Ocean Wind to conduct a shoreside seafood business analysis that would be used to further supplement funds available

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		for settling claims of lost (unrecovered) economic activity as a result of the Ocean Wind 1 Project.
1258-0043, & -0050	We need to compensate commercial fishermen if their ability to harvest scallops and other shellfish is curtailed because of turbines. We need to insure that turbines do not affect radar on boats.	Ocean Wind proposes three fisheries mitigation programs, which consist of a gear claim procedure to request reimbursement related to lost/damaged gear, direct compensation program for lost income, and the navigational safety fund for navigation equipment upgrades. Ocean Wind's fisheries mitigation programs are analyzed as part of the Proposed Action in Section 3.9 of the Final EIS.
1272-0008	We have read the mitigation and compensation plan in Ocean wind 1 COP. What little is there is a joke the only thing that the developer current feels any responsibility for is if their survey vessels cause damage to fixed gear that happens to be in their way and is damaged or destroyed. It is clear that they really do not care. There have been a few issues where fishing gear was damaged or destroyed in the last few years. Since each lease holder takes care of any problems that takes place within their lease there is no standardized system to deal with the problems. Today if the developers has harmed a fisherman one of their employees is to resolve the issues. However there is no way of knowing if developer is even willing to resolve the issue. It is unfair for a fisherman be required to sue the developers for harm that they have caused. There is also a question regarding where the funds would come from without having a federal judge find the developer liable and issuing a judgement against them. That would take years and lawyers' fees and could cost more than the damage done to the fisherman. As of today there has been little to no regard for any ocean user from the developers they do not care about the harm they caused and their fisheries specialist are window dressing. If BOEM does not set standards that apply to all of the current and future leases every developer will have a different set rule on what they consider a reasonable claim. Each would have different payment schedule for the many different possible claims. With so many developers there is no way to get them to agree on what the claim policies would be. Who is going to be the judge that sets the standard for claims? How are the claims going to be the same so there is a sense of fairness? Are the courts going to set the standards? What are the settlement amounts for each type of claim in different	Ocean Wind proposes three fisheries mitigation programs, which consist of a gear claim procedure to request reimbursement related to lost/damaged gear, direct compensation program for lost income, and the navigational safety fund for navigation equipment upgrades. Ocean Wind's fisheries mitigation programs are analyzed as part of the Proposed Action in Section 3.9 of the Final EIS. Gear loss and damage and income loss would be compensated using a claims-based approach, which is consistent with BOEM's draft guidance for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585. The Direct Compensation Program would be managed by a third party, and the third party would determine eligibility. Eligibility would be based on demonstrated fishing history in the Project area. The third party would also approve and deny claims, and there would be an appeals process for those seeking to review a denied claim. Ocean Wind would use the annual average commercial landings

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	regions? The objective we hope is an attempt to keep all claims payouts out of federal court. The simplest way to resolve this is a single standardized mitigation and arbitration (M&A) for conflict resolution and compensation of claims. There are many mitigation and arbitration firms that address such conflict. BOEM should find a firm that can handle such a program and require the developers to agree by making it part of their COP and EIS. Small claims are a problem because their fees could be as much as the compensation. There are M&A firms that have a section for small claims and are set up to handle large conflicts. How to get the developers to fund a compensation plan? One way would add the requirement to each wind farmer COP and EIS that requires them set up an escrow account with funds to cover anticipated claims. The claims would be handled by the arbitration firm and they would have authority to pay the claim from the developers escrow account. • For the first two years the developer funds an escrow account with $1750.00 Per MWh of each turbine name plates in the wind farm. The escrowed funds may be deposited in a national bank yearly. The escrow must have the currents year's claims and the following years estimated needs. • As turbines are installed the fund in increased accordingly. • Once all turbines are contributing to the escrow fund the fund deposit should be equal to two worth of claims on hand. After six years of claim history the wind farm operator will average three highest claim years from the last 6 years as the payment for the coming year. That is to be repeated yearly for the time that the wind farm is intact WITH BOEM'S APPROVAL. • By the time that the construction is complete there should be some understanding to what can be expected in claims and the amount of the current and the following estimate must be on hand. • There escrowed funds should be in the wind operators name and can be released by the arbiter when the arbitration claim has be determined. • I the case of a ruling against a claimant the claimant must post a bond or pay the expenses of the mitigation and arbitration. • When the farm has all of the turbines operating the payment will run for two years after the farm is decommissioned and all turbines converter stations cables both in array and export are removes along with the foundation and cable protection covers and foundation rocks are remover.	values and for-hire revenue stated in the Final EIS as a baseline for commercial and for-hire fishing and would hold in reserve an amount determined by the formula set out in BOEM's draft guidance for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585 using the baseline amounts. Claims for loss or damaged gear are reviewed and either accepted or rejected in whole or in part. If rejected in whole or in part, the fishermen may appeal the decision to an independent third party. The independent third party's review is final.

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	• Other claim can come in for damaged gear and loss of access for 90 days after completion except for possible claims for environmental issues that may become known sometime once the wind farm is removed. • However a two year period will be allow for any biological or ecological harm that may show up even after the wind farm is removed. • Once the wind farm is removes and the claims are settles any funds left over will be returned to the wind farm owner. It is clear that the claim issues for damaged fishing gear and loss of access to traditional fishing areas are problems that need to be addressed. The suggestion is to have an independent third party plus two representatives from the wind energy industry and two for fishing and a fifth a M&A arbitrator to set the policies as to what claims are appropriate and make the decision as to what is a fair compensation. The four industry people would be the expert's contractors and advisor to the M&A arbiter. This group would have a fund to pay the claims from the start of the program. The independent third party will direct the payment of the claims. Once a claim history is developed for each wind farms payments to the fund will be adjusted to assure there are funds for each wind farm account to stays solvent and able to pay their claims. BOEM cannot tell the developers what to do but for the EIS/COP to be approved it must have a section in the document detailing the operators responsibility. Each EIS will have the same statement in their EIS/COP before it can be approved. Loss of access to fishing grounds should be payout out over 10 year instead of 5 years. Each developer creates a claims escrow account for funds to pay the claims. How much should a developer pay into the claims fund? Each developer would have their payments kept as a separate account to pay their claims. Each developer would start with a payment of the number of MW operating in the wind farm X $1750.00 per MW a year. When under construction as a turbine goes on line the payment for that turbine starts. Once the wind farm has been built out and claims have balanced become stable the developer will have their payment reduces or increase to make sure that there are adequate funds to pay the claims but not create a large surplus. However the surplus must be enough to cover the claims both current year and a estimate for all of the next year.	

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O.6.23 Planned Activities Scenario and Cumulative Impacts

Table O.6.23-1 Responses to Comments on Planned Activities Scenario and Cumulative Impacts

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0007-0001	One of my purposes in commenting on the NOI for scoping for this project EIS in April 2021 was to request that consideration be given to the many changes that have occurred since the BOEM Programmatic EIS for Alternative Energy Development was prepared in 2007 and the Final EA was completed for Commercial Lease Issuance in 2012. Such changes should be recognized and fully evaluated in the DEIS. Information needs to be brought up to date yet as stated in Section 1.4 of the DEIS the 2007 and 2012 documents were utilized to "inform the preparation of this Draft EIS" and were incorporated by reference. Changes include: the automation of the operation and maintenance of offshore wind energy systems thereby reducing potential for jobs; the reliability of such systems for base load power absent commercially available energy storage capability; the lack of demonstration of these massive wind energy projects in the U.S. ; the reliability of such systems in adverse weather conditions as illustrated by the events in Texas in the winter of 2021; the advancement of alternative low carbon or carbon free renewable energy generation technologies; the country's once gained but recent loss of energy independence and the effect on world peace and inflation and increased greenhouse gas emissions; the Supreme Court ruling on June 30 2022 finding that EPA doesn't have the authority to regulate carbon emissions from power plants; and the cost impact comparing offshore wind to these alternative technologies particularly the cost impact on electric rate payers who can ill afford significant increases in these times of high inflation.	BOEM is committed to using the best available science and will consider incorporating applicable studies as they become available.
0007-0011	Similarly use of onshore clean energy technologies will have a Foreseeable Impact combating climate change. Did the Foreseeable Impact analysis for the Proposed Action and the No Action Alternative consider the beneficial impact of development of onshore clean energy technologies. If not such an analysis is needed. If done what assumptions were made for the energy mix in the short term and long term considering conservation fossil nuclear hydrogen anaerobic digestion other technologies.	Onshore clean energy technologies were not considered in the analysis. BOEM will take this comment under consideration.
0007-0016	That BOEM not "silo" this project i.e. limit it to the only clean energy project in the future but consider onshore clean technology development as having a Foreseeable Impact in the DEIS. By doing include the future benefits and reduction of climate impacts from onshore development of clean energy	Onshore clean energy technologies were not considered in the analysis. BOEM will take this comment under consideration. The Proposed Action will add 1,100 MW of

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	projects. It is likely that said onshore benefits will result in more significant future beneficial changes on climate and these should be recognized in the impact analysis. (When evaluating onshore clean technologies in the Foreseeable Impact analysis please list the assumptions for each technology type for future power generation and transportation listing % assumptions for conservation and for future use of fossil nuclear wind solar hydrogen AD other types of clean energy production. In other words what is the short and long term energy future assumed to be with and without the Proposed Action and what are the Foreseeable Impacts in that instance.)	wind energy to New Jersey. The foreseeable impacts of the Proposed Action, as well as the No Action Alternative, are analyzed throughout the EIS.
0158-0002	Lastly I would like to know if there has been a cradle to grave environmental impact analysis of the proposed wind farms particularly relative to other forms of energy including nuclear. And if it has been conducted would you please point us to it?	A comparison to other forms of energy, such as nuclear, has not been done.
0390-0022	The cumulative environmental impacts of multiple offshore wind projects along the Atlantic Coast including fisheries commercial and recreational fishing and endangered species-may be significant and irreversible. Also mining the raw materials for offshore wind turbines especially rare-earth minerals has significant environmental impact because those materials primarily are mined overseas where environmental regulations are less stringent than in the United States. Dismissing environmental impacts that occur outside the U.S. while championing offshore wind's alleged worldwide climate change benefits is hypocritical.	Further clarification of ongoing activities contributing to impacts of the No Action Alternative and planned activities contributing to cumulative impacts have been included in the Final EIS.
0837-0001	The final objective presented by the DEIS includes the installation of 1370 WTGs offshore New Jersey. The identified proposals to accomplish this goal include Ocean Wind 1 (OCS-A-0498) and Ocean Wind 2 (OSC-A 0532) Ocean Wind X (no OSC designation) Atlantic Shores North (OCS-A 0549) and Atlantic Shores South (OCS-A 0499) Empire (OCS-A 0512)1 Central Bight (OCS-A 0537) Hudson South B (OCS-A 0538) Hudson South C (OCS-A 0539) Hudson South E (OCS-A 0541) Hudson South F (OSC-A 0542) and Hudson North (OCS-A 0544). Although the names Empire and Hudson indicate a nexus to the New York region they are offshore of New Jersey's coast according to BOEM's mapping. Although BOEM categorizes these projects as part of the New York/New Jersey Region there are no projects identified offshore New York. To ensure the general population has a true understanding of the facts BOEM should explain New York's role in the Region. Further the Ocean Wind X project with 33 WTGs is noteworthy because it receives minimal attention within the DEIS and yet it is the closest to the coast at 9 miles from Atlantic City. An OSC lease is not associated with this project on the BOEM mappings; it is merely a gray outlined area. Ocean Wind X appears in [Italics: Attachment M-2	The label "Ocean Wind X" as shown on the cumulative visual simulation refers to the remaining capacity of the Lease Area and is already accounted for in Appendix F, *Planned Activities Scenario* (Table F2-1).

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	Cumulative Visual Simulations] of the DEIS. It is unclear if this project is defined within the legal parameters of the outer continental shelf (OSC) for leasing purposes.	
0948-0002b	POINT Ill THE CURRENT BIFURCATED NARROW REVIEW PROCESS OF SEPARATINGOCEAN PROJECTS SUCH AS THAT OF "OCEAN WIND 1" MUST BE REJECTEDIN FAVOR OF A THOROUGH SCIENTIFIC REVIEW OF THE CUMULATIVE ANDINDIRECT IMPACTS {EMPHASIS ADDED) AS TO THE ELEVEN (11) OTHERCONCURRENTLY PROPOSED WINDFARM PROJECTS WITH NINE HUNDREDPLUS (900+) ADDITIONAL TURBINES TO BE CONSTRUCTED OFF THE NEWJERSEY COAST. If BOEM remains determined to reject the "no action alternative" for this massive industrial offshore development and BOEM similarly decides not to develop a comprehensive and useful pilot project with peer reviewed research and study I would hereby object to BOEM's artificial and arbitrary procedures being utilized and the scientifically unsupportable consideration for just one (1) project and its limited Draft Environmental Impact Statement alone. As far ranging and large scale as the currently proposed "Ocean Wind 1" project is in and of itself the current scope of review inappropriately is overly narrow and insufficiently comprehensive if not bureaucratically fabricated. Meaning no disrespect to any one BOEM official or employee I rendered the last comment to underscore the urgent and absolute need to engage in a thorough review of the cumulative and indirect impacts (emphasis added) about the currently proposed Ocean Wind 1 project along with the eleven (11) other vast industrial projects currently being proposed for the construction of over nine hundred (900) gigantic turbines off the valuable precious New Jersey Coastline. It is entirely arbitrary if not environmentally unsound to attempt to segregate allegedly separate and distinct projects such as the focus of the pending Draft Environmental Impact Statement without the required scientific review of all of these cumulative and indirect impacts. As I had argued in my testimony in the virtual hearing it is entirely in appropriate and lacking in scientific support to limit and separate out such individual industrial projects off our coast without a full consideration of the massive overall cumulative and indirect impacts as to the greater than five hundred thousand more acres now planned for such an invaluable public resource in the form of the Atlantic Ocean. Migratory birds valuable commercial and recreational fisheries marine mammals and the ocean life and our precious ocean environment itself all deserve a cumulative scientifically supportable overall review process. To carve out	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Clarification regarding BOEM's methodology for assessing impacts has been provided in Section 1.6 of the Final EIS. The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.

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	separate artificially drawn piece meal project sites is contrived inappropriate and unsupportable. In fact proceeding in this manner underscores the very definition of arbitrary and capricious. The offshore expanse of the New Jersey Coast is one magnificent portion of our Atlantic Ocean and should not be carved up with artificially drawn manmade profit driven bureaucratic boundaries for individual though still massive industrial construction sites. Our ocean happens to be one of the richest most valuable and even economic treasures in the world. The critically endangered North Atlantic Right Whale and some of the other inhabitants of our Atlantic Ocean fisheries truly do not recognize any fabricated non-scientific boundaries. The cumulative effects and indirect impacts of the currently projected eleven (11) other projects with massive turbines off our coast have been virtually discounted if not ignored. As such I would reject the current procedures and limited approach to fabricate and to segregate out one particular focus for a Draft Environmental Impact Statement. A cumulative scientific review is warranted. The study of the cumulative and indirect impacts of the areas other pending projects off the New Jersey Coast and the construction of over nine hundred (900) massive turbines is absolutely necessary rather than the far too limited sole review purpose of the pending draft EIS of "Ocean Wind 1 ". Absent such a cumulative study with a thorough review of the cumulative and indirect impacts the current proposal must be seen as arbitrary and capricious. As I had also previously argued in various BOEM created forums as to the premature award of lease sales and otherwise the above referenced exhaustive and cumulative study is essential. This critically necessary BOEM study should involve a complete review of the cumulative and indirect impacts with all the vast areas of public lands off the New Jersey Coast which have already been sold off yet have similarly not yet been fully studied and certainly not developed. Similarly the same cumulative and indirect comprehensive review must be applied as to all pending projects and their too limited Draft Environmental Impact Studies. All these numerous impacts should initially be thoroughly investigated before such a totally unvetted experimental technology is the subject matter of what are tantamount to be irreversible actions. Included in such a non-exhaustive list of the potential impacts to be first thoroughly reviewed and studied as to the specific Atlantic Shores Ocean Wind I Project itself as well as from a cumulative standpoint with all the other Ocean sites and/or various stages of wind farm construction certainly should be the following:	

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	1. A vital habitat for birds fish and marine mammals both in the water as well as throughout the wetlands and other coastal areas of our State 2. Commercial fishery sites as well as the interests of recreational fishing. 3. Air quality and water quality and the specific effects such a massive industrial construction project itself would have as well as the on-going operation of the vast wind turbines and the ultimate not even explained process of trying to decommission or dismantle this huge industrial construct once its useful life has ended or it has been rendered obsolete by the already ongoing development of more efficient technologies. 4. Issues of environmental standing and environmental justice as to the Atlantic Ocean itself and the ocean environment. 5. The cumulative effect upon navigation and ocean vessel traffic in this busy commercial corridor which is already the subject matter of numerous potentially conflicting uses. 6. The interests of recreation and tourism. 7. The visual effects and indeed visual resources of the coastal and the ocean setting in the vicinity of this massive industrial site. 8. Independent of the overall effects upon mammals marine and bird wildlife this gigantic untested industrial construction project has the potential for causing a devasting impact upon threatened endangered species including the extremely endangered North Atlantic Right Whale. The Right Whale frequents this very ocean area in question and may indeed be crowded out and pushed aside from some of the already leased ocean lands subject to the prior rapid bidding process and awards through BOEM.	
0984-0001	A SEIS needs to be required by BOEM to look at the cumulative impacts of the concentrated development of the Ocean Wind 1 (OCS-A 0498) the Atlantic Shores North (OCS-A 0549) the Atlantic Shores South (OCS-A 0499) and the Ocean Wind 2 (OCS-A 0532) sites as a whole.	BOEM analyzes the impacts of all reasonably foreseeable future planned activities, which include future offshore wind activities, in each resource-specific environmental consequences section in Chapter 3 of this Final EIS. The impacts of each alternative are analyzed in relation to the current baseline. Cumulative impacts of each alternative are also analyzed separately in relation to the future baseline.
0984-0034	The function of the ACOE is engineer regiment military construction and civil works. The EIS fails to address the known environmental impacts that the ACOE	USACE serves as a cooperating agency pursuant to 40 CFR 1501.8. USACE

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	will have to mitigate. The omission of known cumulative impacts associated with needed ACOE projects that facilitate the offshore wind applicant is a reason that the ACOE should reject such permit. With holding the intended projects environmental impacts that will be placed on the ACOE is a violation of public trust. The ACOE application should be denied and the applicant should be held liable for any costs associated with green washing information within its application. The United States Attourney General should be notified immediately. A immediate stay should be placed on the application until a thorough investigation is completed and a determination of guilt with fines is accessed. Cooperating agencies will use the Record of Decision (ROD) to deny as support within their decision making process.	provided independent review of the EIS. BOEM worked with USACE to sufficiently address any comments raised.
0984-0036	Look what is not in the EIS. The impacts to non-game or non-marketable species the irreversible impact to the spawning grounds of the fish that lay their eggs at sea and swim to the estuaries The irreversible impact of the change in salinity of surface water The irreversible event of collisions by vessels not under command The irreversible loss of tourism when increased moisture hits the beaches The irreversible loss of agricultural lands due to less heating degree days and higher salinity The irreversible loss of life with the increase of shark predation along beaches the irreversible loss of mental capacity to learn by the youth who come from homes of the food insecure The irreversible extinction of the right whale The irreversible extinction of the American Grebe The irreversible impacts on the razorbill The irreversible extinction of the Black Capped Petrel The irreversible impacts of increased predators like starfish the secondary irreversible impact to the scallop and clam population. The irreversible impact to the flounder population. The irreversible impact to the horseshoe crab population. The secondary impact of extinction of the red knot. The secondary impact of the needed medical uses of the horseshoe crab the irreversible impact to the monarch butterfly the extinction of benthic species not discovered and more impacts the EIS has failed to address. The applicant has not invested the necessary resources to produce a EIS on the impacts that meet the requirements for approval. The application should be disapproved with no modifications.	Appendix L, *Other Impacts*, addresses potential unavoidable adverse impacts as well as irreversible and irretrievable commitment of resources to environmental resources, including marine mammals, navigation and vessel traffic, and recreation and tourism activities, Potential impacts in the EIS were gauged based reliable existing data and resources in accordance with 40 CFR 1502.23.
0984-0041	The impacts of abandonment needs to be included in the application and was purposely omitted. The mitigation of removal of obsolete cables is currently cost prohibitive and was not included to avoid the need for development of a system to remove cables without additional seafloor disturbances that affect the many ocean users inclusive of marine life. The EIS impacts are not based on repeated installations or removals.	The Final EIS assesses impacts that could result from construction, O&M, and conceptual decommissioning of the proposed Project using reliable existing data and resources in accordance with 40 CFR 1502.23.

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		Section 2.1.2.4 of the Final EIS describes decommissioning activities and that, per BOEM regulations, Ocean Wind would be required to remove all cables and clear the seafloor of all obstructions created by the proposed Project. Ocean Wind would need to obtain separate and subsequent approval from BOEM to retire in place any portion of the proposed Project. Approval of such activities would require compliance under NEPA and other federal statutes and implementing regulations. The conceptual decommissioning plan, as proposed by Ocean Wind, is analyzed in the Final EIS. Prior to implementation of any activities associated with decommissioning, BOEM would require Ocean Wind to submit a decommissioning application for technical and environmental review.
0984-0053	Around the world the installation of stationary wind turbines at sea has increased the amount of at sea travel time from one place to another. The cumulative impact to the additional fossil fuel consumption must be staggering because the proprietary studies are not contained in the EIS. The applicants has an obligation to provide a thorough EIS. The Application should be denied based on the failure to provide a detailed EIS inclusive of economic and environmental damages that result from the project even if it makes the development not feasible.	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
0984-0062	All the Ocean related industries referenced are and continue to upgrade their foot prints to come into greater compliance within the environmental regulations of which many go beyond the regulations because they are the small businesses and people whom live work and play on the ocean. The industrialization of the	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the

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	Atlantic ocean by foreign owned and managed companies has been publicly and regulatory removed over the years. The cumulative lease and development of the ocean will have significant coastal impacts and must be highlighted within the EIS.	Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
0984-0092	The model used by BOEM on accidental releases of fuel oil and hazmat from 2013 is outdated. With the estimated 20 gallons of accidental discharge risk assessment increasing doubling every five years at the end of the life span of over WTGs there will be leaking a estimated 800 - 1000 gallons of oil over the years of operation and during decommissioning. It is easy to rationalize; 20 year old leaky car engines suspended over the ocean for ten years waiting to be towed away to the dump. Which in fact is not considered accidental. If your car leaks oil we have laws on land that makes the owner responsible for the dripping on to the land and into the water. If the owners refuse to address the leak immediately the act is not an accident. It is negligence. BOEM is quick to defend the application with the unfounded self-serving statement that 'The likelihood of an oil spill occurring from multiple WTGs and ESPs at the same time is very low". It should also be noted that the estimate does not include the support vessels pre post and during decommissioning. BOEMs suggestion that the cumulative damages from fuel oil and hazmat are within the normal ranges of acceptability is ludicrous since there is none of this discharge occurring with any legal acceptability within the maritime industry and that the industrial Energy development zones impacts would be in addition to anything that currently exists. It is unconscionable to approve any industrialization of the ocean with the known degradation that is presented and not in this EIS. The EIS should be rejected with a resounding NO.	Section 2.2, *Non-Routine Activities and Events*, of the Final EIS describes actions that would be taken in the event of a spill or release. Ocean Wind will comply with its Oil Spill Response Plan (Appendix A of the COP) and USCG and BSEE regulations relating to the prevention and control of oil and fuel spills. The conceptual decommissioning plan, as proposed by Ocean Wind, is analyzed in the Final EIS. Prior to implementation of any activities associated with decommissioning, BOEM would require Ocean Wind to submit a decommissioning application for technical and environmental review.
1012-0004c	c. [Bold: Decommissioning Feasibility.] It does define what decommissioning means or address the technical feasibility let alone the cost of returning the lease area to its original state without which thousands of acres of ocean could be irrevocably lost forever. Without that any decision to move froward with the project would be irresponsible.	The conceptual decommissioning plan, as proposed by Ocean Wind, is analyzed in the Final EIS. Prior to implementation of any activities associated with decommissioning, BOEM would require Ocean Wind to submit a decommissioning application for technical and environmental

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		review.
1012-0004d	3. [Bold: It does not address Common and Cumulative Impacts.]The DEIS fails to acknowledge the restoration of the definition of cumulative impact in the recent CEQ NEPA rule change which for a number of key impacts requires the summation of impacts from both the Ocean Wind area and the Atlantic Shores project area. The Biden Administration in the CEQ rulemaking of April 20 2020 re-instituted the definition of cumulative effects in section 1508.1(g)(3). That definition now states that cumulative impacts are "effects on the environment that result from the incremental effects of the action when added to the effects of other past present and reasonably foreseeable actions regardless of what agency (federal or non- federal) or person undertakes such other actions". Actions by the BOEM in the Ocean Wind area and the Atlantic Shores area are incremental in terms of certain important impacts as discussed below and clearly underway and therefore clearly reasonably foreseeable and therefore this DEIS must include the impacts of those actions as well. In addition. CEQ NEPA rule section 1502.4(b)(1)(i) says that when preparing statements on programmatic actions (including proposals by more than one agency) agencies may find it useful to evaluate the proposals "geographically' including actions occurring in the same general location such as body of water region or metropolitan area". As mentioned above there is a program being implemented.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Clarification regarding BOEM's methodology for assessing impacts has been provided in Section 1.6 of the Final EIS. The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
1012-0004e	For example the primary migration corridor of the critically endangered North Atlantic right whale is adjacent to and goes past both areas (see Exhibit B1). The DEIS is dismissing it but as shown in detail in Enclosure I the predicted noise from the operation of larger turbines based on the two noise measurement studies cited will envelop that corridor causing noise levels that will disturb the whale and potentially block its migration. So this impact must be evaluated in this EIS. It is not scientifically credible to assess impacts on a critically endangered species in a piecemeal fashion so addressing both areas in this EIS would allow for the analysis and presentation of the full impact from operational turbine noise to these endangered whales. Other such impacts that must be evaluated together in one EIS to get to the proper cumulative impact include visible impact the impact to the cold pool decommissioning impact and the	The scope of the EIS, per BOEM's regulations, is to analyze the COP Ocean Wind submitted for Lease Area OCS-A 0498. The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate

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	socio-economic impact of higher electric rates from the full program as opposed to one project. Visible impact is included because from certain shore points turbines from both the Ocean Wind and Atlantic Shores projects will be visible. By limiting the scope of this DEIS to only one project in one lease area the BOEM is unable to present the cumulative impacts as now required.	analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
1012-0014b	5. [Bold: Changes in Shore Breeze Wave Action Air Temperature and Humidity]Along with the visible turbine impacts the DEIS should have provided an analysis of the potential impacts of the wind turbine complex on shore wind speed air temperature humidity and wave action as was requested in our comments on the NOI. This is also a common impact that will occur from development in both lese areas. Several prior measurement studies of such downwind impacts from smaller turbine complexes indicate the potential for reduced wind speeds and higher temperatures. An extrapolation of those results for the wind turbine sizes and atmospheric settings expected here should have been presented in the DEIS. One study [Footnote OS1: New York Bight Area Identification Memorandum Pursuant to 30 C.F.R. § 585.211(b)] deals with the wind velocity deficit the percentage decrease in the free flow wind speed approaching the turbine and concludes that it takes about 10 km (6.25 miles) downwind of the complex for that wind speed to get back to within 7 percent of its free flow value (Figure 5-for offshore winds). Those measurements were for 2 megawatt (mw) turbines. With 13.6 mw or higher power turbines the wind speed reduction at the shore here only 10 miles away from the complex will likely be considerably greater. Since the wind speed drives the currents the wind complex will also have an effect on the longshore currents which in essence will have an effect on the nearshore currents and thus will be impactful on our coastline. Given the size and scope of this project this needs to be analyzed and results presented in the EIS including a description of what type of studies the BOEM and others have conducted on this subject to support any conclusions reached. Another study [Footnote OS2: NREL Assessment of Offshore Wind Energy Leasing Areas for the BOEM New Jersey Wind Energy Area October 2013 Figures ES-1 and ES -2.] speaks to air temperature increases and humidity changes. It finds (see its conclusions) temperature increases up to 0.6 degrees kelvin (1.1 degrees Fahrenheit) 45 kilometers (28 miles) downwind of the wind complex. Here again these measurements are for smaller turbines- a combination of 3.6 mw and 6.2 mw. With larger turbines and the shorter turbine to shore distances here the temperature and humidity changes could be significant and should be analyzed	Wind turbines extract kinetic energy from the atmosphere and thus can reduce wind speeds downwind of the turbine. Wind turbines increase vertical mixing in the atmosphere and thus can increase (or decrease) air temperatures downwind depending on local meteorological conditions. Increased mixing near the ocean surface can take up moisture from the ocean, increasing the humidity and salinity of the air. However, these effects dissipate with distance downwind. Because of the distance of the Project from land (approximately 15 miles), substantial effects on wind speed, temperature and humidity are unlikely to occur over land.

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	in the EIS for the turbine sizes proposed. These are important public issues and concerns that jeopardize the shore resource and deserve a study of the effect of larger turbines so close to shore. The DEIS should be revised and reissued to address it.	
1012-0014d	6. [Bold: Decommissioning] The DEIS says that project decommissioning impacts will be deferred until the lease expires. That is not consistent with NEPA requirements that reasonably foreseeable impacts be included in an EIS. This also creates a cumulative impact regarding disposal sites on shore and acres of ocean resource that may not be returned to an original state. As far as we can tell there are also no decommissioning requirements spelled out in the construction and operations plan or the New Jersey BPU power purchase approval. Even the word itself decommissioning is the wrong one for this situation. Decommissioning merely means putting something out of service and that could mean just shutting a turbine down and leaving it in place. As long as that is an option there is nothing to prevent the foreign corporations from just turning off the switch heading back to Europe and sticking the U.S. taxpayer with the cost of removal. And once the project is approved for construction there is no incentive for the applicants to agree to anything more than that. Therefore in addition to its NEPA flaws this defer it for later approach is the height of arbitrary capricious and irresponsible U.S. decision-making because it could easily foreclose the use of hundreds of thousands of acres of a precious ocean resource in perpetuity. This is precisely the kind of irrevocable environmental loss that the NEPA was passed to avoid and for an EIS to disclose before any decision is made. Therefore at a minimum there must be a condition of project approval that for turbines "decommissioning" means dismantling removal and disposal of the blades the nacelle and the tower entirely and for the foundation removal to a minimum of 15 feet below the seabed. Corresponding overarching requirements should be specified for the cables and substations as well. The DEIS should then first present the technical feasibility of doing this and then assuming it can be done the environmental impacts of the various technical options that can be employed e.g. for cutting the foundation by diamond wire or water jetting. In addition if these structures can be dismantled removed and disposed of decommissioning expenses are estimated to be significant (one study for an 1100 MW offshore wind project shows $590 million or $19.5% of the total project cost) and the scope of the effort is major (each of around 200 structures will be 850 feet above the surface and each monopile base is said to be 40 feet in diameter and weigh up to 5 million lbs.).Decommissioning is an important part of any credible economic and	BSEE's regulations at 30 CFR 285 and commercial Renewable Energy Lease OCS-A 0498 require that Ocean Wind remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the seafloor of all obstructions created by the proposed Project. The conceptual decommissioning plan, as proposed by Ocean Wind, is analyzed in the Final EIS. Prior to implementation of any activities associated with decommissioning, BOEM would require Ocean Wind to submit a decommissioning application for technical and environmental review.

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	environmental impact assessment for a project of this magnitude. A dedicated escrow fund must be set up from annual revenues to assure that the funding is available for it. The DEIS should therefore present a plan for decommissioning. Using one turbine for discussion what is going to be removed? What will remain in place? How is it going to be removed? How many ships how big what flag how many trips how many workers will be involved? What equipment will be needed? How long will the removal process take? For each component what are the disposal options? What is the decommissioning cost per turbine?	
1012-0020a	[Bold: 3. Need to Address Common and Cumulative Impacts in One EIS.]The Biden Administration in the CEQ rulemaking of April 20 2020 re-instituted the definition of cumulative effects in section 1508.1(g)(3). That definition now states that cumulative impacts are "effects on the environment that result from the incremental effects of the action when added to the effects of other past present and reasonably foreseeable actions regardless of what agency (federal or non-federal) or person undertakes such other actions". The actions underway by the BOEM in the Hudson South area and in both leases in the New Jersey wind energy area are incremental in terms of certain important impacts as discussed in Enclosure I and clearly underway and therefore clearly reasonably foreseeable and therefore this EIS must include the impacts of those actions as well. CEQ NEPA rule section 1502.4(b)(1)(i) also says that when preparing statements on programmatic actions (including proposals by more than one agency) agencies may find it useful to evaluate the proposals "geographically including actions occurring in the same general location such as body of water region or metropolitan area". Here there are such geographical areas that will be impacted by development in the Hudson South area and in Lease areas A-0498 and A-0499.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Clarification regarding BOEM's methodology for assessing impacts has been provided in Section 1.6 of the Final EIS. The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
1012-0020b	For example the primary migration corridor of the critically endangered North Atlantic right whale lies between the Hudson South area and lease areas A-0498 and A-0499 and along both A-0498 and A-0499(see Exhibit B1). The DEIS is dismissing it but as shown in detail in Enclosure I the predicted	The scope of the EIS, per BOEM's regulations, is to analyze the COP Ocean Wind submitted for Lease Area OCS-A 0498.

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	noise from the operation of larger turbines based on the two noise measurement studies cited there will envelop that corridor causing noise levels that will disturb the whale and potentially block its migration. So this cumulative impact must be evaluated in this EIS. It is not scientifically credible to assess impacts on a critically endangered species in a piecemeal fashion. Addressing the impact from all three areas in this EIS is required to allow for the analysis and presentation of the full impact from operational turbine noise to these critically endangered whales.	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
1012-0020c	Other such impacts that must be evaluated together in this EIS to get to the proper cumulative impact include visible impact the impact on migratory birds passing through the Hudson South and one of the other two areas to get to onshore nesting grounds such as the piping plover and the red knot the impact to the cold pool decommissioning impact and the socio-economic impact of higher electric rates from the full program as opposed to that from just one project. With respect to the Piping Plover it is our understanding that USFWS Regional Office 5 is preparing such a cumulative analysis. We suggest that the BOEM consult with them toward including that in the DEIS. Visible impact is included because from certain shore areas turbines from both the Ocean Wind and Atlantic Shores projects will be visible. In addition as mentioned above the Coast Guard proposal to make the right whale's migratory corridor a deep draft vessel lane would have a synergistic impact on the whale because it has been shown to surface as a result of the turbine noise where it is exposed to vessel strike. So the combined impact of the foreseeable turbines and the Coast guard proposal should also be analyzed in the DEIS. [Bold: Therefore the scope of the EIS needs to be expanded to include these connected actions and to address cumulative impacts.]The BOEM has already done some internal analysisWEP1 regarding the impacts of turbine placement in the Hudson South lease areas which can be used to provide a comparison of impact there to the other areas consistent with the direction in 40 CFR §1502.21(c).	The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives. Cumulative visual impacts are discussed in Section 3.20, *Scenic and Visual Resources*, and Appendix M, *Seascape, Landscape, and Visual Impact Assessment.* Cumulative impacts on migratory birds are discussed in Section 3.7, *Birds.* USFWS and USCG are serving as cooperating agencies on the EIS, pursuant to 40 CFR 1501.8. USFWS and USCG provided independent review of the EIS. BOEM worked with USFWS and USCG to sufficiently address any comments raised.
1086-0004a	The DEIS is also deficient in that it does not examine cumulative impacts as required by Federal regulations. [Footnote 4: 32 CFR §651.16 In addition	The No Action Alternative consists of the current baseline conditions as influenced

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	Federal courts have recognized the importance of including cumulative impacts under NEPA. For example see Kleppe v. Sierra Club 427 U.S. 390 413 (1976)] Since this project is just 1 of 25 or more proposed wind farms along the Eastern Seaboard the cumulative impacts must be understood prior to construction. NEPA Implementing Regulations encourage the use of programmatic environmental impact statements to reduce redundant paperwork and direct the lead agency to include "actions that may be connected actions which means they are closely related and therefore should be discussed in the same impact statement." [Footnote 5: Council on Environmental Quality 40 CFR Parts 1500-1508 (May 20 2022. §1500.4(k) and §1501.9(e). In addition §1502.4 notes that a programmatic EIS is useful to evaluate proposals that are in the same general location such as a body of water.] Under 40 C.F.R. §1508.7 cumulative impacts are defined as the effect on "the environment which results from the incremental impact of the [proposed] action when added to other past present and [Italics: reasonably foreseeable future actions [emphasis added]]." Ocean Wind 1 and Ocean Wind 2 overlap geographically with one to be constructed before the other. In turn Atlantic Shores to the North is already in the EIS process. To ignore cumulative impacts which result from the "incremental impact of the action when added to other past present and reasonably foreseeable future actions" on the environment is a failure to account for immediate and consequential incremental impacts. Cumulative impacts should have been incorporated into BOEM's NEPA process as part of both EA and EIS documents. [Footnote 6: Considering Cumulative Effects Under the National Environmental Policy Act [Embedded Hyperlink Text (https://digital.library.unt.edu/ark:/67531/metadc31126/m2/1/high_res_d/CumulativeEffects.pdf)] See also [Embedded Hyperlink Text (https://www.epa.gov/sites/default/files/2014-08/documents/cumulative.pdf)] for adoption of CEQ's guidance in the U.S. Environmental Protection Administration's NEPA analyses.]	by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Clarification regarding BOEM's methodology for assessing impacts has been provided in Section 1.6 of the Final EIS. The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
1086-0004b	Additionally decommissioning is a reasonably foreseeable action and its impacts should be quantified and discussed in the DEIS. The Administration has modified NEPA regulations to ensure that every federal agency considers the direct indirect and cumulative impacts of a proposed action.[Footnote 7: 87 FR 23453; also see CEQ Restores Three Key Community Safeguards during Federal Environmental Reviews; White House Press Release April 19 2022] Therefore the County requests that BOEM conduct a cumulative Programmatic Environmental Impact Statement (PEIS) of all lease areas along the coast of	The Final EIS assesses impacts that could result from construction, O&M, and conceptual decommissioning of the proposed Project using reliable existing data and resources in accordance with 40 CFR 1502.23. Section 2.1.2.4 of the Final EIS describes

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	New Jersey or in the alternative amend its DEIS to assure that cumulative impacts are fully evaluated. BOEM's failure to require a PEIS for the southern New Jersey offshore wind fields runs counter to its decision for a similar placement of turbine fields in the New York Bight. [Footnote 8: 87 FR 424 95; July 15 2022; Notice of Intent to Prepare a Programmatic Environmental State for Future Wind Energy Development in the New York Bight. Docket BOEM 2022-0034] As such it is an arbitrary exercise of its administrative authority.	decommissioning activities, and that, per BOEM regulations, Ocean Wind would be required to remove all cables and clear the seafloor of all obstructions created by the proposed Project. Ocean Wind would need to obtain separate and subsequent approval from BOEM to retire in place any portion of the proposed Project. Approval of such activities would require compliance under NEPA and other federal statutes and implementing regulations. The conceptual decommissioning plan, as proposed by Ocean Wind, is analyzed in the Final EIS. Prior to implementation of any activities associated with decommissioning, BOEM would require Ocean Wind to submit a decommissioning application for technical and environmental review.
1194-0002g	BOEM and Ocean Wind should ensure that there are responsible plans and policies for decommissioning transmission lines and turbines once they have surpassed their usefulness.	The conceptual decommissioning plan, as proposed by Ocean Wind, is analyzed in the Final EIS. Prior to implementation of any activities associated with decommissioning, BOEM would require Ocean Wind to submit a decommissioning application for technical and environmental review.
1202-0011a	The DEIS is incomplete because it fails to assess adequately Ocean Wind 1'scumulative impacts to Cape May County. Multiple wind farms are in development off the coasts of New Jersey and adjacent states. These offshore wind projects will have both separate and cumulative adverse visual impacts upon historic properties sites and districts listed or eligible for listing in the National Register of Historic Places. In specifically requiring cumulative impacts analyses NEPA and NHPA recognizes the significant effect that projects can have on the surrounding landscape beyond the scope of a single development. This Project and how it is evaluated and permitted will set a precedent for upcoming projects in the area and along the entire Atlantic Coast; therefore it is essential to apply consistent criteria to this project and subsequent future sites.	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the

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	Due to the historic integrity of historic properties within the Project Area and Area of Potential Effect BOEM must establish and implement best practices. Based on the omissions described above the DEIS should be amended to reflect-and the Final EIS should include-a complete cumulative assessment of all impacts to historic and cultural properties and include additional cumulative visual simulations for Cape May County's historic properties including those reasonably foreseeable effects that Ocean Wind 2 Atlantic Shores and other planned projects will generate.	future baseline as a basis for comparison of the cumulative impacts of the action alternatives. Discussion of cumulative impacts on historic properties is included in Section 3.10, *Cultural Resources*, and Appendix N, *Finding of Adverse Effect for the Ocean Wind 1 Construction and Operations Plan,* which cites the *Cumulative Historic Resources Visual Effects Analysis for Ocean Wind Farm Project* report completed in 2022.
1202-0011b	Finally the DEIS fails to incorporate best practices and minimum guidelines that would apply to all offshore wind developments near Cape May County. In specifically requiring cumulative impacts analyses NEPA recognizes the significant effect that reasonably foreseeable projects can have on the surrounding landscape beyond the scope of a single development. However BOEM's confusing analysis and methodology for assessing cumulative impacts in the DEIS are unclear. Ocean Wind 1 and how it is evaluated and permitted will set the precedent for all future projects in the area and along the entire Mid-Atlantic Coast. Consulting parties and the public have a right to understand BOEM's conclusions and how it arrived at them. Currently no reasonable person can interpret them.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Clarification regarding BOEM’s methodology for assessing impacts has been provided in Section 1.6 of the Final EIS. The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
1234-0003b	There is also a lack of science as to the longer-term impacts of these proposed	The Final EIS presents a complete

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	industrial scale developments in US Waters. At a minimum BOEM working with the developers must require scientific fisheries monitoring for the life of the project. This will help address data gaps identified above but also help address un expected effects of turbine placement and development in these waters.	description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts, including potentially long-term impacts, of the action alternatives. Fisheries monitoring, as explained in Appendix H, *Mitigation and Monitoring,* will consist of regular surveys conducted with BOEM, BSEE, NMFS oversight.
1243-0004a	The subject of environmental impacts site-specific and cumulative in the foreseeable future from the development of WEAs on marine fisheries resources and their habitats has been debated at length. It is important that the wind development companies conduct before and after construction impact (BACI) surveys of the lease site before during construction and following construction of the WEA. I am certainly aware of some of these surveys fisheries and clams specifically being designed and implemented for the Ocean Wind 1 lease site and that approach is a major improvement in monitoring impacts on marine resources.	Appendix H*, Mitigation and Monitoring,* includes the expectations for Annual Monitoring Reports and Post-Construction Quarterly Progress Reports for environmental resources including marine mammals, birds, and bats.
1259-0011	Significantly the Draft EIS does not consider the many other wind farms being proposed on adjacent leased areas nor does it examine connected actions occurring onshore or the cumulative effects of this project in conjunction with subsequent Ocean Wind and other OSW proposals.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Clarification regarding BOEM's methodology for assessing impacts has been provided in Section 1.6 of the Final

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		EIS. The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
1259-0022	Additionally consideration and assessment of cumulative impacts in the Draft EIS is deficient. While cumulative impacts are mentioned briefly in sections the Draft EIS does not broadly or specifically consider impacts as they relate to the twenty-four (24) other known projects and offshore wind lease areas in the NY/NJ Bight as they relate to Ocean Wind 1. As such impacts from any and all of these projects will be amplified in the geographic analysis area. Furthermore scientists admit there is a dearth of scientific knowledge and studies that identify cumulative impacts of offshore wind energy development on wildlife and yet BOEM and the federal government are fast-tracking this Proposed Action and similar large-scale commercial offshore wind development. More independent peer-reviewed scientific studies must be completed before permits are awarded and decisions are made on large-scale offshore wind projects such as Ocean Wind 1. The cumulative impacts can be grave and great to the North Atlantic right whale key benthic species and other important contributors to the ecosystem.	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
1278-0008	Some of the motorized barges may be 400 ft long with very questionable maneuverability and I assume it will take a very powerful and heavy vessel to pull the cable digging equipment although I could not find any detailed information or description in the DEIS on the several methods used to dig and lay cable and how they actually work. And there was no explanation of how site leveling for the WTG area will be done. Perhaps it might be a good idea to threaten penalties for hitting a surveyed or know cultural resource (shipwreck) and require the marine archaeologist to check out all surveyed cultural	Section 3.16, *Navigation and Vessel Traffic*, includes a discussion of vessel types anticipated during construction and installation, O&M, and conceptual decommissioning. Construction and installation activities associated with the Proposed Action are described in Section 2.1.2.2. Marine archaeological resources

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	resources before and after construction.	and investigations are discussed in Section 3.10, *Cultural Resources*, and Appendix N, *Finding of No Adverse Effect for the Ocean Wind 1 Construction and Operations Plan.*
1281-0003	[Bold: THE CURRENT BIFURCATED NARROW REVIEW PROCESS OF SEPARATING OCEAN PROJECTS SUCH AS THAT OF "OCEAN WIND 1" MUST BE REJECTED IN FAVOR OF A THOROUGH SCIENTIFIC REVIEW OF THE [Underlined: CUMULATIVE AND INDIRECT IMPACTS] (EMPHASIS ADDED) AS TO THE ELEVEN (11) OTHER CONCURRENTLY PROPOSED WINDFARM PROJECTS WITH NINE HUNDRED PLUS (900+) ADDITIONAL TURBINES TO BE CONSTRUCTED OFF THE NEW JERSEY COAST.]If BOEM remains determined to reject the "no action alternative" for this massive industrial offshore development and BOEM similarly decides not to develop a comprehensive and useful pilot project with peer reviewed research and study I would hereby object to BOEM's artificial and arbitrary procedures being utilized and the scientifically unsupportable consideration for just one (1) project and its limited Draft Environmental Impact Statement alone. As far ranging and large scale as the currently proposed "Ocean Wind 1" project is in and of itself the current scope of review inappropriately is overly narrow and insufficiently comprehensive if not bureaucratically fabricated. Meaning no disrespect to any one BOEM official or employee I rendered the last comment to underscore the urgent and absolute need to engage in a thorough review of the cumulative and indirect [Underlined: impacts] (emphasis added) about the currently proposed Ocean Wind 1 project along with the eleven (11) other vast industrial projects currently being proposed for the construction of over nine hundred (900) gigantic turbines off the valuable precious New Jersey Coastline. It is entirely arbitrary if not environmentally unsound to attempt to segregate allegedly separate and distinct projects such as the focus of the pending Draft Environmental Impact Statement without the required scientific review of all of these cumulative and indirect impacts. As I had argued in my testimony in the virtual hearing it is entirely inappropriate and lacking in scientific support to limit and separate out such individual industrial projects off our coast without a full consideration of the massive overall cumulative and indirect impacts as to the greater than five hundred thousand more acres now planned for such an invaluable public resource in the form of the Atlantic Ocean.	The No Action Alternative consists of the current baseline conditions as influenced by past and ongoing activities and trends and serves as the baseline against which all action alternatives are evaluated. The EIS also separately analyzes the continuation of all other existing and reasonably foreseeable future activities. Clarification regarding BOEM’s methodology for assessing impacts has been provided in Section 1.6 of the Final EIS. The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
1281-0004	Migratory birds valuable commercial and recreational fisheries marine mammals and the ocean life and our precious ocean environment itself all deserve a cumulative scientifically supportable overall review process. To carve out	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No

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	separate artificially drawn piece meal project sites is contrived inappropriate and unsupportable. In fact proceeding in this manner underscores the very definition of arbitrary and capricious. The offshore expanse of the New Jersey Coast is one magnificent portion of our Atlantic Ocean and should not be carved up with artificially drawn manmade profit driven bureaucratic boundaries for individual though still massive industrial construction sites. Our ocean happens to be one of the richest most valuable and even economic treasures in the world. The critically endangered North Atlantic Right Whale and some of the other inhabitants of our Atlantic Ocean fisheries truly do not recognize any fabricated non-scientific boundaries. The cumulative effects and indirect impacts of the currently projected eleven (11) other projects with massive turbines off our coast have been virtually discounted if not ignored. As such I would reject the current procedures and limited approach to fabricate and to segregate out one particular focus for a Draft Environmental Impact Statement. A cumulative scientific review is warranted. The study of the cumulative and indirect impacts of the areas other pending projects off the New Jersey Coast and the construction of over nine hundred (900) massive turbines is absolutely necessary rather than the far too limited sole review purpose of the pending draft EIS of "Ocean Wind 1". Absent such a cumulative study with a thorough review of the cumulative and indirect impacts the current proposal must be seen as arbitrary and capricious. As I had also previously argued in various BOEM created forums as to the premature award of lease sales and otherwise the above referenced exhaustive and cumulative study is essential. This critically necessary BOEM study should involve a complete review of the cumulative and indirect impacts with all the vast areas of public lands off the New Jersey Coast which have already been sold off yet have similarly not yet been fully studied and certainly not developed. Similarly the same cumulative and indirect comprehensive review must be applied as to all pending projects and their too limited Draft Environmental Impact Studies.	Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
1281-0005	All these numerous impacts should initially be thoroughly investigated before such a totally unvetted experimental technology is the subject matter of what are tantamount to be irreversible actions. Included in such a non-exhaustive list of the potential impacts to be first thoroughly reviewed and studied as to the specific Atlantic Shores Ocean Wind I Project itself as well as from a cumulative standpoint with all the other Ocean sites and/or various stages of wind farm construction certainly should be the following:	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate

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	1. A vital habitat for birds fish and marine mammals both in the water as well as throughout the wetlands and other coastal areas of our State. 2. Commercial fishery sites as well as the interests of recreational fishing. 3. Air quality and water quality and the specific effects such a massive industrial construction project itself would have as well as the on-going operation of the vast wind turbines and the ultimate not even explained process of trying to decommission or dismantle this huge industrial construct once its useful life has ended or it has been rendered obsolete by the already ongoing development of more efficient technologies. 4. Issues of environmental standing and environmental justice as to the Atlantic Ocean itself and the ocean environment. 5. The cumulative effect upon navigation and ocean vessel traffic in this busy commercial corridor which is already the subject matter of numerous potentially conflicting uses. 6. The interests of recreation and tourism. 7. The visual effects and indeed visual resources of the coastal and the ocean setting in the vicinity of this massive industrial site. 8. Independent of the overall effects upon mammals marine and bird wildlife this gigantic untested industrial construction project has the potential for causing a devasting impact upon threatened endangered species including the extremely endangered North Atlantic Right Whale. The Right Whale frequents this very ocean area in question and may indeed be crowded out and pushed aside from some of the already leased ocean lands subject to the prior rapid bidding process and awards through BOEM. The undersigned hereby strenuously would argue that to limit this Draft environmental Impact Statement and the accompanying review without consideration of the cumulative and indirect impacts must be deemed arbitrary and capricious.	analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
TRANS-0003-0003	Moreover BOEM has interpreted and tiered the NEPA review process for Ocean Wind 1 and other offshore wind projects in such away that it obscures the true cumulative impacts of rushing into so much offshore wind development across the northeast so quickly.	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities

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		(i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
TRANS-0041-0001	The size scope and scale of all of these projects altogether being considered simultaneously is alarming. What are the true cumulative impacts of this? The limited studies and results are not available yet projects in leased areas are forging ahead without knowing the consequences	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
TRANS-0069-0001	In Ms. Baker's introductory statement she mentioned 28 leases for offshore wind in the nation. What are the true cumulative impacts of all of this development. The truth is and according to scientists they are not known. The size and scope and scale of all of these projects being considered simultaneously is concerning and alarming.	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
0950-0003	Finally we recommend that Ocean Wind 1 and each subsequent wind project be evaluated in the context of the full buildout scenario along the coast since some impacts to natural resources may be additive and because many of the projects are located in close proximity to one another.	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a

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		current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.
1192-0021	There appear to be at least five other wind proposals for this part of the Atlantic Ocean off shore of New Jersey - why only mention one? Neither the BOEM or the Applicant can say whether or not other Wind Projects want to use the same space on land or the same cable. This is considered segmentation. The DEIS neglects to describe the electric grid for each of the on- land sites. The question here is whether or not Ocean County is bearing the burden of generating electricity for the entire state?	The scope of the EIS, per BOEM's regulations, is to analyze the COP Ocean Wind submitted for Lease Area OCS-A 0498. The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives. Analysis of the electric grid is outside of the scope of this EIS.
0337-0001	The potential risks to the ocean and marine resources are great and grave and too many questions must be considered and answered. While green energy is an opportunity the risks and rewards must be understood: How will building Ocean Wind 1 dramatically reduce carbon dioxide (CO_2) emissions? How many acres of wetlands or open space will be destroyed and impacted by Ocean Wind 1?What are the cumulative effects of the 11 other pending projects off NJ totaling over 900 turbines? These are just the beginning - 500000 more acres are still being planned-out for more turbines. How are these cumulative impacts being addressed? I support responsible and reasonable offshore wind energy but the current trajectory of offshore wind in the NY/NJ region is reckless	Potential air quality, wetland, and land use impacts are discussed in Sections 3.4, 3.22, and 3.14, respectively. The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a

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	privatization and will not ensure protection of marine life including whales dolphins turtles and the hundreds of other species that call the ocean home.	current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives.

O.6.24 NEPA/Public Involvement Process

Table O.6.24-1 Responses to Comments on NEPA/Public Involvement Process

Comment No.	Comment	Response
Incomplete or unavailable information/Preparation of a SDEIS		
0007-0015	That BOEM commit to preparation of a Supplemental DEIS (before preparation of the Final EIS) to cover issues where information is not yet available or for which other government agencies are to make key decisions such as the NMFS re taking of the North American Right Whale or where Ocean Wind is still doing studies such as for radar impacts.	BOEM's EIS complies with the procedural and substantive requirements of NEPA. Appendix J noting incomplete or unavailable information is included in the Final EIS.
0351-0002	Also as was suggested in my original comments please prepare a Supplemental DEIS after key studies are complete and responses to requests have been received thereby allowing for a meaningful review of the EIS in draft stage before a FEIS is prepared.	
1259-0195	Conclusions. Clean Ocean Action is not opposed to offshore wind which is developed responsibly and reasonably. However based on all the above COA respectfully submits that the Draft EIS is incomplete inconsistent and misleading. It fails to present a responsible and reasonable "purpose and need" as required by the National Environmental Policy Act ("NEPA") for the proposed project as well as fails to evaluate all reasonable alternatives to the proposed Project as required by law.	
Public Involvement Process		
0837-0011	BOEM received comments expressing concern for the reliability of offshore wind power and several commenters suggested building the Project in a phased approach or building a much smaller pilot facility to confirm the benefits and impacts before building out the complete Project as proposed. This was described as a phased development or pilot facility with a "go-slow" alternative. BOEM responded that the alternative would negate Ocean Wind's ability to fulfill the terms of BPU's 2019 Order to construct and operate an 1100-MW commercial-scale wind energy facility within the Lease Area with operations targeted to begin in 2024 and does not address a specific environmental or socioeconomic concern. [Footnote 11: Tourism Economics (TE). 2021. Economic Impact of Tourism in New Jersey 2021. Available: https://visitnj.org/sites/default/files/Economic_Impact_of_Tourism_in_New_Jersey_2021_Final.pdf?tag=itinerary. accessed: August 2022.] Essentially BOEM conveyed they will not be deterred from fulfilling their 1100-MW goal regardless of adverse environmental impacts. The previously noted misrepresentations	Before the preparation of the Draft EIS, BOEM conducted a 30-day public scoping comment period and held three virtual public scoping meetings to solicit feedback and identify issues and potential alternatives for consideration. BOEM considered all scoping comments while preparing the EIS; the topics most referenced in the comments include commercial fisheries and for-hire recreational fishing; finfish, invertebrates, and EFH; the NEPA process; socioeconomics; and alternatives. Additional public input occurred during the Project's planning and leasing phases

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	highlight the extent of BOEM's shortsightedness in this respect. For this reason BOEM has undermined public trust and challenged the primary goals of EO 14008 which are to conserve our lands waters and biodiversity through clean energy technologies and infrastructure. The draft EIS provides BOEM an opportunity to correct transgressions and regain public confidence. This objective can be achieved through a realistic depiction of the facts wherein stakeholders can weigh the options. Truthfulness and transparency should not be viewed as an impediment to offshore wind farms but rather as an integral part of the process. To assist stakeholders the governor of New Jersey and state representatives should conduct a fact-oriented outreach to ensure their constituents are informed and prepared for a future referendum on this issue.	between 2010 and 2018. Publication of the Draft EIS initiated a 45-day comment period, which was extended by an additional 15 days, after which BOEM assessed and considered all the comments received in preparation of the Final EIS. See Appendix A for additional information on public involvement.
0984-0031	BOEM has failed to produce peer reviewed science in a rushed timeframe approach to public outreach. BOEM is in direct violation of human rights by accepting a systemic racist format of data collection and is why this EIS should be rejected.	
Document Length		
1012-0005	4. [Bold: Regarding the Presentation of Information to the Public] The full document is too long it contains too much background information and yet despite its length contains very little presentation of numerical or factual significant environmental impacts especially in the body of the EIS. It buries important impact information in lengthy Appendices versus placing it the body of the EIS. It forces the reader to those lengthy Appendices and to hundreds of technical documents and thousands of pages to try to find relevant environmental impacts which is not the readers job but rather was the BOEM's to ferret out relevant information and place it in the body of the EIS. Many of those references cited are not relevant to the proposal or readily accessible and are written for the scientific community not the general public. It presents results from "models" without explanation of the scientific or technical basis for the modeled result or of the key inputs to it forcing the reader to search for other documents to confirm whether those modeled results are accurate which often are not even available. This is a "full disclosure" problem with the EIS. It is not possible for a person to undertake such an extensive document review in 60 days nor should a reader have to. [Italics: It was the BOEM's job to do that show that it has done the "necessary environmental analysis" and to present the relevant impact itself in the EIS proper which it has not done.] The net result is to make the document virtually unreadable and incomprehensible to the general public.	BOEM has worked diligently to provide as much information as is possible, under current regulatory guidance, within the main body of the EIS with supporting or additional information provided in the appendices. One such example is Appendix G, *Assessment of Resources with Minor (or Lower) Adverse Impacts*; to focus on the impacts of most concern in the main body of the EIS, BOEM included the analysis of resources within an appendix. The EIS uses a four-level classification scheme to characterize the potential beneficial and adverse impacts of alternatives as either negligible, minor, moderate, or major. The Final EIS considers the best available data and information that reflect the state of the science at the time of

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1281-0007a	As already noted herein there had been an insufficient time period during which to engage in a thorough review as to the fourteen hundred plus (1400+) page Draft Environmental Impact Statement for which comments are now being sought. Also we have had an insufficient opportunity to have submitted this huge document with its various attachments for even a cursory preliminary review by scientists and economists in the various specialties required.	publication of the EIS.
1012-0005	It promotes the project throughout the entire document by filling it with discussion of what it says are minor impacts which if true have no place in an EIS which is supposed to focus only on significant impacts. It devises a system of scoring impacts as to their severity and throughout the document substitutes a presentation of actual impacts with a discussion of those scores. It's scoring of impacts is in some cases biased towards diminishing impacts and neglects criteria that are in the country's environmental statutes so they present an alternate reality of what BOEM staff think is important versus what the country as a whole has expressed as important in law. Such scoring is not helpful in an EIS because it destroys the objectivity of the EIS i.e. it can drive the impact presentation to support the score rather than the other way around and therefore any such scoring should be reserved for the Record of Decision.	
1012-0005	For example the DEIS cherry-picks the studies used and references cited to show less turbine visible impact versus those that show greater. It avoids or dismisses studies on operational turbine noise impact to the right whale because those would raise significant public and legal concerns and score high. Conversely it embraces studies that show unrealistic turbine avoidance rates for birds and other studies that predict with virtually no data and with great uncertainty whale avoidance behavior when those studies show reduced impacts and low scores.	
1012-0006	[Bold: Conclusions and Recommendation]Taken together the DEIS has not fully disclosed the environmental impacts of the proposed action. It does not have the proper scope nor any true alternatives in the NEPA sense because they are all environmentally the same and is virtually unreadable and incomprehensible to the general public as well as to a decision-maker. It should be restructured into a shorter more focused document with full disclosure of all the relevant impacts meaningful alternatives and reissued if the BOEM continues to promote this project.	
1012-0024	[Bold: 6. EIS Length and Content]An EIS should provide [Bold: full] and fair discussion of [Bold: significant] environmental impacts §1502.1 and only [Bold: brief] discussion of [Bold: other than significant issues] §1502.2. It should be	

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	concise clear and to the point and supported by evidence that the agency has made the necessary environmental analysis §1502.1. It should not be encyclopedic and shall be analytic and concise §1502.2. It should be less than 150 pages or 300 for a project of unusual scope or complexity §1502.7. It should inform federal decision making and the public §1502.1. it should avoid useless bulk and concentrate effort and attention on important issues §1502.15. Verbose descriptions of the affected environment are themselves no measure of the adequacy of an EIS §1502.15.The EIS's being prepared for offshore wind projects are the opposite of these criteria. The body of the EIS is far too long and yet despite its length presents few significant environmental impacts. There is far too much presentation of background information the affected environment and insignificant impacts.	
1012-0025	[Bold: 8. Emphasis on Insignificant Issues.] There is too much focus in these EIS's on insignificant issues. For example in the Vineyard Wind 1 final EIS comparison of alternatives Table on page ES-13 seventy five percent of the one hundred and twelve impact cells are rated as negligible or minor only twenty five percent as moderate or major. That proportionality is reflected in the discussion in the EIS. The focus of an EIS should be predominantly on the latter the former should be presented in one place and then dismissed not repeated over and over. The focus on the negligible and minor also turns the document towards an advocacy one as opposed to a neutral one in terms of just presenting credible impact information.	
1259-0195	The Draft EIS also makes clear the project will have a range of significant negative impacts to the marine environment and surrounding areas plus there is a dearth of scientific studies in certain areas critical to assessing the impacts from this project's effects on multiple ecosystems in the region as well as cumulative impacts.	
0984-0031	The Environmental Impact Statement (EIS) has been hastily written and fails to analyze reasonably foreseeable effects from expanded cumulative activities for offshore wind development. Fishing data safe transit lane alternatives corralling of threatened and endangered species affects on tourism quality of life food security agricultural impacts non- decommissioning projects known additional infrastructure the intent to divest system collapse scenarios supporting countering documents public comments and scientific peer reviewed considerations have been purposely omitted by the developer and representatives party too.	

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Planned Actions		
1259-0024	Introduction. COA objects to the confusing overwhelming and obfuscatory approach that the federal government has taken to reviewing the environmental impacts of Ocean Wind 1 and numerous other OSW projects proposed off the NJ/NY coast. For instance there is an inappropriate bifurcation of the environmental reviews for the New York and New Jersey Bight Region which has undermined a comprehensive and cumulative assessment of the full scale and scope of the offshore wind industry proposals and activities in this region. This bifurcation in turn has resulted in an Alternatives analysis that is neither full nor fair.	Planned offshore wind projects are considered reasonably foreseeable activities, i.e., planned actions that could occur during the life of the Ocean Wind 1 Project and potentially could contribute to cumulative impacts when combined with impacts from the Proposed Action and other alternatives. Appendix F (*Planned Activities Scenario*) describes the methodology used for assessing impacts from planned activities in the EIS. Using the methodology described in Appendix F, each resource-specific environmental consequences section in Chapter 3 of the Draft EIS discusses cumulative impacts.
TRANS-0002-0006	How can the public access and understand the cumulative impacts of one project along with the other 24 projected lease areas in the works offshore. Are they being considered the cumulative impacts in whole?	
Adding Additional Projects to the Ocean Wind 1 EIS		
1012-0019	In addition the DEIS must include connected actions. Therefore in accordance with the NEPA regulation on EIS scoping requirements §1501.9 (e)(1)(iii) development in these three areas are "connected" actions because as shown below they are: "Interdependent parts of a larger action and depend on that larger action for their justification" that larger action being the implementation of a State program that the BOEM has adopted and as such they should all be included in the scope of this DEIS. The real federal purpose and plan here is to meet the New Jersey State plan for 7500 megawatts (mw) of offshore wind power by 2035. NJ Executive Order No. 92 that directed the New Jersey Board of Public Utilities (NJBPU) the New Jersey Department of Environmental Protection and other state agencies with responsibilities arising under the Offshore Wind Economic Development Act (OWEDA) to take all necessary actions to promote the development of wind energy off the coast of New Jersey to secure 7500 megawatts of offshore wind energy generation by the year 2035. On February 28 2020 the Murphy Administration announced the offshore wind solicitation schedule to meet the 7500 mw offshore wind goal by 2035 and called upon the NJBPU to take all necessary actions to implement the schedule. The State has been and is proceeding with a specific defined plan with schedules for solicitations to achieve that objective as shown below. In addition it is proceeding to implement a	Through a competitive leasing process under 30 CFR 585.211, Ocean Wind was awarded Commercial Renewable Energy Lease OCS-A 0498 offshore New Jersey and submitted a COP to BOEM proposing the construction and installation, O&M, and conceptual decommissioning of an offshore wind energy facility in the Lease Area (the Ocean Wind 1 Offshore Wind Farm). The submittal of the COP triggers a NEPA review by BOEM and this EIS is the result of that. Similarly, BOEM is preparing an EIS for the Atlantic Shores Offshore Wind Project for the same reason and will in the future be receiving COPs for the New York Bight Lease areas, which will also trigger a NEPA review. These are not connected actions, as they do not meet the criteria within the CEQ NEPA regulations at 40 CFR

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	consolidated transmission network to bring power from Hudson South to the shore. [Bold: The BOEM has de facto adopted the State's Plan.] Its proposed actions in its Notices of Intent to Prepare an EIS for the Ocean Wind Project and the Atlantic shores projects directly match the NJPBU awards and projected ones. In addition, the BOEM has expressed support for the State's proposed consolidated transmission network the linkage that would make Hudson South an integral part of the State's Plan (BOEM Announces Next Steps for Proposed New York - New Jersey Wind Energy Transmission Line 06/17/2019). As further proof that BOEM's real purpose is to implement the State's program it now says it will not consider any alternative power levels other than what the State approves. If it is bound by each such approval then it is bound by all of them and so its real purpose is to implement a 7500 mw program. Within that context it is simply not rational for a decision-maker having options in other nearby areas that can meet the 7500 mw program with far less environmental impact not to assess them but rather to just say yes or no to this one application. Therefore, this DEIS should have as recommended in our comments on the NOI considered such alternative scenarios and we present several reasonable ones again here. [Bold: Wind Energy Potential]. The wind energy potential from lease area A-0498 (the Ocean Wind Project) A-0499 (the Atlantic Shores offshore wind project) and lease areas A-0538 through A-0543 (the Hudson south area) is shown below. The numbers for lease areas A-0498 and A-0499 from Figure ES1 of reference WEP2 were adjusted to a one nautical mile (8 rotor diameter) turbine spacing using the data in Figure ES2. The wind energy potential from all three areas based on a one nautical mile turbine spacing is 13500 mw 80 percent more than needed to meet the 7500-mw goal. Neither the Ocean Wind or the Atlantic Shores projects by themselves or combined can meet the 7500-mw program goal so executing the State plan requires development in Hudson South. Consequently, all three areas must be considered to execute the Program Plan. Connected Actions. [Italics: Therefore in accordance with NEPA regulation EIS scoping requirements §1501.9 (e)(1)(iii) development in these three areas are "connected" actions because they are: "Interdependent parts of a larger action and depend on that larger action for their justification" and as such they should all be included in the scope of this EIS.]The need to include these areas in this EIS is also required by NEPA rule §1502.4 which states that: "Agencies shall evaluate in a single environmental impact statement proposals or parts of proposals that are related to each other	1508.25. However, these other projects are reasonably foreseeable activities, i.e., planned actions that could occur during the life of the Ocean Wind 1 Project and potentially could contribute to cumulative impacts when combined with impacts from the Proposed Action and other alternatives.

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	closely enough to be in effect a single course of action". Since as shown above development in all these lease areas is in effect a single course of action they should all be evaluated in this EIS.	
1012-002	Several reasonable alternatives commensurate with that expanded scope are provided below. [Bold: 4. Alternatives Commensurate with the Proper EIS Scope][Bold and Italics: NEPA rules require that other reasonable courses of action and their impact should be identified and analyzed in the EIS in detail per 40CFR§1501.9(e) and §1502.14(b) and in comparative form to the proposal per 40CFR§1502.14.] §1502.14 Alternatives including the proposed action. requires that "the alternatives section should present the environmental impacts of the proposed action and the alternatives in comparative form based on the information and analysis presented in the sections on the affected environment (§ 1502.15) and the environmental consequences (§ 1502.16). In this section agencies shall: (a) Evaluate reasonable alternatives to the proposed action and for alternatives that the agency eliminated from detailed study briefly discuss the reasons for their elimination". Therefore §1502.14 requires the EIS to examine all "reasonable" alternatives to the proposal. In determining the scope of alternatives to be considered the emphasis is on what is "reasonable" rather than on whether the proponent or applicant likes or is itself capable of carrying out a particular alternative. Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense rather than simply desirable from the standpoint of the applicant (March 16 1981 CEQ MEMORANDUM FOR FEDERAL NEPA LIAISONS FEDERAL STATE AND LOCAL OFFICIALS AND OTHER PERSONS INVOLVED IN THE NEPA PROCESS). Since as shown above the wind energy potential from all three areas exceeds the State's program requirement there are clearly alternative ways of proceeding that involve all three areas. The proper DEIS scope described above affords the opportunity to craft EIS alternatives that can meet the Governor's 7500 mw programmatic goal with much reduced environmental impact. Such alternatives could take the form below: [Bold: Table 4. EIS Alternatives]Area/Project: A-0498 Ocean WindAlternative A no Action on the Atlantic Shores Proposal: 2248Alternative B reliance on close-in areas: 3192 (Table 3)Alternative C greater reliance on Hudson South area: 305 Area/Project: A-0499 Atlantic ShoresAlternative A no Action on the Atlantic Shores Proposal: 0Alternative B reliance on close-in areas: 3418 (Table 3)Alternative C greater reliance on Hudson South area: 305 Area/Project: Hudson SouthAlternative A no Action on the Atlantic Shores Proposal: 5252Alternative B reliance on close-in areas:	

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	890Alternative C greater reliance on Hudson South area: 6890 (Table 3) Area/Project: AllAlternative A no Action on the Atlantic Shores Proposal: 7500Alternative B reliance on close-in areas: 7500Alternative C greater reliance on Hudson South area: 7500	
1012-0021	[Bold: Alternative A No Atlantic Shores Project] NEPA rule §1502.14 requires that each alternative be considered in detail and comparative form to evaluate their merits and detriments. That includes the no project action alternative. As shown in Tables 3 and 4 above not proceeding with turbine placement in the Atlantic Shores project area would still allow for the State's offshore power generation goal of 7500 mw to be met through development in the Ocean Wind and Hudson South areas. Alternative A would require 5252 mw from Hudson South which is greater than the 4209 mw that has already been secured through area purchases. However the additional 1043 mw can be secured through an expedited unsolicited bid process because there is 2681 mw of remaining wind energy potential in Hudson South and there has apparently has been no competitive interest in those remaining sections. The fact that the Hudson South areas do not yet have specific turbine size and location information need not be a deterrent to the preparation of such a useful comparison. The BOEM has done an internal analysisWEP1 regarding the impacts of turbine placement in the Hudson South lease areas which can be brought up to an EIS level and then used to provide a comparison of impact there to the other areas consistent with the direction in 40 CFR §1502.21(c).Therefore the EIS should at a minimum provide a realistic thorough and comparable analysis of the no Atlantic Shores alternative using the realistic scenario of 2248 mw of power from Ocean Wind and 5252 mw of power from Hudson South. Since the BOEM has repeatedly and in Court stated that it is under no commitment for turbine placement in the current lease areas the no action alternative could also include converting the use of the current lease area to a power transmission effort in support of the one consolidated transmission project to transmit all the power from Hudson South to New Jersey that the NJ BPU and the BOEM are pursuing (BOEM Announces Next Steps for Proposed New York - New Jersey Wind Energy Transmission Line 06/17/2019). The EIS should present the environmental benefit of that in contrast to the need for two transmission projects and the attendant greater sub-seabed excavation and substation construction if turbines are placed in both Hudson South and the current lease area. The Alternative A discussion should also recognize that the current Atlantic Shores lease area was identified over 10 years ago without public input and consideration of onshore visible turbine impact or operational noise impact to endangered whales and that the explosion	

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	in turbine power and dimension and the associated underwater noise now call that selection into question. Our analysis in the cover letter and Enclosure I of the operational noise problem indicates that there is no room for the turbines proposed in the project area consistent with the criteria in the ESA and MMPA because such placement would block the right whale's migration. Alternative A places greater reliance on development in Hudson South. The Hudson South area has been screened more recently by BOEM for relevant turbine placement factors such as visible impact navigation Coast Guard use other defense use fishery conflicts marine mammal conflicts water depth and cost and has been found to be suitable for offshore wind energy leasing. It offers several clear environmental advantages such as avoiding visible turbine impacts to shore communities. Those benefits should be described in the EIS.	
1012-0021	Further regarding the applicant's interests EDF Renewables has purchased the right to leases in a large area in the western part of Hudson south. So it is likely that EDF Renewables will come away with a substantial turbine effort in Hudson South and its interest can be served. Likewise Shell New Energy could use the its advantage with the current lease area to get involved in the substantial transmission project that will be needed to bring the power from Hudson South to shore. [Bold and Italics: To summarize while in many federal projects requiring an EIS the no action alternative is often summarily dismissed in the Atlantic Shores case it is extremely attractive. State power objectives can still be met through greater reliance on the Hudson South area which has substantial wind energy and has already been screened for environmental and other use factors. Impacts to endangered whales can be reduced by smart turbine placement. Using smaller direct drive turbines in Hudson South can limit buffer zones and reduce impact to the right whale. Visible turbine impact on local shore communities would be avoided. The jobs expected for New Jersey are still the same.]	
1012-0021	[Bold: Alternative B Maximum Use of the Closer-in Ocean Wind & Atlantic Shores Areas] would make greater use of the closer-in lease areas but that would exacerbate the visible turbine impact on shore communities and the operational noise danger to the endangered whales.Atlantic Shores has also said they will seek authorization in the next State solicitations (above 1510 mw) for up 20 mw power turbines that are 1042 feet high or about 200 feet higher than the Vestas-236 so this turbine size (and power) needs to be incorporated into this alternative. This would of course exacerbate the shore visible impact and the operational noise impacts on the whales even further.Since even the maximum wind energy potential in lease areas A-0498 and A-0499 combined	

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	cannot meet the 7500-mw goal this alternative would still require some development in Hudson South further linking the three areas and requiring two transmission projects which is avoided under Alternative A.	
1012-0021	[Bold: Alternative C]. Alternative C is similar to alternative A but it places more reliance on Hudson South. That would allow for a more modest projects of 305 mw to proceed in lease areas A-0498 and A-0999 further away from shore. That would reduce the visible impact and the socio- economic impact to Long Beach Island and other shore communities and avoid the DOD turbine exclusion zone in Lease area A-0499 which goes out to 14 miles. It would require 6890 mw of power from Hudson South which is available in that area (See Table 3).	
1012-0021	[Bold: BOEM Screening Criteria for Alternatives.] In requiring the alternatives above we did look at BOEM's recent screening criteria of June 22 2022 for alternatives for a COP EIS but found the criteria inconsistent with the Biden Administration's recent NEPA rule changes. We also found the screening criteria confusing contradictory not supported by the NEPA and subsequent case law and thus not helpful. For example on page 3 it discusses the purpose and need for a COP EIS but on subsequent pages it shifts focus and discusses the purpose and need for the proposed action. These are two different things and it is the purpose of the [Italics: proposed action] that drives reasonable alternatives. Regarding that purpose we agree that the Department of Interior has a broad mandate under the Outer Continental Shelf Lands Act (OCSLA) to make OCS energy resources now decided to be offshore wind power available for expeditious and orderly development subject to environmental safeguards and to ensure that any activity under that provides for a number of factors including protection of the environment. But we see nothing in the OCSLA - and certainly nothing in the NEPA which stresses the need for alternatives and calls them the "heart' of an EIS - that restricts Interior from considering projects in different wind energy and lease areas in the pursuit of that broad goal. In fact by not considering alternate locations for wind turbines - which is the most important environmental factor - at any point in its NEPA review process defeats the fundamental purpose of that Act as it precludes decision-makers from considering alternative ways to achieve program objectives with less environmental damage. Therefore screening criteria 1 that alternatives must be limited to only one lease area is not valid. Nor is criteria 2 that an alternative must meet the primary goals of the applicant. Regarding that issue the Guidance relies on rule language in the CEQ regulations put in place by the previous Administration that was removed by the current Administration in its final rulemaking of April 202022	BOEM evaluated the alternatives using the screening criteria presented in Appendix C, Section C.1, *Alternatives Screening Criteria*. The first criterion states that an alternative was considered but not analyzed if it is outside the jurisdiction of the lead agency, including resulting in activities that are not allowed under the lease (e.g., requiring locating part or all of the wind energy facility outside of the Lease Area), which is important because the Lease Area was delineated through consultation with the BOEM New Jersey Task Force (comprising federal agencies, state government, and locally elected officials), and public input with the intent of protecting ecologically sensitive areas and minimizing user conflicts while making available appropriate areas for wind development. Furthermore, Ocean Wind's lease pursuant to Section 2: Rights of the Lessee grants, "the exclusive right and privilege, subject to the terms and conditions of this lease and applicable regulations, to: (1) submit to the Lessor for approval a Site Assessment Plan

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	which seems strange and highly inappropriate. Therefore a project EIS should consider a reasonable range of alternatives that meet the agency's broader objective in this case the State goal of 7500 megawatts of offshore wind power which the BOEM has adopted.	(SAP) and Construction and Operations Plan (COP) for the project identified in Addendum 'A' of this lease; and (2) conduct activities in the area identified in Addendum 'A' of this lease ('leased area') that are described in a SAP or COP that has been approved by the Lessor." Accordingly, even if BOEM were to evaluate an alternative outside of the Lease Area, BOEM would not have the ability to approve COP activities for an area not leased to Ocean Wind. In the CEQ Phase 1 Final NEPA Rule's Preamble, CEQ states that when considering the purpose and need for a project sponsored by an outside party, in addition to the applicant's goals, other relevant factors include the agency's mission and policy directives, the specifics of the agency's decision, local needs, desired conditions on the landscape, other environmental outcomes, and the purpose and need of any other federal agencies completing the NEPA process for the same proposed project.
1012-0021	[Bold: 6. Segmentation Omission of Other Project in the Same Lease Area.] Section 1502.4 of the CEQ NEPA rules requires that agencies "shall evaluate a single environmental impact statement proposals or parts of proposals that are related to each other closely enough to be in effect a single course of action". It is inappropriate under the NEPA to segment a coherent proposal into pieces and avoid presenting full impacts. The DEIS should have presented all the projects envisioned for Lease area A-0498. Following the BOEM's own logic in the NOI an EIS should include "effects that occur at the same time and place as the Proposed Action and alternatives and such effects that are later in time or not at the same place".	The Ocean Wind 1 EIS analyzes the offshore wind energy project proposed for Lease Area A-0498. No other projects are proposed for Lease Area OCS-A 0498. Other offshore wind energy projects are analyzed as planned activities that could occur during the life of the Ocean Wind 1 Project and potentially could contribute to cumulative impacts when combined with impacts from the Proposed Action and other alternatives. Appendix F (*Planned Activities Scenario*) describes the

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		methodology used for assessing impacts from ongoing and planned activities in the EIS. Using the methodology described in Appendix F, each resource-specific environmental consequences section in Chapter 3 of the Draft EIS discusses cumulative impacts.
Use of a Project Design Envelope		
1012-0021	[Bold: 2. Need for a Clear Proposal.] According to NEPA rule §1502.4(a) a DEIS should "define the proposal" that is the subject of the EIS. A statement regarding the proposal that the BOEM is considering "up to 200 wind turbine generators" does not provide that definition. In addition since the DEIS does not consider alternative power levels below what the State has approved it would seem that the proposal is actually for the maximum number. If so it should state that rather than misleading the public into thinking that 25 or 50 turbines will actually be selected. The public cannot meaningfully comment on such a vague description. The number and power of turbines proposed needs to be specified as well as their size dimensions drive and foundation type spacing approximate location and capacity factor. These are critical parameters necessary to describe the environmental impact. If the applicant does not know them or wish to share them this EIS cannot logically proceed.	The Proposed Action is to construct, operate, maintain, and decommission an approximately 1,100-MW wind energy facility consisting of up to 98 WTGs, which BOEM analyzes in the EIS. BOEM allows lessees flexibility with their project parameters by allowing the usage of a PDE approach. This approach uses a “maximum design scenario” process that analyzes the aspects of each design parameter that will cause the greatest impact for each physical, biological, and socioeconomic resource. Using a maximum design scenario, BOEM considers the parameters that represent the greatest effect for an individual impact for each environmental resource. See Appendix E, *Project Design Envelope and Maximum-Case Scenario*. If a lessee’s COP is approved or approved with modifications, the lessee must submit a Facility Design Report and a Fabrication and Installation Report for BSEE’s review pursuant to 30 CFR 285.700–702, prior to fabricating and installing those proposed facilities. In situations where a lessee’s Facility Design Report or Fabrication and Installation Report describes a project that deviates substantially from the range of parameters outlined in the PDE of a
1012-0021	[Bold: 4.The use of a Project Design Envelope.] The substitution by the BOEM of a project design envelope (PDE) for what NEPA rules require as a proposed action is contrary to one the purposes of the NEPA EIS i.e. to identify agency options that can meet program objectives with lesser not the most environmental impact. First it should be noted that the BOEM 2018 guidance for the use of PDEs was never finalized. It its draft form it only related to BOEM's review of the COP there was no analysis or justification of its applicability to meeting the NEPA requirements for an EIS.	

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		lessee's approved COP, if necessary, BOEM may require a revision to a lessee's COP and may initiate additional NEPA review and other environmental consultations.
1012-0021	[Bold: 3. Failure to Specify Key Parameters in the Proposal.] Neither the DEIS or the COP state the power manufacturer drive type or foundation type of the turbines to be used. But the New Jersey BPU approval of 1510 mw for Project 1 was based on the use of Vesta-236 13.6 mw turbines and monopile foundations [Footnote BG1: NJ BPU Order IN THE MATTER OF THE BOARD OF PUBLIC UTILITIES OFFSHORE WIND SOLICITATION 2 FOR 1200 TO 2400 MW - ATLANTIC SHORES OFFSHORE WIND PROJECT 1 LLC June 302021 pages 18 and 22.]. We assume that Atlantic Shores will adhere to the conditions of the State's approval so these parameters should be specified in the proposal not buried in an opaque project design envelope approach as discussed below.	Chapter 2 of the EIS states that Ocean Wind has selected the GE Haliade-X 12-MW WTG; however, the environmental review analyzes the PDE as it is presented in the COP, which includes a WTG with a rotor diameter up to 240 meters.
1012-0025	[Bold: 7. Lack of Presentation of Significant Impacts.] The affected environment and environmental consequences sections are dominated by discussion of the affected environment i.e. the thing being impacted as opposed to an actual impact itself. Numbers appear when describing technical equipment to be used but very few quantitative environmental impacts are provided. Graphs and visual portrayal of impacts are missing. When impacts are presented it is very often in the form of qualitative conclusory statements as to the severity or the lack thereof of an impact again the focus on scoring discussed above. Some of these conclusions are not supported at all. Some are purportedly supported by references to other documents but on reading those documents they often are not relevant to the proposal and do not support the conclusion. In many cases mitigating measures or caveats regarding what the actual proposal will include are not pinned down so the actual environmental impact is further obscured.	CEQ NEPA Regulations (40 CFR 1502.15) require that the EIS "succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration, including the reasonably foreseeable environmental trends and planned actions in the area(s)." It is important that the affected environment be adequately described to assess the impacts of the Proposed Action and alternatives. Where possible, BOEM included graphs and visual portrayals of impacts and used quantitative rather than qualitative information.
1012-0025	[Bold: 9. Excessive Referencing.] Throughout these EISs including the Ocean Wind EIS the reader is referred to hundreds of references apparently for further information on impacts or to find support for the conclusions stated. But often these references just repeat the conclusion and/or provide no impact information relevant to the EIS proposal or alternatives. It is not the readers job to secure and sift through hundreds of technical documents and thousands of pages to try to ferret out relevant environmental impacts. [Bold: It is BOEM's job to do that show that it has done the "necessary environmental analysis" and to present the	References are used commonly in NEPA documents to point to content that did not originate with the agency authoring the NEPA document. References are also commonly used to support the information contained in the EIS. Conclusions are generally not found in reference documents; rather, information in the

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	relevant impact itself in the EIS proper.] Its excessive referencing throughout the document is the proof that has not done so. The DEIS presents numerous conclusory statements as to what is minor or moderate with superscript references only without extracting a single salient point from those references into the body of the EIS. There are over 800 such references listed. Many are lengthy reports in themselves or of a specialized nature topically. It is impossible for any one person to review even a fraction of those within a 60-day time period to see if the BOEM's conclusion was justified nor should a reader have to. The document descends into a literature review as opposed to an impact statement and the net effect is to hide rather than illuminate the impacts in question. If the BOEM cannot find and present one salient piece of data or information to extract from a reference worthy of being placed in the DEIS proper then it should not list the reference. To compound the referencing problem the references cited are often not accessible or readily accessible. The location of the references is not provided in the Table of Contents. The list of references is also far removed from the actual discussion. So each time a reader wants to go to a reference he/she must scroll through hundreds of pages to get to it. When you get to a reference it is often not readily accessible. For example the DEIS for the Ocean Wind 1 project the EIS presents no impacts on birds in the body of the EIS. It refers the reader to an Appendix that just says the risk is low and refers the reader to a Biological Assessment prepared for the Fish and Wildlife Service. But searching the web does not produce any such document. This is unconscionable for EIS presentation. As mentioned above where there is important information in these references to understand the impacts the BOEM should extract that material and put it right in the DEIS. Where a document is available electronically it should put the website right next to the reference. Where a document can only be obtained through paid subscription BOEM should pay the bill and make the document readily accessible.	references cited in the EIS support the conclusion. BOEM provided as much information as is possible, under current regulatory guidance, within the main body of the EIS with supporting or additional information provided in the appendices. Appendix B, *List of Preparers and Reviewers, References Cited, and Glossary*, contains the references used throughout the EIS. Additionally, to focus on the impacts of most concern in the main body of the EIS, BOEM included the analysis of resources with minor or lower impacts within Appendix G, *Assessment of Resources with Minor (or Lower) Adverse Impacts*. References include as much information as possible, including web links where available in order to make them accessible to the reader.
1012-0025	[Bold: 10. Use of and Presentation of "modeled" results.] To compound the presentation problem even further the BOEM sites "models" that it uses and presents modeled results. But modeled results are not sacrosanct and like any other scientifically supported result depend on the mathematical equations or assumptions used in the model and the inputs to the model which may be disputed within the scientific community or have great uncertainty. Therefore when the BOEM sites a model it must explain the basic equations and assumptions being used in it the inputs provided to the model the scientific basis for both and the uncertainties involved. Without that there's no basis or justification to include that modeled result. Therefore whenever the EIS relies on	Where models are cited in the Ocean Wind 1 EIS, they are accompanied by a citation that further explains the model.

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	"modeled" impact results it must present the key assumptions made in the model the inputs used their uncertainty and the scientific basis for all that in readily accessible documents.	
1192-0001	It is the responsibility of the applicant and/or lead agency to begin the environmental review as early as possible. Instead, this project has been reviewed and certified before the Environmental Assessment began totally ignoring the most sensitive and natural areas of Barnegat Bay Oyster Creek and Island Beach State Park. Additionally, this DEIS does not explain the full extent of the total wind energy project in the Atlantic Ocean in and around New Jersey. This is the definition of segmentation or should have been in a Generic EIS to alert the public of the agency's plans and allow an open discussion of environmental concerns. The DEIS neglects to describe the electric grid and its electric-shed (like watershed or sewersheds) for each of the on-land sites. The agency should not expect the public to understand the electric grid or how it works; therefore, that should be explained in the DEIS.	Impacts on Barnegat Bay, Oyster Creek, and Island Beach State Park are included in the EIS. Alternative E was developed to minimize impacts on SAV in Barnegat Bay. Other offshore wind projects are considered reasonably foreseeable impacts i.e., planned actions that could occur during the life of the Ocean Wind 1 Project and potentially could contribute to cumulative impacts when combined with impacts from the Proposed Action and other alternatives. Appendix F (*Planned Activities Scenario*) describes the methodology used for assessing impacts from ongoing and planned activities in the EIS. Using the methodology described in Appendix F, each resource-specific environmental consequences section in Chapter 3 of the Draft EIS discusses reasonably foreseeable impacts.
1192-0016	The DEIS should provide copies of the letters of comment from interested agencies not just list their names. A supplemental DEIS is acceptable for those areas that were not fully investigated or where adverse impacts are noted. List of required permits by federal state or municipality and type should be in the DEIS particularly the Executive Summary and not hidden in the Appendix. Appendix is for other documentation that is the basis for the information in the DEIS [Italics: not the Alternative Analysis that was rejected] which belongs in the DEIS.	Full text of comments can be found on www.regulations.gov by searching for Docket No. BOEM-2021-0024. There is no requirement to include these as part of a NEPA document. BOEM provided as much information as is possible, under current regulatory guidance, within the main body of the EIS with supporting or additional information provided in the appendices. To focus on the impacts of most concern in the main body of the EIS, BOEM included the list of permits and consultations within Appendix A, *Required Environmental Permits and*

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		Consultations.
1202-0013	BOEM has violated the letter and spirit of NEPA and the NHPA by refusing to subject its permitting review to public scrutiny. BOEM has violated the NHPA by refusing to make public certain reports that would assist the public in determining impacts to the community. Section 304 of the NHPA allows federal agencies to keep confidential certain types of sensitive information about historic properties such that disclosure would result in a significant invasion of privacy cause damage to the historic property or impede the use of a traditional religious site by practitioners.[Footnote 16: 54 U.S.C. § 307103; 36 C.F.R. § 800.11(c).] Determining which material to keep confidential must be made in coordination with the Secretary of the Department of the Interior through the National Park Service. The policy behind the confidentiality rule is designed to balance the policy of transparency of environmental permitting laws against historic preservation needs where public disclosure could lead to harm. No consulting party has requested confidentiality in this matter. Despite this fact BOEM has apparently made the historic resource reports confidential in their entirety. To our knowledge BOEM has not coordinated its decision with the National Park Service to keep confidential nearly every document concerning historic property visual and cumulative effects assessments as Section 304 requires. Instead BOEM and Ørsted have prevented the public from having access to the identification of historic properties adverse effects visual simulations and the proposed resolution of adverse effects. For example BOEM has done so by removing or not posting on its project websites the following documents: Marine Archaeological Resources Assessment, Terrestrial Archaeological Resources Assessment, Memorandum on the Updated Historic Resources, Visual Effects Analysis Offshore Historic Resources, Visual Effects Analysis Onshore Historic Resources, Visual Effects Analysis Cumulative Historic Visual Effects Analysis, the memorandum on BOEM's Area of Potential Effect Delineation, BOEM's proposed Memorandum of Agreement to resolve adverse effects, and Ørsted's proposed mitigation measures to offset adverse effects. Nor has BOEM made public its consultation meeting transcripts presentations or meeting summaries. Instead BOEM has kept the public from having access to this information and purported to limit what consulting parties can share claiming some unspecified need for confidentiality. As elected officials with an affirmative duty to keep their community informed the County finds these vague requirements particularly troubling. Moreover BOEM has refused to respond to legitimate questions concerning the basis for its nondisclosure thus creating	BOEM has kept certain documents confidential in keeping with Section 304 of the NHPA. The National Park Service is a participating federal agency and an NHPA consulting party. BOEM's Cumulative Historic Resources Visual Effects Analysis was made available to the public with the publication of the Draft EIS. Public summaries of the Marine Archaeological Resources Assessment and Terrestrial Archaeological Resources Assessment have been made available to the public on BOEM's website. A non-technical summary and full version of the Visual Effects on Onshore Historic Properties (also referred to as the Historic Resources Visual Effects Assessment) have also been made available to the public on BOEM's website. Section 3.10, *Cultural Resources*, and Appendix N, *Finding of Adverse Effect for the Ocean Wind 1 Construction and Operations Plan*, of the Final EIS identify historic properties within the APE that would be adversely affected by the Project. The NHPA Section 106 consultation process culminates in a Memorandum of Agreement detailing avoidance, minimization, and mitigation measures to resolve adverse effects on historic properties caused by the Project. The Memorandum of Agreement is provided in Appendix N of the Final EIS.

<table>
<tr><th>Comment No.</th><th>Comment</th><th>Response</th></tr>
<tr><td></td><td>confusion among consulting parties especially local governments who need public input to assist with consultation. Therefore BOEM must make public all documents associated with the Ocean Wind 1 and all other offshore wind consultations with appropriate redactions as necessary in coordination with the National Park Service.

For the reasons discussed above BOEM should revise the DEIS so that it fully identifies historic properties within the Area of Potential Effects and resolve them appropriately for all of these properties. In addition because BOEM has refused to allow the public to review information related to Ocean Wind 1 it must reissue the DEIS and its associated appendices and allow the public a reasonable opportunity to comment.</td><td></td></tr>
<tr><td colspan="3">Speed and adequacy of NEPA Process</td></tr>
<tr><td>1259-0002</td><td>COA respectfully submits that the Draft EIS is incomplete inconsistent and misleading. It fails to present a responsible and reasonable "purpose and need" as required by the National Environmental Policy Act (NEPA) for the proposed project as well as fails to evaluate all reasonable alternatives to the proposed Project as required by law. The Draft EIS makes clear that Ocean Wind 1 is being fast-tracked and the document is written with a clear indication of a positive outcome for the Applicant here.</td><td rowspan="2">The Ocean Wind EIS meets the requirements of NEPA.

The Fixing America’s Surface Transportation Act aims to improve the federal environmental review and authorization process for covered infrastructure projects rather than to fast-track reviews. NEPA regulations at 40 CFR 1501.10 provide time limits for NEPA documents to “ensure that agencies conduct NEPA reviews as efficiently and expeditiously as practicable.”

Additionally, the purpose of the New York Bight Programmatic EIS is to develop programmatic avoidance, minimization, mitigation, and monitoring measures; to provide a document from which to tier New York Bight lease-area-specific analysis; and to allow those documents to focus on the areas that have the greatest potential for impacts. No construction will be approved as part of the ROD that results from this EIS.</td></tr>
<tr><td>1259-0019</td><td>Further the federal fast-tracking initiative "Fast 41" which refers to Title 41 of the Fixing America's Surface Transportation Act (FAST Act) (42 U.S.C. § 4370m et seq.) created a new governance structure set of procedures and funding authorities to advance the federal environmental review and authorization process for covered infrastructure projects. It is important to note that all of the offshore wind projects off the NJ coast are listed in the federal "FAST-41" program and set for advancement. According to the U.S. Department of Transportation's "Permitting Dashboard" "Participation in the FAST-41 program is voluntary and sponsors of projects that qualify under specific statutory criteria apply to obtain program benefits. The program helps ensure a deliberate transparent and predictable Federal environmental review and permitting process for certain large complex infrastructure projects." These federal agreements and initiatives fast-tracking and streamlining large projects are essentially giving the "green light" to private companies to control and the rights to develop a public resource the ocean. In short BOEM is violating its obligation to protect offshore resources under the public trust and limiting due process. Fast-tracked reviews for Ocean Wind 1 are not fair or just and they do not reflect good governance especially in combination with the many expedited government and agency agreements described above. There will be moderate to major</td></tr>
</table>

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	impacts from this OSW project as noted in the Draft EIS. There will also be numerous Incidental Harassment Authorization applications state permits for onshore development U.S. Army Corps of Engineers permit applications state consistency reviews and again now the Programmatic environmental review for the six (6) recently leased areas for offshore wind in the NY/NJ Bight - all being fast-tracked with lengthy complicated materials to simultaneously review. Moving quickly and carelessly could prove devastating to marine life and impact onshore communities. BOEM must provide more time overall to review Draft EIS and Final EIS documents now and in the future.	
1259-0005	The primary purpose of an Environmental Impact Statement ("EIS") is to "provide full and fair discussion of significant environmental impacts and inform decision makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts." [Footnote 5: 40 CFR 1502.1.] The document is also required to specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action. [Footnote 6: Id. at 1502.13.] Here the Draft EIS does not provide a full discussion of the impacts nor a fair portrayal of the impacts of the proposed activities. The DEIS also does not present a sufficient purpose and need for the Proposed Action. As such it is procedurally and substantively flawed.	
1259-0198	In sum the impacts of offshore wind development-and Ocean Wind 1 in particular-should be evaluated fairly and completely to ensure transparency about the scope and magnitude of the impacts to the ocean and coastal ecosystems as well as to prove that this is in fact the safest fastest cheapest alternative to reducing carbon dioxide emissions which is so critically needed to reduce climate change. Despite this offshore wind appears to be getting a greenlight approach from the federal government without due process and scrutiny.	
TRANS-0002-0006	These projects are being fast tracked reviews are being fast tracked and it's not fair or just to the communities and the ocean that will be impacted.	
TRANS-0090-0001	I am not opposed to wind energy I am not denying a climate change issue but what I am opposed to is an aggressive fast tracked wind farm planned 15 miles off the coast that will desecrate the ocean view and destroy tourism in South Jersey beach communities. Orsted is able quite capable of building similar projects similar wind farm farther from coast in fact Hornsea 1 and 2 which are built by Orsted off the coast of England are 55 miles off the coast of England and 75 miles off the coast of England clearly out of ocean view coastal view and clearly not an impact to coastal communities. Why would we not demand that Orsted do the same for us. Why would we allow a Danish corporation to steam	

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	roll over our coastal communities. A leased area for Ocean Wind 1 was determined in 2009. At that time wind turbines were half the size of what is proposed for this project yet the lease area has not been reconfigured further from the coast to account for the changes in visual impact with these massive 900 foot turbines. The fairway lease area planned for 12 miles off the coast of the Hamptons was actually determined by BOEM to be too close. Ocean City New Jersey is the hottest vacation home market in the United States over 70 percent of mortgages are vacation homes. Those vacation homes serves as rentals for millions who have visited Ocean City New Jersey's beaches and rated it the number one beach in New Jersey. In a North Carolina state university study in 2016 which surveyed people who had recently rented houses on the coast of North Carolina 54 percent surveyed told researchers they would not rent a vacation home if offshore wind turbines were in view at all no matter how large a discount they were offered. After listening to these calls I have heard testimony from many again who Orsted is providing economic benefits.	
1259-0195	The Draft EIS makes clear that Ocean Wind 1 is being fast-tracked and the document is written with a clear indication of a positive outcome for the Applicant here.	
1259-0024	Importantly it is unclear how many of the studies used to justify the project have been peer reviewed or were primarily conducted through the Applicant's financial support. Furthermore many of the panels of reviewers for studies relied upon in the Draft EIS's analysis include representatives of BOEM or the Department of the Interior ("DOI"). This dynamic begs serious questions regarding the blurred line between the external peer review process and the agencies' consultative roles in the preparation of these documents. Timely and independent peer review must take place for all studies produced by Ocean Wind 1 BOEM or other federal agencies for the purposes of this OSW project.	The COP and associated appendices are prepared by the Applicant. However, these documents undergo extensive review by BOEM before they are deemed complete and sufficient. BOEM received the first version of the Ocean Wind COP on August 15, 2019, as detailed in Chapter 1 of the EIS. In accordance with 40 CFR 1506.5 BOEM independently evaluated the information submitted by Ocean Wind and is responsible for its accuracy, scope, and contents.
1259-0025	As a more specific example Section 1.2 of the Draft EIS indicates that the National Marine Fisheries Service ("NMFS") has received a request for an Incidental Harassment Authorization ("IHA") to take marine mammals during Ocean Wind 1's construction and operation activities. The Draft EIS explains that if NMFS issues the requested IHA it intends to adopt BOEM's Final EIS to support its decision and fulfill its NEPA requirements. This approach to fulfilling NMFS's obligations for the Ocean Wind 1 IHA process is a prime example of	NMFS is a cooperating agency in the preparation of the Ocean Wind 1 EIS and was involved at all stages of EIS preparation to ensure the EIS meets its needs to use it to fulfill its NEPA requirements. This is a common practice in NEPA documents. Information from the

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	how the federal government has stacked the deck for offshore wind developers at the expense of the public and the environment. It does not make sense for NMFS to close its public comment period for the IHA before the full scope of Ocean Wind 1's impacts on marine mammals can be fully vetted during the DEIS process.	Incidental Harassment Authorization documentation has been incorporated into the EIS.
1275-0005	Each comment I start to write many more questions come to mind and I wish there was another public hearing to gather more information. But all that requires time. I wish I had time to further digest the 4000 pages of documentation contained in the EIS produced by BOEM and their countless consultants and experts. I am a little confused about the EIS. Is this the EIS for Ocean 1 alone or will this be used for all the other planned projects since you look at cumulative impacts in the report?	The EIS is for the Ocean Wind 1 Project but considers impacts from all other planned projects consistent with CEQ NEPA regulations.
1281-0008	[Bold: THE DEIS CONTAINS INSUFICIENT DATA AND DISCLOSURE OF ALL FUNDING SOURCES OF THE APPLICANT AND ANY GROUPS ASSOCIATED WITH THE APPLICANT WHO PROVIDED TESTIMONY.] Any realistic estimate of the cost benefit analysis of the project and it's funding cumulative and indirect impacts should include the full disclosure of the project as well as funding of all groups associated with the applicant who provided testimony. Transparency and full disclosure of all funding of the applicant is also necessary for any realistic weighing process of alternative actions including a "no action alternative" to remain in place pending the implementation of a useful peer-reviewed pilot project. Similarly BOEM 's realistic credibility assessment as to the weight and value of the applicant's presentation requires such complex financial data and background. To render a determination as to the DEIS without such complete financial data and the full disclosure of all funding sources would be arbitrary and capricious. Based on all of the aforesaid procedural as well substantive arguments presented I would ask that BOEM rejects without prejudice the current Draft Environmental Impact Statement to implement a "no action alternative". Included in such a result would be an invitation to develop and to create a valuable pilot windfarm project from which to study cumulative and indirect impacts with independent comprehensive and peer reviewed research and findings to be generated. The State of New Jersey its citizens the magnificent precious and valuable New Jersey Coast and its environmentally rich section of the vast Atlantic Ocean are rapidly becoming collateral damage to a juggernaut of inadequately researched "feel good" experimentation and generational potentially irreversibly devastating impacts. As noted above I would object from a procedural standpoint to the within process and the Draft Environmental Impact Statement itself as violative of BOEM's own Rules	NEPA regulations do not require a cost-benefit analysis. Rather, if an agency conducts this analysis, it must do so in a fair and balanced way. Section 3.11, *Demographics, Employment, and Economics*, of Appendix G, *Assessment of Resources with Minor (or Lower) Adverse Impacts*, discusses potential impacts on demographics, employment, and economics.

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	Regulations and Mission Statement and NEPA. From a substantive standpoint as well I would ask BOEM to reject the proposal in favor of a "no action alternative" which should be supplemented with a truly scientific pilot project and an accompanying cost benefit analysis as required by NEPA and otherwise. Such a review demands a complete assessment of the risks as applied to the vast economic value of our fisheries commercial and recreational fishing industries the recreation and tourism industry as well as the precious ocean environment itself.	
TRANS-0002-0004	There is a need for transparency and fairness. Where is the best place to get all the information about ocean wind and all the research that's happening about -- focusing on ocean wind and offshore wind? Is it BOEM is it with the DEP? Is it with other agencies? The developer itself? It's very confusing to find all the information all in one place especially when having to compare cumulative impacts to the ocean region and the marine resources.	Information regarding the Ocean Wind 1 Project can be found on BOEM's website.
TRANS-0090-0001	Thank you this will be the third call I have been on and surprisingly only very few Ocean City residents or any residents from these coastal communities have spoken and that is because the public is unaware. Through these calls we have heard all sorts of testimony from Orsted's partners in the project those that are going to benefit economically. We have heard from lobbyists and we have heard from Union members and all those that are getting some sort of economic benefit but we have not heard from Ocean City residents we have not heard from the homeowners of Ocean City residents and that is because around 70 percent of the homeowners in Ocean City New Jersey are absentee homeowners and they are not aware. So during my five minutes here I would like to just address two concerns one is that the lack of public notice to absentee homeowners and the industrialization of the ocean view an impact to South Jersey tourism. In a prior call I had asked how BOEM had notified residents of the public comment period and of Ocean Wind 1 project in general and the response was social media post on BOEM's social media channels which I don't know why any lay person would just randomly go to BOEM's social media channels. Press release issued by BOEM again if it's not picked up by a major media outlet again it's not going to reach anybody. Notices in the Star Ledger which is a Newark published distributed paper which is North Jersey not South Jersey. Asbury Park Press again a paper in North Jersey. It's become evident to me that any real means to notify absentee homeowners in the South Jersey communities such as Ocean City have been avoided. I have gotten letters in the mail to notify me in Ocean City if a house is being torn down for new construction yet not an email not a letter nothing about this project so	Appendix A, *Required Environmental Permits and Consultations*, provides an overview of the development of the Draft EIS, including public scoping, cooperating agency involvement, and distribution of the Draft EIS for public review and comment.

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	unfortunately the absentee homeowners in Ocean City New Jersey do not know what is going on. Additionally since becoming aware a few weeks ago I have approached many neighbors and they also too have had no knowledge of the project. Most people as I said speaking on the call are with organizations who are economically benefitting from Orsted many declare they live in a New Jersey coastal community yet many are living in North Jersey areas where their Coastal communities will not lose their coastal view or be impacted directly.	
0984-0111	The Project includes three offshore alternating current substations with array cables that can be contained within the leased areas by BOEM. During BOEM public outreach the cable routes and the substations locations are not disclosed for "security reasons". The fact that the intent was to increase the footprint of development was to be outside of the lease areas was not disclosed but should have been. This failure of disclosure should require BOEM to restart the public process of the impact of this and other lease areas. At a minimum require all cables and substations to be contained in the lease area or neighboring leased areas.	Figure 1-1 of the Draft EIS depicts the OSS locations and indicative array cable layout. BOEM's regulations (30 CFR 585.200(b)) provide the lessee the right to one or more Project easements for the purpose of installing gathering, transmission, and distribution cables on the OCS as necessary.
1012-0015	Therefore the BOEM has decided upon the turbine location the number of turbines and their power output without any NEPA review or public input contrary to the basic purpose and requirements of the NEPA and its implementing regulations. Now at the end of that decision process when all those keys decisions have been made by unelected persons it presents to the public only the applicant's proposal with some minor variations as "alternatives" that have virtually no benefit to the general public or any noteworthy environmental benefits. It then goes further to insult the intelligence of the general public by avoiding key issues such as the impact of operational turbine noise on endangered whales and turbine decommissioning creating an environmental scoring system that promotes insignificant impacts and downplays significant ones and presents material through the EIS lengthy Appendices and hundreds of references in a manner that makes it virtually impossible for a single person to read and understand. It never presents any criteria short of non-compliance with another law that would cause the BOEM to disapprove a project. So under that promotional scheme even the no action alternative is not despite BOEM's statements a real option. Therefore the BOEM has pursued a NEPA process culminating with this EIS that never provides reasonable alternatives for the public to weigh in on and an EIS without reasonable alternatives is not an EIS. Apparently not wishing to discuss this the DEIS presents a table titled the History of BOEM Planning and Leasing for Shore New Jersey that begins in 2011. But it conveniently leaves out the history before that when the most important decision for this project was made	BOEM's renewable energy program occurs in four distinct phases: (1) planning and analysis, (2) lease issuance, (3) site assessment, and (4) construction and operations with defined decision points that require a NEPA review. BOEM used public input received through scoping and coordination with cooperating agencies to develop a reasonable range of alternatives for consideration in the EIS, as described in EIS Chapter 2.

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	i.e. the selection of the wind energy area. Since the BOEM has dismissed any consideration of alternate areas the public deserves to know what that selection process was how it was determined that this particular area is suitable for wind turbines and who made that decision.	
1086-0003	In addition BOEM should have conducted a more thorough NEPA analysis of the potential lease areas prior to leasing the Wind Energy Area for Ocean Wind 1. Grouping the coasts of New Jersey Maryland Delaware and Virginia into one site assessment is too large of a study area and did not provide the public with the needed depth of information prior to the lease sale that would have come from a Programmatic EIS. Once the lease sites were determined BOEM proceeded to develop a Draft EIS for only the Ocean Wind 1 project. Instead BOEM should have conducted a PEIS for Ocean Wind 1 and its surrounding projects as it has done for other lease areas in the New York Bight area. Had BOEM been more thorough prior to determining Wind Energy Area's in the Atlantic it would have allowed many of the issues raised in the County's comments to be addressed and perhaps resolved.	BOEM's renewable energy program occurs in four distinct phases: (1) planning and analysis, (2) lease issuance, (3) site assessment, and (4) construction and operations with defined decision points that require a NEPA review. In *Fisheries Survival Fund, et al. v. Sally Jewell, et al.*, the D.C. Circuit Court of Appeals affirmed that BOEM does not need to produce an EIS under NEPA when granting an offshore wind farm lease. Additionally, the purpose of the New York Bight Programmatic EIS is to develop programmatic avoidance, minimization, mitigation, and monitoring measures; to provide a NEPA document from which to tier New York Bight lease area site-specific NEPA analysis; and to allow those site-specific NEPA documents to focus on the areas that have the greatest potential for impacts. As with the Ocean Wind 1 Project, once COPs for New York Bight lease areas are provided to BOEM, BOEM will prepare site-specific NEPA documents. BOEM’s regulations require BOEM to review Ocean Wind’s submitted COP and prepare an appropriate NEPA analysis. BOEM evaluates considerations such as the number of lease sales expected in each area, as well as where BOEM is in the overall leasing process, for determining whether a programmatic EIS

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		is appropriate for a regional area.
1241-0002	C. [Bold: The DEIS must adhere to current policy frameworks] BOEM and the U.S. Department of the Interior appear to be applying conflicting environmental regulations and policies to their OSW project reviews including NEPA and interagency agreements. Some of these contradictions are summarized in RODA's Ocean Wind scoping comments and others including those submitted on another recent Atlantic Ørsted project (South Fork). The public cannot be prepared to offer comment—and BOEM cannot release a DEIS for such comment—when there is no certainty as to what laws and policies will apply to the agency's review. The fishing industry and other sectors are persistently confused by BOEM's process how to engage and the potential benefits of engagement. Again we call on BOEM to provide this transparency and a balanced and coherent planning process.	The commenter's reference to their comments on the South Fork EIS were responded to in the South Fork Final EIS. That being said, BOEM believes there is no uncertainty as to what laws and policies apply to the review of the Ocean Wind 1 Project.
0984-0031	In consideration of the Draft Ocean Wind 1 Environmental Impact Statement I respectfully submit that the EIS does [Bold: not] meet the environmental safeguards (43 USC $ 1332(3)) and does [Bold: not] take into consideration natural resources and existing ocean uses to the extent necessary to receive approval. Bureau Of Energy Management (BOEM) actions does [Bold: not] further United States Policy to make the Outer Continental Shelf energy resources available for development in an expeditious and orderly manner.	Environmental safeguards (43 USC 1332(3)), including consideration of natural resources and existing ocean uses, are examined throughout the Ocean Wind 1 EIS. Based on previous environmental reviews, subject-matter expert input, consultation efforts, and public involvement to date, BOEM identified the resources addressed in Chapter 3 as potentially affected by the Project. Each resource is examined in detail in the Ocean Wind 1 EIS. BOEM has focused the main body of the EIS on the impacts for resources of most concern and moved the analysis of other resources, including all resources consisting of only negligible to minor Proposed Action impacts, to Appendix H.

O.6.25 Accidental Releases

Table O.6.25-1 Responses to Comments on Accidental Releases

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1086-0011	According to the Construction and Operations Plan (COP) provided by Orsted in total across the 98 turbines and 3 offshore substations as part of just Ocean Wind 1 there will be a total of 741241 gallons of highly toxic and hazardous fluids contained within the offshore structures that are subject to accidents similar to offshore drilling platforms. Each individual turbine consists of as much as 3359 gallons of diesel fuels oils dielectric fluids sulfur hexafluoride (SF6) and coolants. In addition each of the 3 offshore substations includes a total of 137353 gallons of similar fluids. While the safety mechanisms account for the containment of accidental leaks they do not account for total failure which could result from high winds from tropical storms hurricanes and nor'easters or collision with a large vessel. Furthermore as 25 or more offshore windfarms come online many of which are larger than Ocean Wind 1 a simple data extrapolation shows that the total exposure of hazardous substances stored offshore within structures will grow to 18.5 million gallons or more. Summaries of potential volumes are shown below which have been taken directly from Orsted's Ocean Wind 1 COP. [Bold: Ocean Wind 1 Total Estimated Volumes Oils Fuels and Lubricants]Per Turbine Volumes: 3359 gallons Total Number of Turbines: 98[Bold Italics: 3359 x 98 = [Underline: 329 182 gallons]] Per Substation Volumes: 137353 gallons Total Number of Offshore Substations: 3 [Bold Italics: 137353 x 3 = [Underline: 412059 gallons]] All Atlantic Wind Farms Total Estimated Volumes Oils Fuels and Lubricants Per Turbine Volumes: 3359 gallons Estimated Number of Atlantic Turbines: 5500[Bold Italics: 5500 x 3359 = [Underline: 18474500 gallons]] Among the primary reasons for opposition to offshore oil drilling in the Mid-Atlantic are widespread concerns about oil spills and impacts to marine species. [Footnote 25: Grassroots Opposition to Offshore Drilling and Exploration in the Atlantic Ocean and off Florida's Gulf Coast [Embedded Hyperlink Text (https://usa.oceana.org/climate-and-energy-grassroots-opposition-offshore-drilling-and-exploration-atlantic-ocean-and-3/)] Citing the concerns about environmental impacts raised previously in the County's comments in addition to the enormous volumes of hazardous fluids contained within each WTG it is puzzling that Ocean Wind project is viewed any differently than offshore oil and gas drilling. [See original comment for Table 8.1-1. Summary of maximum potential volumes oils fuels and lubricants per WTG.] [See original comment for Table 8.1-2. Summary of maximum volumes oils fuels and lubricants per offshore substation.] Source: Ocean Wind 1 Construction and Operations Plan Page 165It is even more concerning to the County is that BOEM and Orsted have	Estimates of oil, diesel fuel, coolants, and lubricants contained in WTGs and OSS are presented in EIS Appendix F, Table F2-3 for the proposed Ocean Wind 1 Project and other ongoing and planned offshore wind projects. An analysis of the potential for total failure of the facility is discussed under the accidental releases IPF in EIS Section 3.21. As noted by the commenter, Ocean Wind's Oil Spill Response Plan is redacted because it contains trade secrets and commercial or financial information that is privileged and confidential, and that is exempt from public disclosure under the Federal Freedom of Information Act and the New Jersey Open Records Act.

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	redacted the entire Emergency Response Plan including the Oil Spill Response Plan (Appendix A of the COP) citing it as confidential. As an American energy project Americans specifically citizens directly impacted by the project and citizen workers helping to construct the project should have full access to information that directly affects their health and safety as well as the health and safety of their surrounding ecosystem.	
1259-0051	The Draft EIS provides the following details concerning sea bed anchoring disturbance and scour protection: • Estimated foundation number is 101 including Offshore Survival Systems (OSS) with a foot print of 4 acres. • WTG seabed disturbance is 84 acres. • Offshore export cable disturbance is 1935 acres the highest among current leases in the NY/NJ area. • The disturbances to sea bed (including scour protection) from 101 WTG foundations (scour protection incl) construction/anchoring operation and hard protection offshore export cables and interarray is estimated to be 4 285 acres. • More than 400000 gallons (426671) of oils and lubricants will be used in WTGs and OSS. • About a quarter million (236216) gallons of total diesel fuel will be used. All of these carry considerable risks and these have not been discussed more thoroughly in the Draft EIS. [Footnote 36: Jared Anderson You Can't Have Offshore Wind Power Without Oil Forbes (Mar. 1 2017) https://www.forbes.com/sites/jaredanderson/2017/03/01/you-cant-have-offshore-wind-power-without- petroleum/?sh=1d7507494f2f.] And yet the Draft EIS lacks information on the composition and toxicity of these lubricants. In particular worst case discharges ("WCDs") from electric service platforms have not been addressed but these may have adverse shoreline impacts and impacts on wildlife.	The estimated 101 foundations include foundations for up to 98 WTGs and 3 OSS. See EIS Section 3.6, *Benthic Resources*, for analysis of impacts of seabed disturbance and Section 3.21, *Water Quality*, for analysis of potential impacts associated with accidental release of fuel, oil, lubricants, and coolants contained in WTGs and OSS. BOEM assessed the toxicity of chemicals used at offshore wind facilities and conducted modeling to determine the likelihood and effects of a chemical spill at offshore wind facilities in a 2013 study (Bejarano et al. 2013), which is referenced in EIS Section 3.21.
1259-0052	Potential impacts include mortality from heat loss starvation or drowning. [Footnote 37: See Tim Gunter Potential Impacts from a Worst Case Discharge from an United States Offshore Wind Farm 2014 Oil Spill Conference 299032 (2014) https://tethys.pnnl.gov/sites/default/files/publications/Gunter%202014.pdf.] Weather events such as hurricanes need to be an important criterion for planning for WCD scenarios for an oil spill from an offshore wind farm with adverse events like Hurricane Katrina in 2005 serving as cautionary tales. In fact with respect to the possibility of a similar event occurring in the context of offshore wind development "A hurricane or powerful northeaster has the potential for causing structural failure and environmental damage if the ESP was blown off its moorings and either sank or grounded in a sensitive	EIS Section 2.2, *Non-Routine Activities and Events*, identifies severe weather and storm events as potential non-routine activities and events that could occur during construction and installation, O&M, or decommissioning of the proposed Project. See EIS Section 3.21, *Water Quality*, for analysis of potential impacts associated with accidental

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	area. While this may seem like an extreme case during Hurricane Katrina in 2005 a mobile offshore drilling unit the Ocean Warwick broke from its moorings drifted 66 miles before running aground near Dauphin Island AL. While the probability of a hurricane impacting the Northeast is less likely than in the Gulf of Mexico Superstorm Sandy similarly caused significant damage across New Jersey and New York in 2012." [Footnote 38: Id.]	release of fuel, oil, lubricants, and coolants contained in WTGs and OSS.
1259-0054	Accidental Releases The Draft EIS states that non-routine events such as accidental oil or chemical spills can have adverse or lethal effects on marine life. Applicant-proposed measures ("APMs") such as a spill prevention and a response plan would be developed and implemented during all phases of Ocean Wind 1. However this is inadequate for the following reasons: • Unlike the Gulf Coast the Eastern Seaboard does not have the support vessel supply that can be relied upon during such events. • Regulatory requirements for offshore wind have not been developed and prescribed by the regulatory authority BOEM and this is an inherent challenge to developing appropriate response strategies for offshore wind farms. The closest comparative would be Offshore Facility plans that stipulate the amount of boom skimming capacity and storage capacity required in a 6-hour 12-hour and 24-hour timeline for offshore facilities with similar WCD scenarios. [Footnote 41: Offshore Wind Marine Spill Response Corporation (last accessed Aug. 22 2022) https://www.msrc.org/industries/offshore-wind.] • Ocean Wind 1 will impact nearshore and offshore habitats but the Draft EIS does not detail the magnitude of these impacts the species at risk and recovery of habitats. Similarly the document does not specify which state Federal and local regulations are applicable and will be adhered to. • The COP Volume III for the proposed project does not provide any details on the OSRO instead stating that "Ocean Wind LLC has marked each Appendix in this COP which contains privileged and confidential material with the legend 'Contains Confidential Information' and requests that BOEM (and each federal and state agency to which a copy of this COP is provided) withhold these designated materials from public disclosure." On the contrary Atlantic Shores has a draft Oil Spill Response plan that covers the offshore wind energy generation project within the southern portion of Lease Area OCS-A 0499 (the Lease Area). BOEM should impose the same requirement here for Ocean Wind 1 and adjust the Draft EIS's analysis concerning impacts to finfish and invertebrates as appropriate.	See discussion under the accidental release IPF in EIS Section 3.21, *Water Quality*, and Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*, for analysis of potential impacts associated with accidental release of fuel, oil, lubricants, and coolants contained in WTGs and OSS. As noted by the commenter, Ocean Wind’s Oil Spill Response Plan is redacted because it contains trade secrets and commercial or financial information that is privileged and confidential, and that is exempt from public disclosure under the Federal Freedom of Information Act and the New Jersey Open Records Act.

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1259-0072	The Draft EIS states: [A]ccidental releases of fuel fluids hazardous materials trash and debris may increase as a result of the Proposed Action. [...] Ocean Wind would establish and implement a Spill Prevention Control and Countermeasures Plan which would include an Oil Spill Response Plan and Spill Prevention Control and Countermeasures Plan specific to vessels as part of the APMs (Appendix H Table H-1 GEN-11). [Footnote 60: DEIS at 3.15-55.] The Draft EIS goes on to state "All offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of accidental spills administered by USCG and BSEE. Oil Spill Response Plans (OSRO) are required for each project and would provide for rapid spill response cleanup and other measures that would help to minimize potential impacts on affected resources from spills." However the Draft EIS does not provide a detailed draft OSRO for accidental spills which has been submitted for the Atlantic Shores South project. Does BOEM have any specific guidance/regulatory requirement for an OSRO for offshore wind farms? Likewise does BOEM require a regional OSRO as the proposed project will be concurrently developed with the other lessees? An equally important concern that could cause potential harm to marine mammals are the intakes and discharges related to cooling offshore wind conversion stations for Ocean Wind 1 alongside the intakes and discharges from other offshore wind projects. [Footnote 61: DEIS at 3.15-28.] This has not been given enough attention considering that the lifetime of the Project is 25-30 years. The Draft EIS acknowledges that potential effects are likely and include: altered micro-climates of warm water surrounding outfalls altered hydrodynamics around intakes/discharges prey entrainment and association with intakes if prey are aggregated on intake screens from which marine mammals scavenge. However it concludes that these long-term impacts would be localized and low in intensity as the number of offshore substations is small. What were the references used to determine this conclusion? One of the most recent reports by BOEM (BOEM 2022) on offshore wind substations specifically HVDCs states that innovations in cooling systems are being studied and developed [Footnote 62: See Bur. Ocean Energy Mgmt. Supporting National Environmental Policy Act Documentation for Offshore] but so far no new systems are tested and available for use on a commercial scale. Are there similar studies that the Draft EIS used to make this assessment?	As noted by the commenter, Ocean Wind's Oil Spill Response Plan is redacted because it contains trade secrets and commercial or financial information that is privileged and confidential, and that is exempt from public disclosure under the Federal Freedom of Information Act and the New Jersey Open Records Act. Lessees will independently develop an Oil Spill Response Plan to support the COP for each planned offshore wind project. The conclusion of localized low-intensity impacts for intakes and discharges is based on the fact that offshore wind projects typically have one to a few OSS associated with each individual offshore wind project. In addition, there are only a few projects proposed along the coast with OSS that have intake and discharges of seawater and these are geographically distributed.
1259-0097	On a separate note the Draft EIS states "All offshore wind projects would be required to comply with regulatory requirements related to the prevention and control of accidental spills administered by USCG and BSEE. Oil Spill Response Plans (OSRP) are required for each project and would provide for rapid spill response cleanup and other measures that would help to minimize potential impacts on affected resources from spills." This	Ocean Wind's Oil Spill Response Plan is redacted from the public posting of the Ocean Wind 1 COP because it contains trade secrets and commercial or financial information

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	disclosure however begs an important question that is left unanswered by the Draft EIS: Does BOEM have any specific guidance/regulatory requirement for an OSRP for offshore wind farms? Similarly will BOEM require a regional OSRP since the proposed project will be concurrently developed with the other lessees? The Draft EIS does not provide a draft OSRP for accidental spills and this is a paramount consideration with respect to the environmental impacts of Ocean Wind 1.	that is privileged and confidential, and that is exempt from public disclosure under the Federal Freedom of Information Act and the New Jersey Open Records Act. Lessees will independently develop an Oil Spill Response Plan to support the COP for each planned offshore wind project.
1278-0020	Each WTG will have 187 gallons of grease 40 gallons hydraulic oil 106 gallons gear oil 1585 gallons of dielectric fluid 793 gallons of diesel fuel 243 lbs of sulfur hexafloride 357 gallons of propylene glycol and 48 gallons of ethylene glycol that has to be physically transferred to the new WTG. The substations will have 79252 gallons of transformer oil 52834 gallons diesel fuel 4950 lbs sulfur hexafluoride and 317 gallons of hydraulic oil. It is highly unlikely that all those chemicals and fuels will be transferred to the WTG or substations without incident. Could a Category 4 or 5 hurricane knock out a WTG or substation and cause a major pollution disaster? And Atlantic City is the likely victim of that disaster.	See discussion under the accidental release IPF in EIS Section 3.21, *Water Quality*, for analysis of potential impacts associated with accidental release of fuel, oil, lubricants, and coolants contained in WTGs and OSS.

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O.6.26 Other Comments

Table O.6.26-1 Responses to Other Public Comments

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0019-0001	Will lacey township receive similar compensation as east hampton in new york did. please see link East Hampton Town reaches payment agreement with South Fork Wind Farm developers | Wind Energy News (wind-watch.org) the South Fork Wind Farm formerly called the Deepwater Wind project will pay the town to be allowed access for the installation and maintenance of power export cable from up 15 offshore wind turbines that will run four miles under town roads and trustee-owned land to a Long Island Power Authority substation the town said in a statement on Thursday. The 138-kiolvolt electricity transmission line will come onshore at Beach Lane in Wainscott 30 feet below the beach and parking lot and run to the substation on Cove Hollow Road in East Hampton. The cable landing in Wainscott has been strongly opposed by a group now looking to incorporate Wainscott as a village. A separate easement agreement which looks to impose construction conditions to protect the environment and restore the road after the cable is install is still being negotiated." Offshore wind energy represents an important component that will help the Town of East Hampton achieve its 100-percent renewable energy goal" said East Hampton Town Supervisor Peter Van Scoyoc. "The importance of this is only underscored when daily we see more and more devastating impacts of carbon pollution and climate change." Under the Host Community Agreement Deepwater Wind South Fork LLC whose parent companies are Ørsted and Eversource Energy will pay the town $870000 each year for 25 years including a 2% increase after the first year. The total comes to $28.9 million including a $100000 in geotechnical access and license fees already paid to the town. The payment is nearly quadruple the amount the developer first offered the town - $8 million - when discussions began when East Hampton Town Supervisor Peter Van Scoyoc took office in early 2018. The potential maximum output also increased from 90 to 132 megawatts. The developer also will have to pay town property taxes on its onshore infrastructure which is estimated to bring in an additional $4 million over the life of the project.	Ocean Wind will be coordinating with Lacey Township with regard to required building and zoning permits and approvals. Ocean Wind has not included an APM to provide monetary compensation to Lacey Township in the Ocean Wind 1 COP.
0020-0001	when the oyster creek nuclear plant was create in lacey township the town received ERT from the state of Nj yearly on amount of $11 million. with the wind farms will Lacey receive similar ERTs? appreciate any insight you can provide.	Ocean Wind will be coordinating with Lacey Township with regard to required building and zoning permits and approvals. Ocean Wind has not included an APM to provide monetary

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		compensation to Lacey Township in the Ocean Wind 1 COP.
1259-0010	The Draft EIS also fails to discuss the true magnitude and extent of the proposed OSW facility's environmental impacts throughout the project's life-cycle from pre-construction through decommissioning.	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The conceptual decommissioning plan, as proposed by Ocean Wind, is analyzed in the Final EIS. Prior to implementation of any activities associated with decommissioning, BOEM would require Ocean Wind to submit a decommissioning application for technical and environmental review.
1259-0098	On a related note the Draft EIS states "Ocean Wind proposes to use an onshore O&M facility in Atlantic City New Jersey. Construction of the O&M facility would be separately reviewed and authorized by USACE and local authorities as needed." However the nexus between Ocean Wind 1 and this proposed O&M facility would appear to suggest that construction of the latter is a connected action and therefore must be considered as part of this Draft EIS. On what basis is the O&M facility construction not being submitted with this Draft EIS? The Draft EIS presumptively concludes that the overall impacts on water quality from the Proposed Action would be short term and minor during construction and to a lesser degree during decommissioning. During operations the number of vessels in use would decrease even more resulting in fewer impacts. How are these conclusions drawn?	Section 2.1.2.3 of the Final EIS explains that the rehabilitation of a retired marine terminal facility into an O&M facility is being separately reviewed and authorized by USACE and is not dependent on the Proposed Action. Section 3.21 of the Final EIS describes potential impacts on water quality from the Proposed Action and provides the reasoning behind the determination per IPF. Section 3.16 of the Final EIS describes navigation and vessel traffic and explains that vessel activity would decrease from construction and operation activities as, during operation, vessel activity would consist of scheduled inspection and maintenance activities, with corrective maintenance as needed.
1259-0185	Neodymium and Other Rare Earth Elements. Perhaps the most glaring omission in the Draft EIS is the document's total failure to acknowledge the neodymium and other rare Earth elements ("REEs")-such as praseodymium and	Activities such as mining of critical minerals are not within the scope of analysis or BOEM’s authority. Analysis of

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	dysprosium-that Ocean Wind 1 will require or the impact that procuring this neodymium will have on the environment. Neodymium praseodymium and dysprosium are REEs required for offshore wind energy development among other industrial activities. [Footnote 182: See Jishuo Li et al. Critical Rare-Earth Elements Mismatch Global Wind Power Ambitions 3 OneEarth 116 116-25 (2020) https://www.cell.com/one-earth/pdf/S2590-3322(20)30298-0.pdf;Timer Fishman & T.E. Graedel Impact of the establishment of US offshore wind power on neodymium flows 2 Nature Sustainability 332-38 (2019) https://www.nature.com/articles/s41893-019-0252-z.] In fact the expansion of offshore wind energy development in the United States by 2050 is predicted to require 17000 tons of neodymium alone-roughly equal to the amount required for 20 million hybrid and electric cars. [Footnote 183: Id.; see Maddie Stone Offshore Wind Has a Looming Rare Earth Metals Problem Gizmodo (Apr. 5 2019) https://gizmodo.com/offshore-wind-has-a-looming-rare-earth-metals-problem-1833788750.] This eye-popping number is particularly concerning because like most rare earth minerals neodymium is mined in China. Consequently the procurement of neodymium not only frequently involves large fluctuations in price but also serious environmental and labor hazards as well. [Footnote 184: Stone infra n.181.] Nevertheless the Draft EIS does not acknowledge that neodymium praseodymium and dysprosium will be required to construct and operate the offshore wind turbines associated with Ocean Wind 1 nor how much of it will be required for the project or what the environmental impacts of procuring these REEs will be. The underlying analysis must capture not only the impacts that the REE mining process will have on the environment in and of itself but also the environmental repercussions of transporting the REEs from their site of extraction to the Northeast U.S. for use in Ocean Wind 1. In sum BOEM cannot rely upon an EIS that does not address REE-related impacts to justify its authorization of this OSW project.	impacts from mining activities in the United States would be conducted by the agency with applicable permitting authority for those activities. NEPA applies to major federal actions (in other words, activities undertaken or permitted by the United States government). Mining activities in other countries would not be subject to NEPA and any analysis of impacts from those activities would be covered by any laws or requirements those countries have.
1259-0186	Decommissioning. While Ocean Wind 1 will eventually need to submit a decommissioning plan for BOEM's approval at the end of the lease for Lease Area OCS-A 0498 "conceptual decommissioning" of Ocean Wind 1 falls within the purview of both the Draft EIS and the Final EIS. In this regard however the Draft EIS is severely lacking. To start the Draft EIS provides no meaningful analysis regarding what will happen to the reef ecosystems that are expected to form around turbine foundations upon the project's decommissioning. In fact the analysis reads in full: "Ocean Wind proposes to leave scour protection placed around the base of the monopile if used in place; however BOEM would most likely require that the scour protection be removed in accordance with 30 CFR	The Final EIS assesses impacts that could result from construction, O&M, and conceptual decommissioning of the proposed Project using reliable existing data and resources in accordance with 40 CFR 1502.23. Section 2.1.2.4 of the Final EIS describes decommissioning activities and that, per BOEM regulations, Ocean Wind would be required to remove all cables and clear

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	585.902(a)." [Footnote 185: DEIS at Exec. Summ. 2-16.] Even at the conceptual level clearer commitments regarding the fate of scouring around Ocean Wind 1 turbine foundations must be made in order for the public to understand the reasonably foreseeable long-term consequences of this project on local marine ecosystems. Uncertainty likewise abounds with respect to the long-term environmental repercussions of cables associated with Ocean Wind 1 both offshore and onshore. While the Draft EIS indicates that onshore overhead cables will be removed or used for other projects at the end of Ocean Wind 1's life-cycle [Footnote 186: Id. at Exec. Summ. 2-16.] the document seems to suggest that all underground cables-both onshore and offshore-will be left in place after the project's eventual decommissioning. Despite this however the Draft EIS never discusses the expected effects of abandoning these significant heat- and EMF-producing pieces of infrastructure in situ. Again even at the mere conceptual stage this is information that is vital to the public's understanding of the overall environmental impacts from Ocean Wind 1 including its decommissioning.	the seafloor of all obstructions created by the proposed Project. Ocean Wind would need to obtain separate and subsequent approval from BOEM to retire in place any portion of the proposed Project. Approval of such activities would require compliance under NEPA and other federal statutes and implementing regulations. The conceptual decommissioning plan, as proposed by Ocean Wind, is analyzed in the Final EIS. Prior to implementation of any activities associated with decommissioning, BOEM would require Ocean Wind to submit a decommissioning application for technical and environmental review.
1241-0002	5. [Italics: Further clarification for project decommissioning is needed.] We are encouraged that a bond is to be held by the U.S. government to cover the costs of decommissioning. BOEM should disclose the bond amount to the public along with the estimated costs of decommissioning to allow the public to consider the sufficiency of the bond and ease or raise any concerns over responsibility for uncovered expenses. Additional information on how the turbines will be disposed of after decommissioning should be provided and analyzed in future documents including the EIS. It also should be made clear to the public that decommissioning does not mean the wind energy area will be restored to its prior condition. It is possible that large amounts of materials required for OSW projects could remain in the ocean e.g. scour protection materials and cables. This would represent the permanent conversion of soft sediment areas to those with hard structure especially for the Ocean Wind area which is dominated by soft bottom (page 3.6-15). The DEIS qualitatively concludes this conversion is a benefit as this is believed to generally create habitat however insufficient discussion of the impacts on species naturally occurring in the Ocean Wind area is provided. It is unclear whether this newly created harder habitat will give other species a competitive advantage over species that prefer or require soft bottom for their life cycle. The primary concern regarding cables remaining in the water is the dynamic nature of the seabed - scour protection is required because sediment moves and therefore cables can	See response to comment 1259-0186 above.

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	become uncovered. It is unclear who is responsible for uncovered cables left in the ocean after decommissioning. These cables are a major safety concern for fishing vessels operating mobile bottom tending gear as they can hang-up on cables.	
1259-0187	Separately the Draft EIS does not provide any information whatsoever about the disposal of turbine blades. At a time when the generation of single-use waste is becoming a global crisis the Draft EIS provides no assurances that blades and other materials from Ocean Wind 1 will be reused recycled or otherwise disposed of responsibly let alone a specific plan for doing so. This is particularly problematic because even though wind turbine blades are not especially toxic the resulting landfill may contribute to dangerous environmental impacts including the pollution of land and waterways. [Footnote 187: Arthur Nelsen Surging wind industry faces its own green dilemma: landfills Reuters (Sept. 10 2021) https://www.reuters.com/legal/litigation/surging-wind-industry-faces-its-own-green-dilemma-landfills-2021-09-10/] Turbine blade waste in turn undermines the overall sustainability of wind energy projects. [Footnote 188: See id.]Even when (or if) Ocean Wind 1 does reveal its plan for the turbine blades it will almost certainly rely on the assertion that the project will be able to avoid sending the many giant blades it demands to landfills by recycling them. Yet this claim is fatally flawed upon closer scrutiny. To start some turbine blade manufacturers have recently started claiming that they can now produce recyclable blades but the blades can be recycled only through a process known as "chemical recycling." [Footnote 189: See Press Release ZEBRA project achieves key milestone with production of the first prototype of its recyclable wind turbine blade GE (Mar. 17 2022) https://www.ge.com/news/press-releases/zebra-project-achieves-key- milestone-with-production-of-first-prototype-of-recyclable-wind-turbine-blade ("Elium® based composite components can be recycled using an advanced method called chemical recycling [...].)] To call this process recycling however would not be accurate. So- called "chemical recycling" is a process that theoretically breaks down plastic waste into its molecular components to then be turned back into new plastics-thereby supporting a "circular economy." [Footnote 190: Judith Enck NJ Don't believe the hype about advanced recycling NJ Spotlight News (July 1 2021) https://www.beyondplastics.org/news-stories/dont-believe-the-hype-about-advanced-recycling. In practice such results would be an exception from the norm. Instead two of the three "chemical recycling" facilities that are operational in the U.S. today convert plastic waste into low-grade fuel and none of the three facilities have been proven to recover plastics for the purpose of making new	BSEE's regulations at 30 CFR 285 and commercial Renewable Energy Lease OCS-A 0498 require that Ocean Wind remove or decommission all facilities, projects, cables, pipelines, and obstructions and clear the seafloor of all obstructions created by the proposed Project. The conceptual decommissioning plan, as proposed by Ocean Wind, is analyzed in the Final EIS. Prior to implementation of any activities associated with decommissioning, BOEM would require Ocean Wind to submit a decommissioning application for technical and environmental review.

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	materials on a commercial scale. [Footnote 191: Id.] All the meanwhile chemical recycling is a major source of air pollution and greenhouse gas emissions as well. In fact "chemical recycling" facilities emit three (3) tons of carbon dioxide for every one (1) ton of plastic that they process and also spew out severely hazardous substances like dioxins furans heavy metals and particulate matter. [Footnote 192: Id.]	
1259-0188	In brief it is imperative for the EIS to more thoroughly account for the inevitable disposal of blades used at Ocean Wind 1 including for blades that need to be replaced during operation and maintenance as well as during decommissioning. Even at the merely conceptual state this information has considerable consequences for the overall environmental and public health impacts of the proposed OSW project.	The details of how blades would be disposed of should they be decommissioned are not known at this time and cannot be analyzed. Prior to implementation of any activities associated with decommissioning, BOEM would require Ocean Wind to submit a decommissioning application for technical and environmental review.
1267-0001	The Ocean Wind 1 Draft Environmental Impact Statement speaks at length of the Electromagnetic Field (EMF) produced by the Inter-Array and export cables and discusses the impact or expected lack of impact on sea life. The EIS is silent with regards to the heat given off by the Inter-Array and export cables. The "COP Volume I" is annexed to the EIS on Page 2-6 and on page 147/159 of the Construction and Operation Plan Ocean Wind Offshore Wind Farm Volume I November 2021 reference to the thermal output of the cables is referenced in the statement "The alignment of the onshore interconnect cable system duct bank will be spaced at a minimum of 15 feet from the onshore transmission cable system duct bank in order to maintain thermal isolation between the two circuits. The Draft SIA and COP Volumes I & II do not mention the operating temperature of the cables but imply that the cables if closer than 15 feet could adversely impact other cables. The insulation of these cable are typically rated for 90 degrees centigrade (194 degrees Fahrenheit). On Page 121 & 120 of 159 of the COP Volume I on table 6.1.2-10 forecasts three (3) cable fault events for the BL England Export Cables and also faults in the Offshore Export Cables and Substation Interconnection Cables and Array Cables. The Offshore wind Submarine Cabling Final Report number 21-14 dated April 2021 by NYSERDA on page 13 states "Cables that are buried deeper than planned are at risk of damage due to overheating. As little as 1.6 ft over burial.. can necessitate larger cable cross sections. "The Draft EIS states that the 275-KiloVolt alternating current offshore export cable and Inter-array cables would be buried 4 to 6 feet	Sections 2.1.2.2.2 and 2.1.2.2.3 of the Final EIS describe the construction and installation of the proposed inter-array and export cables. The target burial depth is determined based on a number of factors including decreased thermal conductivity associated with increased burial depth. A CBRA would be developed prior to construction and would involve coordination with applicable state and federal agencies to inform final target burial depth. Remedial protection measures, as described in Section 2.1.2.2.3, would be installed wherever the target burial depth cannot be met. The CBRA is subject to review and approval by the Certified Verification Agency and BOEM.

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	but do not indicate cable temperature or the seabed temperature over the cable. Are we to assume that the cables will be operating at in the range of 176 to 194 degrees Fahrenheit as sited in the Public Service Commission of Wisconsin in their article titled" Underground Electric Transmission Lines"? These temperatures are consistent with ORSTED's expectation that there will be cable faults. Based on a 176 degree cable temperature at 5 feet of cover and a 194 degree cable temperature at 6.6 feet of cover the seabed over the cable would be 118 degrees Fahrenheit significantly warmer than the 50 degree Ocean Temperature. The aversion to enter and cross a hot zone by fish like flounder or crabs not being mentioned in the draft EIS appears to be a serious defect in the report. Additionally the increase in soil temperatures crossing the barrier islands will impact the viability of reptile (turtles) and crabs as well as vegetation in the protected wetlands located over the cables. A secondary impact of heating at the ocean floor and the adjacent water is the change in the Oxygen and Calcium Carbonate solubility in sea water. The heat of the cables will also have an impact on the roots of trees and the life of the asphalt roadways along the export routes. If heating by the cables is an issue for sea life the power through each cable could be reduced or sections can be elevated above the water with poles or buried at greater depth with forced cooling. On land forced cooling is an alternative. Revisions to the Draft Environmental Impact Statement are warranted.	
1267-0002	The Onshore Export Cable will heat the environment when in use. The Onshore Export Cable will cross water supply mains and services. The project should be required to provide thermal insulation to prevent heating of the public drinking water supply mains and services.	Ocean Wind will construct onshore export cables in accordance with design specifications and engineering best practices. BOEM has not proposed specific mitigation related to thermal insulation of export cables.
0984-0028a	Buffer Between Lease Areas Sand Ridges and Trough Avoidance and Submerged Aquatic Vegetation Avoidance (SAVA) are all Major Impacts that should be discussed separately. A [Bold: Major Impact] of sediment deposition is known within the multiple scientific reports that can be used to do computer generated calculations. The applicant is aware of the [Bold: Major Impacts] and that the maintenance the cables require. The constant reburial process will have [Bold: Major Impacts]. The failure of the applicant to disclose such calculations within the EIS is an act in violation of public trust.	The IPF of cable emplacement and maintenance is analyzed across applicable EIS Chapter 3 resource sections, including in Section 3.6, *Benthic Resources*, and Section 3.22, *Water Quality*. Specifically, Section 3.22 reports results of sediment dispersion modeling conducted for three other offshore wind projects with general sediment conditions and hydrodynamics that are similar to

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		those of the Project area.
0984-0028b	The applicants desire to sell the cables to avoid the continued cost of maintenance and pending Environmental Justice prosecution should also be part of the EIS. When dredging is used there will be long lasting impacts that will take decades to mitigate after operations cease to exist. The applicant is failing to address the requirements found in the German standards that require mitigation of sediment temperature changes of greater than two degrees. Heat rises. It doesn't matter how deep you bury the cables there is always a environmental affect. Also the EIS is failing to discuss the [Bold: Major Impacts] of cable failures from webbing within cables if they are buried deep. This has become a consistent cause of cable failure around the world because of the intent to mitigate marine life damages by burring the cables deeper than the manufacturer intended.	The sale and cost of maintaining cables would not affect environmental justice populations and is not analyzed in the EIS. Sections 2.1.2.2.2 and 2.1.2.2.3 of the Final EIS describe the construction and installation of the proposed inter-array and export cables. The target burial depth is determined based on a number of factors including decreased thermal conductivity associated with increased burial depth. A CBRA would be developed prior to construction and would involve coordination with applicable state and federal agencies to inform final target burial depth. The CBRA is subject to review and approval by the Certified Verification Agency and BOEM.
0984-0028c	The applicants claim that seabed alterations will "be short term and would have little impact" on coastal habitat is as far from accurate representation. Misrepresentation of the facts of the project in the EIS and the is a reason to deny the EIS. The burial of cables along the shore will have considerably costs to the environment and the tourism industry. It has been scientifically proven that an object burred along the coast creates scarring along the beach and puts ocean front homes and communities nearby at greater risk from storm damage. The applicant knows the science and has refused to try to mitigate the damages that will be created by the cables and their landfall.	The impacts of cable emplacement, cable landfalls, and onshore cables are analyzed across applicable EIS Chapter 3 resource sections, including in Section 3.8, *Coastal Habitat and Fauna*, and the basis of impact conclusions is explained. BOEM does not concur that installation of cables and landfalls would increase risk of storm damage for ocean-front homes and communities.
0007-0009	Affordability and Reliability: In Appendix L of the DEIS Other Impacts Section L.3 it is stated that long term benefits of the Proposed Action be considered. It lists as goals promotion of clean and safe domestic energy sources and promotion of renewable energy to help ensure security combat climate change and provide electricity that is affordable reliable safe secure and clean. No where in the DEIS do I see a discussion of the affordability and reliability of offshore wind particularly as compared to onshore technology alternatives. How can you evaluate the affordability reliability and cleanliness of offshore wind without comparing it to onshore clean energy technology options? Is there a Federal Agency (such as the Department of Energy) that will request or perform that	The EIS for the Project analyzes the impacts of constructing, operating and maintaining, and decommissioning the Project as described in the Ocean Wind 1 COP. Comparative analysis of the affordability and reliability of the Proposed Action with other onshore technology is outside the scope of the EIS. See Chapter 2, Table 2-3 for discussion of alternative energy sources that were considered but

Comment No.	Comment	Response
	analysis before the EIS for the Proposed Action is finalized? As mentioned earlier the reliability of wind power was recently called into question with the power outages in Texas during the winter of 2021. A reassessment of comparative costs and impacts on electricity users is also needed. Increased costs of electricity from offshore wind will negatively impact residential and business users and in the case of commercial and industrial enterprises may lead to siting these facilities elsewhere. This will effect job opportunities and tax revenues. This should be considered.	dismissed from detailed analysis in the EIS.
1012-0004b	b. [Bold: Micro-climate Changes at the Shore]. It does not include an analysis of potential changes to shore wind waves air temperature and humidity as a result of wind energy extraction from the turbines which was asked for in our comments on the NOI.	Wind turbines increase vertical mixing in the atmosphere and thus can increase (or decrease) air temperatures downwind depending on local meteorological conditions. Increased mixing near the ocean surface can take up moisture from the ocean, increasing the humidity and salinity of the air. However, these effects dissipate with distance downwind. Because of the distance of the Project from land (approximately 15 miles), substantial effects on temperature and humidity are unlikely to occur over land.
1012-0014a	4.[Bold: The Cold Pool] An important factor impacting marine habitats and migratory patterns on the mid-Atlantic shelf is the "Cold Pool". This seasonal thermocline is one of the largest of its kind in the global ocean and extends from Nantucket to Cape Hatteras. Wind turbines have been shown to impact the mixing of ocean water both at the surface through their change in wind energy and at other levels through their physical structure. The impact on the Cold Pool both off the New Jersey coast and more broadly off the mid-Atlantic shelf from this project and in conjunction with the other foreseeable offshore wind projects must be carefully assessed. As mentioned in the July 22 2020 report of the Science Center for Marine Fisheries Management (a project funded by the National Science Foundation) in its critique of the BOEM Supplementary Environmental Impact Statement for the Vineyard Wind Project: "Too much attention cannot be given to the Cold Pool" and "The weakening of the Cold Pool supports the potential of generating the most catastrophic ecological event on the continental shelf the world has ever seen". The potential impact of this and other such wind projects on the Cold Pool should be clearly understood before this or any new projects are permitted.	Discussion of the potential impacts on the cold pool has been added to Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*, in the Final EIS.

Comment No.	Comment	Response
1012-0014c	In addition the high noise source level from these turbines discussed above and the lesser noise dissipation in water than air raises the prospect that persons going underwater at the shore will hear the turbines. Underwater noise is received differently than an air and the impacts of this on a person are not clear. This needs to be fully investigated for the EIS lest diving into a wave at the shore becomes a thing of the past.	Potential O&M noise impacts on human activities is discussed in Section 3.11, *Demographics, Employment, and Economics*, and Section 3.18, *Recreation and Tourism.* The WTGs would be sited 15 miles offshore and BOEM does not expect that noise from WTG operation would be audible onshore or near shore.
1234-0003a	As written the no action alternative assumes projects beyond Ocean Wind 1 will continue above and beyond this project. As a result the COP assumes cumulative benefits without consideration of cumulative impacts of this project and is erroneous in its assumptions. The DEIS must consider cumulative impact and benefits it should not consider only one without the other. Assurance for the protection of the Cold Pool phenomenon must be include in the analysis and scientific research ensuring its protection must be completed prior to the COP.	The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives. Discussion of the potential impacts on the cold pool has been added to Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*, in the Final EIS.
1194-0002f	Ocean Wind should adopt Alternative D - Sand Ridge and Trough Avoidance to protect important benthic habitat in the Lease Area. Ocean Wind should adopt Alternative E-Submerged Aquatic Vegetation Avoidance which alters the route of offshore export cables through ecologically important eelgrass in Barnegat Bay which is considered essential fish habitat habitat area of particular concern and a Special Aquatic Site under the Clean Water Act. BOEM and Ocean Wind must use relevant timely and primary sources to estimate marine mammal and sea turtle occurrence and abundance metrics to evaluate exposure of species in and around the project area. BOEM and Ocean Wind should not employ 24-hour pile driving due to the	Comment noted. Final EIS Section 3.15, *Marine Mammals*, incorporates updates to marine mammal densities and exposure based on the most recent marine mammal density models for the U.S. East Coast (released June 20, 2022). Appendix H, *Mitigation and Monitoring,* describes mitigation measures regarding pile driving, including specific measures concerning acoustic monitoring and the

Comment No.	Comment	Response
	increased prolonged exposure of vulnerable species to noise impacts from pile-driving activities and the limitations of detecting species in the clearance zones at night. BOEM and Ocean Wind should evaluate other turbine foundation options in particular quiet foundations to reduce noise impacts to vulnerable species and should provide that analysis to the public for their review.	development and submittal of a nighttime pile-driving monitoring plan for NMFS and BOEM review and approval. As explained in Section 2.1.7 of the Final EIS, alternative foundation types such as suction caisson foundations, gravity-based foundations, and floating platforms were deemed not suitable for the Proposed Action due to local site conditions and technical and supply chain considerations.
0011-0002	Clearly the proposed project has serious major impacts on historic uses of the outer continental shelf. Some compensating actions are offered such as reimbursement for lost fishing gear and adoption of Aircraft Detection Lighting System. However a December 14 2020 letter (attached) page 12 from the Department of the Interior Solicitor to Interior Secretary David Bernhardt states: "It is important to observe that any compensation system established by a lease to make users of the lease area whole financially does not negate interference - indeed the creation of such a system presumes interference. As such any proposed compensation process should not be viewed as 'curing' any 8(p)(4(I) interference since the statute does not provide for such a cure." The letter also discusses the Secretary's duty to prevent interference with reasonable historic uses in federal waters such as fishing navigation and the viewshed by denying offshore wind projects in accordance with the Outer Continental Shelf Lands Act Subsection 8(p). We note this is in contrast with a new Solicitor General's opinion quoted in the DEIS: As stated in M-Opinion 37067 ". . . subsection 8(p)(4) of OCSLA imposes a general duty on the Secretary to act in a manner providing for the subsection's enumerated goals. The subsection does not require the Secretary to ensure that the goals are achieved to a particular degree and she retains wide discretion to determine the appropriate balance between two or more goals that conflict or are otherwise in tension. "Major impacts to historic ocean uses cannot be overlooked at the discretion of the Secretary. These contrasting opinions are the kind of legal debates to be settled in lawsuits filed against BOEM approval such as has been done against the Vineyard Wind project. It is recommended no further offshore wind project Final EIS and Record of Decision be published until these cases are heard likely by years end.	The Solicitor's opinion of December 14, 2020, M-37059, was withdrawn on April 9, 2021, by M-37067 for the reasons explained in the latter opinion. The Solicitor's M-opinions on matters within the jurisdiction of the Department of the Interior are binding on BOEM (see 209 Department Manual 3.2(A)(11)), and, accordingly, BOEM does not agree with the characterization of the two opinions as a "legal debate." BOEM acknowledges that there are pending challenges to federal approvals for the Vineyard Wind project, but none of those cases limit BOEM's ability to analyze impacts or alternatives of the Ocean Wind Project or to come to a decision on Ocean Wind's COP.

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O.7. General Comment Summaries and Responses

O.7.1 Purpose and Need

Table O.7-1 General Comments on the Purpose and Need

General Comment Summaries and Responses
Comment Summary 1: Commenters generally affirmed the purpose and need for the Project noting that the Project is an opportunity for New Jersey to diversify its energy generation and meet baseline energy goals while facilitating New Jersey's goal of achieving 7,500 MW of offshore wind energy by 2035. Commenters noted the need to increase energy supply and production capacity to offset supply imbalances and supply chain disruptions that have created volatility in energy commodity prices, and to create long-term certainty for private sector businesses investing in energy infrastructure. Other commenters questioned whether the Project would actually address climate change, given the modest reduction in GHG emissions that could be achieved through offshore wind energy generation.
Response: Thank you for your comment. EIS Section 1.2 outlines the policy goals of the Biden Administration to combat the climate crisis and the state of New Jersey's offshore wind energy generation goals to which the proposed Ocean Wind 1 Project would contribute.
Submission IDs contributing to comment summary: 0951-0001; 1040-0002; 1040-0003; 1040-0004; 1048-0006; 1275-0002; 0022-0001.

O.7.2 Proposed Action and Alternatives

Table O.7-2 General Comments on the Proposed Action and Alternatives

General Comment Summaries and Responses
Comment Summary 1: Several comments recommended that BOEM consider a smaller pilot project to test the technology and assess impacts as an alternative in the EIS. Others recommended additional studies to mitigate environmental impacts. Other comments made recommendations for new alternatives or to modify existing alternatives. These recommendations included the use of native materials around turbine bases, the inclusion of seafloor cable removal as part of the Project, a minimum 6-foot burial depth for cables, alternatives to reduce the length of cable required, a shared cable corridor, and a larger transit zone (between 2 and 4 miles) between Ocean Wind 1 and Atlantic Shore.
Response: BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Lease Area. In the Draft EIS, BOEM considered but dismissed from further consideration an alternative to build a much smaller pilot facility to confirm the benefits and impacts before building out the complete Project as proposed. BOEM also considered but dismissed from further consideration an alternative to increase spacing between Ocean Wind 1 and Atlantic Shores South, alternative wind turbine foundations, alternatives to bury cables deeper, and a shared cable corridor. Additional detail is provided in Table 2-3, *Alternatives Considered but not Analyzed in Detail*, in the Final EIS.
Submission IDs contributing to comment summary: 0007-0003; 0007-0013; 0007-0017; 0388-0001; 0390-0025; 0487-0005; 0984-0003; 0984-0068; 1243-0005; TRANS-0102-0002; 1272-0006; TRANS-0068-0003; TRANS-0080-0011; TRANS-0081-0003; 0948-0004; 1278-0014
Comment Summary 2: Several comments raised concerns regarding the limited experience of the developer and these specific WTGs, the high capital costs and maintenance costs due to waves and storm damage, the short lifecycle of WTGs, the proximity of the WTGs to one another and the resulting impacts on the fishing industry, and the proximity of the Oyster Creek export cable to the Atlantic City Artificial Reef.

General Comment Summaries and Responses
Response: Comment noted.
Submission IDs contributing to comment summary: 0175-0003; 0222-0007; 0283-0002; 0388-0001; 0390-0009; 0390-0013; 0390-0014; 0390-0015; 0487-0003; 1272-0003; 1272-0007; 1275-0014; 1278-0012; TRANS-0041-0002
Comment Summary 3: Several comments expressed preferences for one particular alternative or several alternatives. Several comments also expressed support for dismissal of certain alternatives or construction methods.
Response: Comment noted.
Submission IDs contributing to comment summary: 0158-0001; 0444-0001; 0753-0001; 0967-0003; 0967-0002; 1188-0002; 1190-0028; TRANS-0079-0004; TRANS-0087-0003; 1247-0005
Comment Summary 4: Several comments raised concern regarding the proximity of the wind farm to the shoreline and popular tourist beaches. Many of these commenters recommended the consideration of alternatives farther offshore. Specifically, one commenter recommended consideration of alternatives in the Hudson South Call Area.
Response: In the Draft EIS (Chapter 2, Table 2-3), BOEM considered but dismissed from further consideration alternatives for alternate locations for the wind energy facility outside of the Lease Area. BOEM's regulations require BOEM to analyze Ocean Wind's proposal to build a commercial-scale wind energy facility on the Lease Area.
Submission IDs contributing to comment summary: 0627-0001; 0656-0003; 0658-0001; 0659-0001; 0670-0001; 0675-0001; 0676-0001; 0677-0001; 1008-0001; 1100-0001; 1071-0018; 1087-0002; TRANS-0038-0003; 0717-0004

O.7.3 Air Quality

Table O.7-3 General Comments on Air Quality

General Comment Summaries and Responses
Comment Summary 1: Commenters generally affirmed the purpose and need for the Project noting that the Project is an opportunity for New Jersey to transition away from the use of fossil fuels and toward the generation and use of renewable, clean offshore wind energy to meet energy demand while reducing GHG emissions. Commenters noted the essential role of this transition in preventing worsening impacts of climate change, including sea level rise, extreme heat, extreme weather events, wildfires, destruction of coastal ecosystems, threats to wildlife, and ocean acidification. Commenters also noted that global climate change impacts disproportionately affect environmental justice communities. Some commenters highlighted the effects of climate change on birds, coastal habitat and fauna resources, commercial fisheries, marine mammal resources, tourism resources, scenic and visual resources, and water quality. Other commenters highlighted the potential for offshore wind to provide additional jobs and employment opportunities while reducing GHG emissions.
Response: Thank you for your comment. EIS Section 3.4 outlines the Project's anticipated GHG emissions and potential impact with respect to global climate change. As discussed in EIS Section 3.4.5, the Project is expected to have an overall net beneficial impact on GHG emissions compared to a similarly sized fossil-fueled power plant or to the generation of the same amount of energy by the existing grid. EIS Sections 3.7, 3.8, 3.9, 3.11, 3.12, 3.15, 3.18, 3.20, and 3.21 outline the Project's potential impacts on birds; coastal habitat and fauna; commercial fisheries and for-hire recreational fishing; demographics, employment, and economics; environmental justice; marine mammals; recreation and tourism; scenic and visual resources; and water quality, respectively.

General Comment Summaries and Responses
Submission IDs contributing to comment summary: 0048-0001; 0055-0001; 0058-0001; 0062-0002; 0062-0004; 0063-0002; 0063-0005; 0097-0003; 0138-0003; 0139-0001; 0139-0004; 0139-0006; 0147-0001; 0175-0001; 0212-0006; 0222-0002; 0284-0004; 0289-0001; 0432-0002; 0436-0001; 0608-0001; 0621-0001; 0939-0002; 0989-0001; 0990-0001; 1015-0003; 1015-0004; 1015-0006; 1015-0008; 1087-0001; 1119-0001; 1119-0002; 1125-0012; 1194-0001; 1247-0003; 1252-0001; 1259-0007; 1268-0001; TRANS-0004-0001; TRANS-0011-0003; TRANS-0014-0001; TRANS-0028-0004; TRANS-0045-0004; TRANS-0045-0005; TRANS-0046-0001; TRANS-0047-0001; TRANS-0050-0001; TRANS-0053-0001; TRANS-0055-0001; TRANS-0057-0002; TRANS-0058-0001; TRANS-0059-0001; TRANS-0061-0001; TRANS-0062-0001; TRANS-0072-0001; TRANS-0074-0001; TRANS-0076-0001; TRANS-0078-0001; TRANS-0082-0001; TRANS-0084-0003; TRANS-0087-0001; TRANS-0091-0001; TRANS-0094-0001; TRANS-0095-0001
Comment Summary 2: Commenters questioned whether the Project would reduce GHG emissions and address climate change in an effective and economically efficient manner.
Response: Thank you for your comment. EIS Section 3.4 outlines the Project's anticipated GHG emissions and potential contribution to global climate change. As discussed in EIS Section 3.4.5, the Proposed Action would produce GHG emissions that contribute to climate change; however, its contribution would be less than the emissions reductions from fossil-fueled sources during operation of the Project. Project activities that would produce GHG emissions would have negligible impacts on climate change and an overall net beneficial impact on GHGs compared to a similarly sized fossil-fueled power plant or to the generation of the same amount of energy by the existing grid. Moreover, EIS Section 3.11 outlines the Project's potential impacts on demographics, employment, and economics.
Submission IDs contributing to comment summary: 0175-0002; TRANS-0004-0001; TRANS-0075-0007
Comment Summary 3: Commenters generally affirmed the purpose and need for the Project noting that the Project is an opportunity for New Jersey to transition away from the use of fossil fuels to reduce air pollutant emissions and public health impacts from fossil fuel combustion. In addition, commenters noted that poor air quality and public health impacts from fossil fuel combustion disproportionately affect environmental justice communities.
Response: Thank you for your comment. EIS Section 3.4 outlines the potential criteria pollutant emissions and air quality impacts resulting from the Project. As discussed in EIS Section 3.4.5, the Project would result in air quality–related health effects avoided in the region due to the reduction in emissions associated with fossil-fueled energy generation. EIS Section 3.12 outlines the Project's potential impacts on environmental justice.
Submission IDs contributing to comment summary: 0055-0001; 0062-0002; 0062-0004; 0138-0003; 0139-0004; 0432-0002; 0436-0001; 0608-0001; 1015-0004; 1015-0006; 1087-0001; 1119-0001; 1247-0003; TRANS-0045-0005; TRANS-0046-0001; TRANS-0047-0001; TRANS-0052-0001; TRANS-0057-0002; TRANS-0059-0001; TRANS-0071-0003; TRANS-0076-0001; TRANS-0078-0001; TRANS-0084-0003; TRANS-0087-0001; TRANS-0094-0001
Comment Summary 4: Commenters questioned whether the Project would effectively reduce air pollutant emissions from fossil fuel combustion, given that marine vessel, helicopter, and generator activity during the Project's O&M phase would require the use of fossil fuels, resulting in criteria pollutant emissions.
Response: Thank you for your comment. EIS Section 3.4 outlines the Project's anticipated criteria pollutant emissions and potential impact on air quality. As discussed in EIS Section 3.4.5, minor air quality impacts would be anticipated for a limited time during construction, maintenance, and decommissioning, but there would be a minor beneficial impact on air quality near the Wind Farm Area and the surrounding region overall to the extent that energy produced by the Project would displace energy produced by fossil-fueled power plants. Moreover, Ocean Wind has committed to APMs that would reduce potential impacts by complying with applicable emissions and fuel standards (AQ-01, AQ-02, and AQ-04), limiting engine idling time (AQ-03), and requiring dust control plans for onshore construction areas (AQ-05).

General Comment Summaries and Responses
Submission IDs contributing to comment summary: 0175-0002; TRANS-0065-0003; TRANS-0075-0007
Comment Summary 5: Commenters questioned whether the Project would be resilient to extreme climate-related weather events, which are likely to become more frequent and severe.
Response: Thank you for your comment. As discussed in EIS Section 3.11, coasts are sensitive to sea level rise and changes in the frequency and intensity of storms. These events are likely to worsen over time due to climate change and can result in property or infrastructure damage. As discussed in EIS Section 3.11, efforts to protect against potential increased storm damage and sea level rise are included in the planned activities for coastal and marine activity other than offshore wind. See EIS Appendix F, Section F.2, which describes ongoing and planned activities.
Submission IDs contributing to comment summary: 0948-0004

O.7.4 Bats

There were no general comments coded to bats.

O.7.5 Benthic Resources

Table O.7-4 General Comments on Benthic Resources

General Comment Summaries and Responses
Comment Summary 1: Commenters had concerns about the location of the WTGs and the threat they pose to the benthic environment.
Response: The impacts on benthic resources from the location of turbines include effects of physical displacement, scour, loss of soft-bottom habitat, opportunities for the establishment and dispersal of invasive species, altered wind-wake characteristics and corresponding water column mixing, and changes in primary productivity. Benefits of the WTGs include additional hard-surface habitat for hard-bottom fauna. The loss of soft-bottom habitats likely poses less impact on benthic resources because it occurs extensively throughout the region, compared with less extensive hard-bottom habitat. Restoration of SAV for impacts that cannot be avoided would be implemented, per SAV Monitoring and Mitigation Plans. Impacts are not expected at a population level. Adverse impacts are anticipated to range from negligible to moderate and adverse.
Submission IDs contributing to comment summary: 0728-0001; 0980-0001; 1013-0001

O.7.6 Birds

Table O.7-5 General Comments on Birds

General Comment Summaries and Responses
Comment Summary 1: Several comments expressed broad concern with birds, including potential impacts on migrating birds, impacts from WTGs, impacts on shore birds and raptors, and effects on federally listed threatened and endangered birds and other sensitive birds. Some of these comments also included a general concern with other marine life and fisheries. These comments do not raise any specific concern regarding the conclusions or adequacy of the Draft EIS.

General Comment Summaries and Responses
Response: Draft EIS Section 3.7, *Birds*, discusses the potential impacts on bids from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area for birds. All birds occurring in the geographic analysis area are addressed, including marine birds, migratory birds, raptors (including bald and golden eagles), and federally listed threatened and endangered birds. BOEM addressed impacts on birds and their habitats through the following IPFs: accidental releases, lighting, cable emplacement and maintenance, noise, presence of structures, traffic (aircraft), and land disturbance (onshore construction). These IPFs address the direct and indirect impacts on birds and their habitats including, but not limited to, potential collisions with offshore structures (e.g., WTGs), effects on migration, and impacts on onshore habitats. Included in the analysis for the proposed Project are APMs intended to avoid and minimize impacts on birds and their habitats. In addition, Ocean Wind has proposed an *Avian and Bat Post-Construction Monitoring Framework* (as mentioned in the Draft EIS) to monitor the effects of the offshore wind components on birds. As stated in Draft EIS Section 3.7.8, *Proposed Mitigation Measures*, if the reported post-construction bat monitoring results indicate bird impacts deviate substantially from the impact analysis included in this EIS, then Ocean Wind must make recommendations for new mitigation measures or monitoring methods. Potential effects on federally listed threatened and endangered birds are discussed at a high level in Draft EIS Section 3.7, *Birds*, but BOEM's BA, a document required for federal actions that may affect federally listed threatened and endangered species, provides in-depth analysis of the Project's effects on each individual species. BOEM continues to consult with USFWS on potential impacts on federally listed threatened and endangered birds. Draft EIS Section 3.6, *Benthic Resources*; Section 3.13, *Finish, Invertebrates, and Essential Fish Habitat*; Section 3.15, *Marine Mammals;* and Section 3.19, *Sea Turtles*, address the potential effects of the Project on other marine life. Draft EIS Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, addresses potential effects the Project could have on fisheries.
Submission IDs contributing to comment summary: 0047-0002; 0210-0002; 0210-0007; 0390-0007; 0633-0004; 0634-0003; 0656-0002; 0729-0001; 0945-0003; 1251-0003; 1256-0001; 1256-0002; 1259-0106; TRANS-0006-0005; TRANS-0065-0002
Comment Summary 2: One comment requested a more robust discussion on birds that migrate through New Jersey, including the federally listed red knot and other birds. No specific suggestion or information was provided to provide a more robust discussion.
Response: Because the commenter did not provide additional information, BOEM is unable to respond to the comment. However, Draft EIS Section 3.7, *Birds*, discusses the potential impacts on bids from the proposed Project, alternatives, and ongoing and planned activities in the geographic analysis area for birds. All birds occurring in the geographic analysis area are addressed, including marine birds, migratory birds, raptors (including bald and golden eagles), and federally listed threatened and endangered birds. BOEM understands the migratory patterns of birds along the Atlantic Coast and has provided that information in Draft EIS Section 3.7.1, *Description of the Affected Environment for Birds*. This section also addresses birds and bird habitats in the onshore area of the Project (see text after Draft EIS Table 3.7-1).
Submission IDs contributing to comment summary: TRANS-0079-0002

O.7.7 Coastal Habitat and Fauna

Table O.7-6 General Comments on Coastal Habitat and Fauna

General Comment Summaries and Responses
Comment Summary 1: Several comments expressed general concern with potential impacts on coastal resources, including wetlands, habitats at Island Beach State Park, and sensitive species (monarch and sturgeons). These comments do not raise any specific concern regarding the conclusions or adequacy of the Draft EIS.

General Comment Summaries and Responses
Response: Draft EIS Section 3.8, *Coastal Habitat and Fauna*; Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*; and Section 3.22, *Wetlands*, address resources in the coastal environment. Island Beach State Park and monarch butterfly are addressed in Draft EIS Section 3.8, *Coastal Habitat and Fauna*; wetlands are addressed in Draft EIS Section, 3.22, *Wetlands*; and Atlantic and shortnose sturgeon are addressed in Draft EIS Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*. The monarch butterfly and sturgeon and addressed in further detail in BOEM's BA as part of the ESA Section 7 consultation requirements.
Submission IDs contributing to comment summary: 0984-0015; 1192-0029; TRANS-0041-0008; TRANS-0042-0005; TRANS-0075-0004

O.7.8 Commercial Fisheries and For-Hire Recreational Fishing

Table O.7-7 General Comments on Commercial Fisheries and For-Hire Recreational Fishing

General Comment Summaries and Responses
Comment Summary 1: Several comments raised general concerns regarding adverse effects on the fishing industry due to the Proposed Action. Some of the concerns related to effects of electrical currents; the safety of boats and divers; potential impacts on commercial and recreational fishing, marine mammals, birds, and the entire ecosystem; and the potential for the artificial reef effect to result in increased predation of lobsters. Several of these comments requested additional analysis of potential impacts and testing of offshore wind technology. Another comment raised concerns regarding the characterization of the Lease Area by a spokesman for Ørsted as a "fish desert."
Response: Draft EIS Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, discusses potential impacts on commercial fisheries and recreational fishing from the Proposed Action, alternatives, and ongoing and planned activities in the geographic analysis area. Included in the analysis for the proposed Project are APMs intended to avoid and minimize impacts on commercial fisheries and for-hire recreational fishing. In addition, the EIS considers mitigation measures for gear loss and damage, compensation for lost fishing income, and cable protection measures, which can be found at the end of Section 3.9.
Submission IDs contributing to comment summary: 0018-0002; 0047-0004; 0652-0002; 0175-0008; 0717-0003; TRANS-0079-0003; TRANS-0080-0002; 0962-0006; 0962-0008; 0984-0091; 1117-0002; 1124-0001; 1272-0001; 1278-0023
Comment Summary 2: Comments request the developer provide impact payments and other forms of compensation to fishers and the tourism industry for the duration of the Project.
Response: The EIS includes as a mitigation measure a compensation program for lost income for commercial and recreational fishers and other eligible fishing interests for construction and operations, which can be found at the end of Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*. These proposed mitigation measures are consistent with BOEM's Draft Guidance for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR 585.
Submission IDs contributing to comment summary: TRANS-0080-0004; 1125-0008
Comment Summary 3: Several comments expressed support for the Proposed Action due to the additional fishing opportunities the WTGs would create through artificial reef effects and the benefits of offshore wind energy with respect to preventing worsening impacts of climate change on the commercial fishing industry. One comment asserted that the location of the Proposed Action minimizes effects on surrounding prime commercial fishing areas, marine mammals, and sea turtles.
Response: Thank you for your comment. BOEM acknowledges your support for the Project. Draft EIS Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, acknowledges the potential beneficial effects of the Proposed Action and action alternatives on commercial fishing and for-hire recreational fishing.

General Comment Summaries and Responses
Submission IDs contributing to comment summary: 0058-0003; 0222-0003; TRANS-0030-0003; TRANS-0086-0001; TRANS-0086-0002; 0967-0004; 1278-0004

O.7.9 Cultural, Historical, and Archaeological Resources

There were no general comments coded to cultural, historical, and archaeological resources.

O.7.10 Demographics, Employment, and Economics

Table O.7-8 General Comments on Demographics, Employment, and Economics

General Comment Summaries and Responses
Comment Summary 1: Numerous comments expressed support for the Project because it would increase investments in the local economy, create new employment opportunities, and increase revenue for the recreation and tourism industries. Commenters asserted that the Project would provide positive economic benefits to coastal communities in New Jersey and to other regions that support the offshore wind installation and operation supply chain. Other commenters expressed support for the workforce development opportunities that have already been created and will continue to be developed to support offshore wind projects.
Response: These comments are noted. EIS Section 3.11, *Demographics, Employment, and Economics*, provides estimates of the anticipated job creation during construction and operation of the Proposed Action and concludes that the Proposed Action would result in beneficial employment and economic impacts related to job creation, expenditures on local businesses, tax revenues, grant funds, and support for additional regional offshore wind development.
Submission IDs contributing to comment summary: 0003-0003; 0003-0004; 0059-0003; 0100-0001; 0139-0002; 0139-0003; 0306-0001; 0313-0001; 0315-0002; 0429-0001; 0487-0007; 0532-0002; 0533-0003; 0565-0002; 0641-0003; 0764-0001; 0951-0004; 1015-0002; 1040-0006; 1085-0001; 1125-0004; 1190-0002; 1119-0003; 1190-0007; 1156-0001; 1178-0001; 1186-0002; 1195-0001; 1228-0003; 1228-0004; 1247-0002; 1254-0006; 1258-0089; 1266-0001; 1266-0003; TRANS-0007-0003; TRANS-0007-0004; TRANS-0008-0001; TRANS-0010-0001; TRANS-0011-0002; TRANS-0012-0002; TRANS-0012-0003; TRANS-0015-0003; TRANS-0015-0004; TRANS-0018-0001; TRANS-0019-0002; TRANS-0023-0002; TRANS-0028-0002; TRANS-0028-0003; TRANS-0029-0001; TRANS-0029-0002; TRANS-0031-0001; TRANS-0033-0001; TRANS-0035-0002; TRANS-0035-0003; TRANS-0036-0001; TRANS-0037-0002; TRANS-0045-0003; TRANS-0048-0001; TRANS-0053-0002; TRANS-0071-0001; TRANS-0089-0002; TRANS-0089-0005; TRANS-0092-0002; TRANS-0093-0001; TRANS-0106-0002; TRANS-0078-0002
Comment Summary 2: Comments expressed concern that the cost to ratepayers would be high and was not disclosed. One commenter requested an analysis of when installation costs would be recovered through earnings for revenue generation.
Response: The timeframe for the lessee to recover installation costs and the cost to ratepayers has not been disclosed in the Ocean Wind 1 COP and was not analyzed in the EIS. However, as stated in Section 3.11, *Demographics, Employment, and Economics*, according to the BPU OREC Award, ratepayers could see an increase in their monthly energy bill of $1.46 for residential customers, $13.05 for commercial customers, and $110.10 for industrial customers (New Jersey Office of the Governor 2019). The lessee is eligible to receive the approved OREC rates and payments for 20 years subject to the terms and conditions of the Board Order (https://www.njcleanenergy.com/files/file/6-21-19-8D.PDF).
Submission IDs contributing to comment summary: 0175-0014; 0175-0015; 0175-0016; 0175-0017; 0175-0018; 0175-0019; 0387-0001; 0390-0020; 0390-0021; 0965-0001; TRANS-0026-0002; TRANS-0066-0003; 0022-0001

General Comment Summaries and Responses
Comment Summary 3: Some commenters expressed opposition to the Project due to the cost of offshore wind. Others expressed opposition to the Project due the perception that it would result in adverse effects on property values, tourism revenue, and recreational and commercial fishing/diving industries. Others raised concerns that the jobs created by the Project will not be high paying or would mostly benefit workers outside of New Jersey and the U.S.
Response: BOEM acknowledges the opposition to the Project based on these concerns. Information on Project costs is proprietary and therefore is not disclosed in the Ocean Wind 1 COP or reported in the EIS. Refer to Section 3.11, *Demographics, Employment, and Economics*, for analysis of the Project's effects on employment and economics. Refer to Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, for analysis of potential impacts on commercial fishing revenue and jobs.
Submission IDs contributing to comment summary: 0011-0006; 0390-0023; 0471-0001; 0487-0001; 0633-0005; 0661-0001; 0664-0001; 0691-0004; 0717-0002; 0962-0005; 0981-0001; 1086-0018; 1112-0006; 1193-0002; 1259-0127; TRANS-0060-0001; TRANS-0077-0001; 0984-0018d
Comment Summary 4: Several commenters felt that the economic impacts of the Project were not clearly communicated to the public, including the cost of the Project, the economic impacts on residents, and how the money from leases will be utilized.
Response: Thank you for your comment. Refer to Section 3.11, *Demographics, Employment, and Economics*, for analysis of the Project's effects on employment and economics. Refer to Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, for analysis of potential impacts on commercial fishing revenue and jobs. Information on Project costs is proprietary and therefore is not disclosed in the Ocean Wind 1 COP or reported in the EIS. With respect to lease revenue from development of resources on the OCS, these funds are distributed to the U.S. Treasury to fund operations of the federal government and to several different programs that protect historic places and recreation opportunities. Additional information is available on BOEM's website: https://www.boem.gov/oil-gas-energy/energy-economics/revenue-sharing.
Submission IDs contributing to comment summary: TRANS-0083-0001; TRANS-0041-0009; 0175-0013; 0658-0005; 0984-0018a; 1071-0016, 1275-0015; TRANS-0069-0006

O.7.11 Environmental Justice

Table O.7-9 General Comments on Environmental Justice

General Comment Summaries and Responses
Comment Summary 1: Commenters noted the varied and wide-ranging adverse health effects caused by air pollution, the disproportionate burden that people of color experience related to air pollution, and the substantial public health benefits associated with transitioning to clean energy, particularly in communities that have been historically overburdened by pollution. A commenter noted that offshore wind can help bring much-needed equity by replacing fossil fuel plants often in or near communities of color and by alleviating health risks and other inequities in environmental justice communities near generation facilities and exceptionally dirty peaker plants. One commenter asked whether utility costs would increase if the Project were completed and whether cost increases would disproportionately affect minorities, the elderly, and people on fixed incomes. One commenter noted that New Jersey's offshore wind goals create opportunities for growing a domestic clean energy workforce and bringing economic development jobs and opportunities to vulnerable communities through workforce training opportunities for small women-owned and minority-owned businesses, and programs for historically disinvested communities. The goals also prioritize workforce development benefits for environmental justice communities that include highlighting economic development plans that emphasize diversity and include initiatives to support environmental justice communities through job grants training programs.

General Comment Summaries and Responses
Response: Thank you for your comment. EIS Section 3.4, *Air Quality*, estimates annual avoided emissions and the potential health benefits of avoided emissions associated with the Proposed Action alone and with installing a cumulative 36 GW of offshore wind power under the planned activities scenario. EIS Section 3.12, *Environmental Justice*, estimates that annual avoided health effects would range from $213 to $539 million dollars in health benefits and 21 to 48 avoided mortality cases (Section 3.4, Table 3.4-5). Environmental justice populations are disproportionately affected by emissions from fossil-fueled power plants nationwide and by higher levels of air pollutants. Therefore, the Proposed Action could benefit environmental justice populations by displacing fossil fuel power-generating capacity. EIS Section 3.11, *Demographics, Employment, and Economics*, describes the anticipated economic benefits of the Project, including increased direct and indirect spending and employment.
Submission IDs contributing to comment summary: 0023-0001; 0062-0003; 0138-0004; 0984-0019; 0984-0035; 1015-0005; 1258-0088; 1275-0013; TRANS-0054-0001; TRANS-0078-0002

O.7.12 Finfish, Invertebrates, and Essential Fish Habitat

Table O.7-10 General Comments on Finfish, Invertebrates, and Essential Fish Habitat

General Comment Summaries and Responses
Comment Summary 1: Several comments noted the potential benefits of introducing structures such as WTGs into the ocean, as they provide an artificial reef system for marine life.
Response: Thank you for your comment. EIS Section 3.13 acknowledges that new structures could have beneficial effects on finfish and invertebrate species through the creation of artificial reefs, which would provide potential feeding grounds and areas of protection from predators.
Submission IDs contributing to comment summary: 0095-0001; TRANS-0030-0002
Comment Summary 2: A commenter noted that EMF generated by transmission cables could have effects on the behavior or physiology of species such as sharks and rays that use electro reception for detecting prey or conspecifics.
Response: EIS Section 3.13 includes an evaluation of the effects of transmission cable operation on finfish and invertebrates and concludes that, due to the small footprint of existing undersea transmission lines within the benthic geographic analysis area and the fact that EMF decreases rapidly with distance from the cable, impacts from EMF would be minor.
Submission ID contributing to comment summary: 0390-0018
Comment Summary 3: A commenter requested additional analysis of the potential impacts of sea floor cables on horseshoe crab migration and activity.
Response: An analysis of potential impacts on horseshoe crab is presented in the EFH Assessment, which concludes that impacts associated with dredging would be either short term, limited in spatial extent, or insignificant to the success of the species.
Submission IDs contributing to comment summary: TRANS-0079-0001

O.7.13 Land Use and Coastal Infrastructure

Table O.7-11 General Comments on Land Use and Coastal Infrastructure

General Comment Summaries and Responses
Comment Summary 1: One commenter urged BOEM to require offshore wind power developers to carefully consider the locations they choose for bringing power cables on land to connect to the grid. Specifically, the commenter recommended the routing of cables and connection infrastructure through locations zoned for industrial use to minimize disruption to residential and commercial properties on the Jersey shore.
Response: Comment noted. Multiple landfall locations are being considered as part of the Project to minimize disruption to residents and minimize impacts on the onshore environment.
Submission IDs contributing to comment summary: 0138-0001
Comment Summary 2: A commenter expressed support for the Project because it would replace nuclear and coal power plants that are destroying Barnegat Bay and Egg Harbor Bay.
Response: Comment noted. Thank you for your comment.
Submission IDs contributing to comment summary: TRANS-0084-0002
Comment Summary 3: A commenter asserted that the use of taxpayer and ratepayers' financial contributions for port utilization and expansion to accommodate the development of offshore wind violates the Executive Order.
Response: Comment noted. Thank you for your comment.
Submission IDs contributing to comment summary: 0984-0081
Comment Summary 4: Several comments advocated for a coordinated efficient grid constructed between turbines and the shore with turbines being with a minimum of cables that is as safe as possible. Commenters also expressed that local communities where cables come on shore should have a say in that process as well as direct benefits.
Response: Comment noted. Thank you for your comment.
Submission IDs contributing to comment summary: 1258-0004; 1258-0009; 1258-0014; 1258-0021; 1258-0028; 1258-0035; 1258-0042; 1258-0049; 1258-0057; 1258-0064; 1258-0071; 1258-0078; 1258-0083

O.7.14 Marine Mammals

Table O.7-12 General Comments on Marine Mammals

General Comment Summaries and Responses
Comment Summary 1: Numerous comments raised general concerns regarding adverse effects on marine mammals due to the Proposed Action. Specifically, concerns were raised that the Project would affect migration pathways and breeding grounds for whales (including the NARW) and would increase the potential for vessel strike of marine mammals due to corralling in shipping lanes. Concerns were also raised regarding construction noise impacts (e.g., associated with pile driving) and operational noise impacts on marine mammals and their ability to communicate. Several comments provided background information regarding marine mammal species in the vicinity of the Lease Area. Other comments reported the large number of incidental harassment authorizations that have already been issued for offshore wind projects and for Ocean Wind 1 specifically. Several comments asserted that effects on marine mammals are not fully understood and that additional analysis is necessary to minimize impacts. Other comments recommended consideration of all potential mitigation measures, including bubble curtains, installation of turbine foundations during the off-season, and consultation between BOEM and organizations such as the National Wildlife Foundation to minimize impacts on marine mammals. One commenter urged BOEM to select an option that minimizes noise impacts on marine mammals during construction and O&M.
Response: Draft EIS Section 3.15, *Marine Mammals*, discusses potential impacts on marine mammals from the Proposed Action, alternatives, and ongoing and planned activities in the geographic analysis area. BOEM addressed impacts on marine mammals through the following IPFs: traffic (vessel strikes), gear utilization, noise, accidental releases and discharges, EMF, presence of structures, cable emplacement and maintenance, port utilization, lighting, and climate change. These IPFs address the direct and indirect impacts on marine mammals. Included in the analysis for the proposed Project are APMs intended to avoid and minimize impacts on marine mammals. In addition, the EIS considers mitigation measures for training regarding marine debris, implementing a passive acoustic monitoring plan, implementing a pile-driving monitoring plan and an alternative monitoring plan for pile driving, and vehicle speed restrictions, which are described in detail at the end of Section 3.15. Potential effects on federally listed threatened and endangered birds are discussed at a high level in Draft EIS Section 3.15, but BOEM's BA, a document required for federal actions that may affect federally listed threatened and endangered species, provides in-depth analysis of the Project's effects on each individual species of marine mammal. BOEM continues to consult with NMFS on potential impacts on federally listed threatened and endangered marine mammals.
Submission IDs contributing to comment summary: 0058-0002; 0175-0009; 0210-0006; 0305-0001; 0390-0016; 0445-0001; 0634-0002; 0913-0001; 0962-0007; 0984-0102; 0984-0105; 1048-0001; 1109-0002; 1112-0001; 1193-0001; 1251-0001; 1251-0002; 1259-0006; 1259-0064; 1259-0065; 1259-0066; 1259-0074; 1259-0076; 1259-0077; 1259-0086; 1259-0087; 1278-0019; TRANS-0002-0002; TRANS-0003-0002; TRANS-0041-0004; TRANS-0041-0006; TRANS-0065-0001; TRANS-0080-0005; TRANS-0080-0006; TRANS-0089-0003
Comment Summary 2: Several comments noted that Ocean Wind is supporting development of a program at Stockton University that will train local individuals to be protected species observers. This program will prepare students to participate in the offshore wind industry and is important to monitoring marine mammals and ecosystem dynamics throughout the wind farm development and installation process.
Response: Comment noted. Refer to Final EIS Appendix H, *Mitigation and Monitoring*, for additional information regarding protected species observer training and requirements.
Submission IDs contributing to comment summary: 1190-0007; TRANS-0009-0001

O.7.15 Navigation and Vessel Traffic

Table O.7-13 General Comments on Navigation and Vessel Traffic

General Comment Summaries and Responses
Comment Summary 1: Commenters expressed concern regarding the impact that turbine interference will have on radar and marine navigation.
Response: This topic is covered in depth in Appendix M of the COP (NSRA) and in EIS Section 3.17, *Other Uses (Marine Minerals, Military Use, Aviation).* Current studies indicate that the effects on marine radar, communications, and positioning systems are minor.
Submission IDs contributing to comment summary: TRANS-0003-0008; TRANS-0068-0005; 0175-0010
Comment Summary 2: A commenter expressed concerns of future restrictions on anglers with regard to the WTGs.
Response: This topic is covered in depth in Section 2.34 of the COP, *Commercial Fisheries and For-Hire Recreational Fishing*. Ocean Wind conducted visits to various fishing interests involved in the area of the Project. Forty-seven interviews were held with commercial and recreational fishers between July 2019 and January 2020. From those interviews it was determined that there is very little commercial fishing taking place in the Lease Area. A majority of commercial fishing that does occur in the Project vicinity includes squid and groundfish trawls, conch and lobster pots, and clam and scallop dredging; therefore, there is no foreseeable need for additional regulations.
Submission IDs contributing to comment summary: 0488-0001
Comment Summary 3: A commenter expressed concern over the authorities of BOEM and USCG with shipping lanes versus transit lanes as presented as a buffer zone between the Atlantic Shores and Ocean Wind 1 projects.
Response: Subsequent to publication of the Draft EIS, Ocean Wind submitted an updated COP incorporating an array layout compression scenario analyzed under Alternative C-2, Wind Turbine Layout Modification to Establish a Buffer Between Ocean Wind 1 and Atlantic Shores South. This array layout compression scenario, depicted on Figure 2-9 of the Draft EIS, would modify the WTG array layout by compressing the WTG array layout to create a 0.81-nm buffer. The Final EIS notes that a Memorandum of Understanding has been executed between Ocean Wind and Atlantic Shores, LLC for this compressed array layout scenario. There is no mention of either a transit zone or a shipping lane.
Submission IDs contributing to comment summary: 0984-0023
Comment Summary 4: A commenter expressed concern over the probability of increased vessel collisions.
Response: Appendix M of the COP is the NSRA that was conducted for this Project. As part of the risk analysis, extensive modeling was done based on the anticipated increase in marine traffic and it was determined that the modeled risk increase is 0.40 accident per year, 72 percent of which are groundings, primarily of pleasure vessels. The NSRA did not identify any major areas of concern regarding the impact on marine navigation. Additional information about the NSRA is in Section 3.16.5. Details about the NSRA development and conformance with USCG guidelines for key areas of inquiry such as vessel traffic and assessment of navigation within or close to Project structures are in Appendix F of the NSRA.
Submission IDs contributing to comment summary: 1278-0018

O.7.16 Other Uses (Marine Minerals, Military Use, Aviation)

There were no general comments coded to other uses.

O.7.17 Recreation and Tourism

Table O.7-14 General Comments on Recreation and Tourism

General Comment Summaries and Responses
Comment Summary 1: Commenters expressed concern that the presence of the WTGs would cause a decrease in vacation rentals in the region, as vacationers would choose beaches without an “industrial landscape” when choosing a vacation rental location.
Response: Thank you for your comment. Additional information on the potential impacts of the Proposed Action on the vacation rental market was added to the Final EIS.
Submission IDs contributing to comment summary: 1048-0005; 1112-0005
Comment Summary 2: Commenters expressed both general concern with how the presence of WTGs would negatively affect fishing and support for the additional fishing opportunities the WTGs would create through the reef effects.
Response: Thank you for your comment. As described in Section 3.18.5, *Impacts of the Proposed Action on Recreation and Tourism*, the presence of WTGs is expected to have both negative impacts, where offshore recreational anglers may not feel comfortable navigating within the wind farm, and positive impacts through the creation of artificial reefs, which would attract fish. Onshore anglers are not anticipated to be affected by Project infrastructure.
Submission IDs contributing to comment summary: 0660-0001; TRANS-0031-0002
Comment Summary 3: Commenters expressed concerns that the presence of the WTGs and potential visual impacts would cause a decrease in tourism, as they state visitors would choose beaches without WTGs. They indicate that a decrease in tourism would have lasting effects on local economies.
Response: Thank you for your comment. Additional information was added to the Final EIS about the economic impacts of a potential decrease in tourism. Further information on potential visual impacts can be found in Section 3.20, *Scenic and Visual Resources*.
Submission IDs contributing to comment summary: 0390-0004; 0633-0003; 0635-0002; 0636-0002; TRANS-0080-0003
Comment Summary 4: A commenter expressed support for the increased tourism opportunities they feel the Project would create, such as tours of the WTGs.
Response: Thank you for your comment.
Submission IDs contributing to comment summary: 1230-0004
Comment Summary 5: Several comments believe the potential visual impacts associated with the Project would not have an effect on tourism. Some commenters pointed to the fact there are already industrial structures that can be seen from the shore.
Response: Thank you for your comment.
Submission IDs contributing to comment summary: 0157-0002; 0212-0001; 0212-0004
Comment Summary 6: Several commenters provided thoughts on how the visual impacts of the Project would negatively and positively affect real estate prices and property values.
Response: Thank you for your comment. Additional information on the potential impacts of the Proposed Action on the vacation rental market was added to the Final EIS. Further information on economic impacts associated with the Project can be found in Section 3.11, *Demographics, Employment, and Economics.*
Submission IDs contributing to comment summary: 0212-0005; 0652-0003; 0660-0002
Comment Summary 7: Several commenters expressed general disapproval of the Project because of potential impacts on recreation and tourism.
Response: Thank you for your comment. Detailed information on the potential impacts of the Project on recreation and tourism can be found in Section 3.18, *Recreation and Tourism.*

General Comment Summaries and Responses
Submission IDs contributing to comment summary: 0656-0001; 0658-0006; TRANS-0080-0010
Comment Summary 8: A commenter expressed concern that the sound waves from the WTGs would lead to an increase in shark attacks, which would affect recreation and tourism on the Jersey Shore.
Response: Thank you for your comment. An increase in shark attacks is not expected as a result of the Project and was not analyzed in detail in Section 3.18, *Recreation and Tourism*. Further information on the impacts on marine species can be found in Section 3.15, *Marine Mammals*, and Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*.
Submission IDs contributing to comment summary: TRANS-0016-0001

O.7.18 Sea Turtles

There were no general comments coded to sea turtles.

O.7.19 Scenic and Visual Resources

Table O.7-15 General Comments on Scenic and Visual Resources

General Comment Summaries and Responses
Comment Summary 1: Several commenters expressed opposition to the Project due to impacts on visual quality and urged BOEM to move the Project farther offshore so that nothing is visible from shore. Commenters offered a range from 17 miles offshore to 50 miles offshore as the appropriate distance to reduce visual impacts. Their primary concern is that having WTGs within view will destroy the pristine vista, ruin sunrises and sunsets, and have a detrimental impact on housing values and tourism. Some also expressed concern about the lighting at night affecting the view of the stars and posing a risk of seizure.
Response: Thank you for your comment. Alternatives raised during scoping that would relocate the Project outside Lease Area OCS-A 0498 would not meet BOEM's purpose and need as explained in EIS Section 2.1.7, *Alternatives Considered but not Analyzed in Detail* (Table 2-3). The visibility of the WTGs from coastal areas would be variable depending on meteorological, moonlight, and sunlight conditions. In views seaward from the shoreline there will be periods of high, moderate, low, and no visibility. Section 3.20 of the Final EIS has been updated to include the results of a Capital Airspace Group analysis that estimated ADLS-controlled obstruction lights would be activated for 1 hour 19 minutes and 17 seconds over a 1-year period based on historical air traffic data.
Submission IDs contributing to comment summary: 0018-0001; 0047-0003; 0135-0002; 0135-0003; 0390-0002; 0390-0006; 0489-0001; 0623-0001; 0633-0002; 0637-0001; 0641-0002; 0667-0001; 0668-0001; 0669-0001; 0671-0001; 0672-0001; 0673-0001; 0674-0001; 0678-0001; 0679-0001; 0681-0001; 0682-0001; 0688-0001; 0690-0001; 0691-0001; 0693-0001; 0701-0001; 0703-0001; 0704-0001; 0705-0001; 0706-0001; 0707-0001; 0709-0001; 0713-0001; 0715-0001; 0717-0001; 0719-0001; 0720-0001; 0732-0001; 0735-0001; 0750-0001; 0761-0001; 0849-0001; 0935-0001; 0945-0001; 0973-0001; 0978-0001; 0985-0001; 0992-0001; 1048-0004; 1071-0017; 1071-0019; 1111-0001; 1112-0004; 1117-0001; 1182-0001; 1236-0001; 1255-0001; TRANS-0067-0001; TRANS-0075-0002
Comment Summary 2: Some commenters are of the opinion that the visual impact will be minimal and any impact on visual quality is acceptable in order to make progress toward renewable energy. Some stated that the lights used on the WTGs at night would only be visible to boats and airplanes but not to people onshore. Other commenters claimed that being able to see the WTGs would not be any worse than seeing the shipping barges that frequent the horizon.

General Comment Summaries and Responses
Response: Thank you for your comment. EIS Section 3.20 concludes that the visibility of the WTGs from coastal areas would be variable depending on meteorological, moonlight, and sunlight conditions. In views seaward from the shoreline there will be periods of high, moderate, low, and no visibility. Section 3.20 of the Final EIS has been updated to include the results of a Capital Airspace Group analysis that estimated ADLS-controlled obstruction lights would be activated for 1 hour 19 minutes and 17 seconds over a 1-year period based on historical air traffic data. BOEM expects that viewer experience from offshore and onshore KOPs would range from negligible to major (Section 3.20, Table 3.20-12).
Submission IDs contributing to comment summary: 0058-0004; 0063-0003; 0139-0005; 0432-0003; 0694-0001; 1230-0004; 1280-0003

O.7.20 Water Quality

Table O.7-16 General Comments on Water Quality

General Comment Summaries and Responses
Comment Summary 1: Three comments generally expressed concern with impacts on Barnegat Bay, Tuckahoe River, Tuckahoe Wildlife Management Area, and the Oyster Creek Nuclear Power Plant Station. These comments do not raise any specific concern regarding the conclusions or adequacy of the Draft EIS.
Response: Existing conditions of Barnegat Bay and potential impacts on water quality throughout the life of the Project (including Barnegat Bay) are addressed in Draft EIS Section 3.21, *Water Quality*. No part of the proposed Project is sited within the Tuckahoe Wildlife Management Area or the Tuckahoe River. No part of the Project is sited on the former location of the Oyster Creek Nuclear Power Plant. The interconnection and substation would be sited across the river from the plant in previously disturbed areas. If BOEM approves the Project, Ocean Wind would need to obtain the applicable New Jersey Pollutant Discharge Elimination System permits to ensure water quality standards are not exceeded during construction and operations.
Submission IDs contributing to comment summary: 1192-0018; 1192-0026; 1259-0100

O.7.21 Wetlands

Table O.7-17 General Comments on Wetlands

General Comment Summaries and Responses
Comment Summary 1: Three comments expressed general concern with potential impacts on wetlands. These comments do not raise any specific concern regarding the conclusions or adequacy of the Draft EIS.
Response: Draft EIS Section 3.22, *Wetlands*, addresses potential wetland impacts from construction, O&M, and decommissioning of the proposed Project.
Submission IDs contributing to comment summary: 0533-0004; 1278-0001; TRANS-0003-0006

O.7.22 Mitigation and Monitoring

Table O.7-18 General Comments on Mitigation and Monitoring

General Comment Summaries and Responses
Comment Summary 1: Commenters requested that onshore impacts associated with HDD specifically, and that impacts of Project construction and operation generally, be monitored and mitigated to reduce impacts and that responsibility for mitigation should be transferable and financially supported. Commenters also requested clarification of specific mitigation proposed and who is responsible for net loss of resources, and how claims would be managed in the event of damage to natural resources or private property.
Response: Thank you for your comment. Appendix H identifies all specific mitigation proposed for the Project, the anticipated enforcing agency for each proposed measure, and reporting requirements where applicable.
Submission IDs contributing to comment summary: 0984-0039; TRANS-0078-0003; 1275-0017; 1275-0016; 1087-0004

O.7.23 Planned Activities Scenario/Cumulative Impacts

Table O.7-19 General Comments on the Planned Activities Scenario/Cumulative Impacts

General Comment Summaries and Responses
Comment Summary 1: Commenters suggested that BOEM should consider the foreseeable impacts of onshore clean energy development and the benefits that onshore clean energy development would have for combating climate change, or that the benefits of offshore wind for combating climate change would not be great enough to offset the risks. Commenters stated that the cumulative impacts of multiple offshore wind projects would be significant and irreversible and that the impacts of mining rare-earth minerals outside the United States would also be significant. Commentors stated that specialized vessels that meet the requirements of the Jones Act could not be contracted and built within proposed timeframes, which will put pressure on the supply chain, and that other economic or environmental constraints would make offshore wind development infeasible. Commenters raised concerns that offshore wind would be less reliable and more expensive compared to other sources of electricity generation. Commenters stated that projects should not be analyzed as stand-alone projects but as a whole over a larger area, including the cumulative impacts of 25 different offshore wind projects.
Response: Thank you for the comment. The Ocean Wind 1 EIS analyzes the impact of the Proposed Action and action alternatives in combination with other ongoing and planned activities (including other non-offshore wind and offshore-wind activities) as described Appendix F, *Planned Activities Scenario*. All ongoing and planned offshore wind projects described in Appendix F are understood to be technically feasible and the details of each ongoing or planned project used to develop the cumulative scenario are outlined in Appendix F, Attachment 2, *Maximum-case Scenario Estimates for Offshore Wind Projects*. These estimates were used to quantify aspects of project design that would contribute to cumulative impacts such as WTG and OSS count; volume of fuel, oil, lubricants, and coolants associated with WTGs and OSS; acreage of cable or scour protection; and acreage of seafloor disturbance associated with cable emplacement and anchoring. The Final EIS presents a complete description and analysis of impacts from ongoing activities and trends (i.e., No Action Alternative) and impacts from the Proposed Action and action alternatives. The No Action Alternative provides a current baseline for analysis of impacts from the action alternatives. A separate analysis of the No Action Alternative when combined with future planned activities (i.e., cumulative actions) provides the future baseline as a basis for comparison of the cumulative impacts of the action alternatives. A comparative analysis of costs and reliability of offshore wind compared to other sources of energy generation is outside the scope of this EIS.

General Comment Summaries and Responses
Submission IDs contributing to comment summary: 0007-0002; 0018-0003; 0047-0006; 0965-0002; 0984 (multiple); 1012-0002; 1086-0022; 1110-0001; 1012-0002; 1193-0003; 1271-0001; 1272-0004; TRANS-0081-0004; TRANS-0103-0002

O.7.24 National Environmental Policy Act/Public Involvement Process

Table O.7-20 General Comments on the National Environmental Policy Act/Public Involvement Process

General Comment Summaries and Responses
Comment Summary 1: Commenters requested that BOEM extend the comment period for the Draft EIS. These requests varied in duration, with the majority of commenters requesting an additional 60 days, some requesting at least 3 months, and a few commenters requesting 6 months. Commenters attested that 45 days was not long enough to review an EIS this large and complex and provide meaningful feedback. Several commenters indicated that the summer was not an appropriate time to have this review period, as many people are not available to comment and organizations do not meet over the summer. Some commenters claimed that the EIS was incomplete and had too many references to other studies not provided that would require additional time to collect and review. A small number of commenters indicated a comment period extension was necessary because COVID-19 limited public engagement. Commenters also indicated that the comment period for the Ocean Wind 1 Draft EIS overlapping with the review period for other projects such as a fishery mitigation plan and the newly announced New York Bight Programmatic EIS was extremely overwhelming and made it difficult to provide meaningful comments. Overall, commenters were concerned that this Project is being fast tracked and the public has not received sufficient time to review and provide comment.
Response: BOEM, in its role as NEPA lead agency, circulated the Draft EIS consistent with the CEQ's NEPA Implementing Regulations, which state that "agencies shall allow at least 45 days for comments on draft statements" (40 CFR 1506.11). The Draft EIS was originally made available for review and comment for 45 days beginning June 24, 2022, and ending August 8, 2022. In response to interested party requests, BOEM announced on August 5, 2022, the extension of the comment period by 15 days to end on August 23, 2022. The time provided, including the 15-day comment period extension, was a total of 60 days and was sufficient for the public to review and provide comments on the Draft EIS. The efficiency of the NEPA process is dependent on completing the analysis and making the document available to the public in a timely manner. As described in the NEPA regulations, an agency should commence preparation of an EIS as close as practicable to the time the agency received a proposal so that the Final EIS can contribute to the decision-making process (40 CFR 1502.5). It would not be feasible for BOEM to delay the analysis or the EIS to avoid having a comment period over the summer months or coinciding with nearby projects.
Submission IDs contributing to comment summary: 0007-0004; 0007-0007; 0007-0014; 0009-0001; 0010-0001; 0013-0001; 0016-0001; 0283-0001; 0487-0004; 0487-0006; 0948-0001; 1241-0001; 1259-0004; 1259-0017; 1275-0001; 1281-0001; TRANS-0001-0001; TRANS-0002-0007; TRANS-0002-0008; TRANS-0003-0001; TRANS-0003-0009; TRANS-0004-0006; TRANS-0025-0001; ; TRANS-0026-0007; TRANS-0038-0002; TRANS-0040-0001; TRANS-0041-0007; TRANS-0041-0011; TRANS-0042-0001; TRANS-0042-0004; TRANS-0042-0006; TRANS-0069-0007; TRANS-0075-0006; TRANS-0081-0001; TRANS-0095-0003; TRANS-0097-0001; TRANS-0102-0001; TRANS-0103-0001

O.7.25 Accidental Releases

Table O.7-21 General Comments on Accidental Releases

General Comment Summaries and Responses
Comment Summary 1: Several commenters were generally concerned that the WTGs run on hydraulic fluid and oil and this poses a risk of spills or leaks, especially during hurricanes and storms.
Response: EIS Section 2.2, *Non-Routine Activities and Events*, identifies severe weather and storm events as potential non-routine activities and events that could occur during construction and installation, O&M, or decommissioning of the Ocean Wind 1 Project. See EIS Section 3.21, *Water Quality*, for analysis of potential impacts associated with accidental release of fuel, oil, lubricants, and coolants contained in WTGs and OSS.
Submission IDs contributing to comment summary: 0210-0008; 1048-0003; 1112-0003; 1258-0054; TRANS-0075-0001

O.7.26 General Support or Opposition

Table O.7-22 Comments Reflecting General Support or Opposition

General Comment Summaries and Responses
Comment Summary 1: Many commenters expressed support for the Project, indicating that it is a step in the right direction to meeting the current and future energy demands of both the state and the country. Commenters stated that offshore wind, and this Project specifically, will help combat global climate change, which is wreaking havoc on the East Coast. Several commenters felt that the benefits of this Project far outweigh any negative impacts and, for this reason, BOEM should not select the No Action Alternative. Several commenters indicated that the aesthetic impacts are not a reason to reject the Project and some commenters claim the offshore wind farms are beautiful. Others indicated that while they understand the concern for wildlife, climate change poses a larger threat to wildlife that projects like this will help reduce.
Response: Thank you for your comment. BOEM acknowledges your support for the Project.
Submission IDs contributing to comment summary: 0005-0001; 0006-0001; 0003-0005; 0003-0006; 0008-0001; 0014-0001; 0015-0001; 0017-0001; 0024-0002; 0024-0003; 0033-0001; 0034-0001; 0035-0001; 0049-0001; 0050-0001; 0053-0001; 0055-0002; 0056-0001; 0057-0001; 0059-0004; 0061-0001; 0063-0001; 0063-0004; 0064-0001; 0065-0001; 0066-0001; 0067-0001; 0068-0001; 0069-0001; 0070-0001; 0071-0001; 0072-0001; 0073-0001; 0074-0001; 0075-0001; 0076-0001; 0077-0001; 0078-0001; 0079-0001; 0081-0001; 0082-0001; 0083-0001; 0084-0001; 0086-0001; 0087-0001; 0089-0001; 0090-0002; 0091-0001; 0093-0001; 0096-0001; 0097-0001; 0097-0002; 0098-0002; 0101-0002; 0110-0001; 0110-0002; 0113-0001; 0115-0001; 0116-0001; -0117-0001; 0118-0001; 0119-0001; 0121-0001; 0124-0001; 0125-0001; 0126-0001; 0128-0001; 0129-0001; 0130-0001; 0131-0001; 0132-0001; 0134-0001; 0136-0001; 0138-0002; 0138-0005; 0146-0001; 0157-0001; 0174-0001; 0176-0001; 0177-0001; 0180-0001; 0182-0001; 0183-0001; 1186-0001; 0194-0001; 0201-0001; 0207-0001; 0208-0001; 0209-0001; 0211-0001; 0212-0007; 0213-0001; 0223-0001; 0242-0001; 0254-0001; 0259-0001; 0282-0001; 0284-0001; 0284-0002; 0284-0003; 0284-0005; 0294-0001; 0298-0001; 0300-0001; 0307-0001; 0307-0002; 0307-0003; 0307-0004; 0314-0001; 0315-0001; 0326-0001; 0335-0001; 0372-0001; 0374-0001; 0427-0001; 0428-0001; 0430-0001; 0432-0001; 0435-0001; 0437-0001; 0438-0001; 0439-0001; 0443-0001; 0446-0001; 0458-0001; 0480-0001; 0488-0003; 0512-0001; 0518-0001; 0532-0001; 0533-0001; 0533-0002; 0533-0005; 0565-0001; 0571-0001; 0577-0001; 0590-0001; 0592-0001; 0593-0001; 0598-0003; 0606-0001; 0617-0001; 0619-0001; 0641-0001; 0642-0001; 0654-0001; 0698-0001; 0740-0001; 0751-0001; 0907-0001; 0924-0001; 0939-0001; 0939-0003; 0950-0004; 0951-0002; 0951-0003; 0980-0002; 0991-0001; 1015-0001; 1040-0001; 1040-0007; 1087-0005; 1125-0001; 1125-0014; 1154-0001; 1157-0001; 1157-0002; 1158-0001; 1173-0001; 1184-0001; 1186-0001; 1186-0002; 1190-0001; 1228-0002; 1230-0002; 1230-0005; 1246-0001; 1247-0001; 1247-0006; 1258-0025; 1264-0001; 1264-0002;

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1266-0002; 1266-0004; 1268-0001; 1277-0001; 1280-0001; 1280-0002; TRANS-0007-0001; TRANS-0007-0005; TRANS-0008-0002; TRANS-0008-0003; TRANS-0011-0001; TRANS-0011-0004; TRANS-0012-0001; TRANS-0012-0004; TRANS-0013-0001; TRANS-0013-0002; TRANS-0013-0003; TRANS-0014-0002; TRANS-0014-0003; TRANS-0015-0001; TRANS-0015-0002; TRANS-0015-0005; TRANS-0015-0006; TRANS-0017-0001; TRANS-0019-0001; TRANS-0019-0003; TRANS-0020-0001; TRANS-0021-0001; TRANS-0022-0001; TRANS-0023-0001; TRANS-0023-0003; TRANS-0024-0001; TRANS-0028-0001; TRANS-0028-0005; TRANS-0028-0006; TRANS-0030-0001; TRANS-0030-0004; TRANS-0031-0003; TRANS-0032-0001; TRANS-0034-0001; TRANS-0035-0001; TRANS-0037-0001; TRANS-0037-0003; TRANS-0037-0004; TRANS-0039-0001; TRANS-0043-0001; TRANS-0045-0001; TRANS-0045-0002; TRANS-0063-0001; TRANS-0064-0001; TRANS-0071-0002; TRANS-0076-0003; TRANS-0082-0002; TRANS-0084-0004; TRANS-0087-0004; TRANS-0088-0001; TRANS-0089-0004; TRANS-0092-0003; TRANS-0096-0001; TRANS-0098-0001; TRANS-0099-0001; TRANS-0100-0001; TRANS-0101-0001; TRANS-0104-0001; TRANS-0105-0001; TRANS-0106-0001
Comment Summary 2: Several commenters provided general statements about the proposed Project such as the capacity or the location of the Lease Area, provided information about the commenting agency or organization, or expressed appreciation to BOEM for the opportunity to provide comments on the Project.
Response: Thank you for your comments.
Submission IDs contributing to comment summary: 1119-0004; 1203-0001; 1207-0008; 1222-0001; 1243-0002; 1248-0001; 1259-0050; 1259-0079; TRANS-0005-0001
Comment Summary 3: Many commenters expressed opposition to the Project with general concerns for the environment, the economy, and the view. Many suggest that the visual impact from the Project would be severe and would ruin the pristine and natural beaty of the coastline. Some commenters recognize the need for renewable energy but recommend moving the Project at least 30 miles offshore where it could not be seen and would have fewer impacts on sea life; some suggest the Hudson South Call Area as an alternative location. Many are concerned that the aesthetic impacts would result in significantly reduced tourism and a decline in property values. Others worry that the impacts on commercial fishing will also drive that reduction in tourism. Many commenters are most concerned with the impacts on marine life including whales, birds, sea turtles, fish, dolphins, and the ocean floor. specifically that the Project would affect migration pathways and breeding grounds for these important species. Some commenters claim that this Project (and offshore wind in general) would do nothing to combat climate change and is inferior to existing energy options. Some suggest the funding should instead go toward nuclear energy, natural gas, or onshore wind in other areas. A few commenters expressed concern that the electricity rates would rise to the point of making living in the area unaffordable. Some commenters are concerned about the risk of oil spills, ice on the blades during the winter, and the amount of waste generated. Others mention concerns about cables and the threat of radiation. Some commenters claim that many people are not aware of this Project, that it is being rushed for political gains and corporate greed, and that it is not in the public's best interest. Some commenters suggested the use of a pilot-scale project before rushing through approval of such a large-scale project. Others suggest waiting to implement technological improvements such as bladeless or floating turbines. Overall, many commenters opposed to the Project either do not believe that there will be any benefits for the people of New Jersey or believe that the negatives far outweigh any benefits.
Response: Thank you for your comments. More detailed and specific comments were provided on many of these topics and are included and addressed within those topics. BOEM acknowledges your opposition to the Project based on these general concerns.
Submission IDs contributing to comment summary: 0006-0001; 0011-0007; 0012-0001; 0021-0001; 0022-0001; 0047-0001; 0080-0001; 0085-0001; 0114-0001; 0123-0001; 0137-0001; 0153-0001; 0210-0004; 0210-0009; 0222-0001; 0316-0001; 0317-0001; 0325-0001; 0327-0001; 0350-0001; 0373-0001; 0375-0001; 0389-0001; 0390-0024; 0390-0026; 0391-0001; 0392-0001; 0393-0001; 0404-0001; 0426-0001; 0431-0001; 0434-0001; 0440-0001; 0441-0001; 0442-0001; 0447-0001; 0448-0001; 0449-

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0001; 0462-0001; 0490-0001; 0509-0001; 0510-0001; 0511-0001; 0513-0001; 0514-0001; 0550-0001; 0562-0001; 0605-0001; 0607-0001; 0618-0001; 0620-0001; 0622-0001; 0624-0001; 0625-0001; 0626-0001; 0628-0001; 0629-0001; 0630-0001; 0631-0001; 0631-0002; 0632-0001; 0633-0001; 0634-0001; 0635-0001; 0636-0001; 0638-0001; 0639-0001; 0640-0001; 0643-0001; 0644-0001; 0645-0001; 0646-0001; 0646-0002; 0646-0003; 0652-0001; 0652-0004; 0653-0001; 0654-0001; 0655-0001; 0657-0001; 0661-0002; 0662-0001; 0663-0001; 0665-0001; 0666-0001; 0680-0001; 0689-0001; 0691-0002; 0691-0003; 0692-0001; 0693-0002; 0695-0001; 0696-0001; 0697-0001; 0699-0001; 0700-0001; 0702-0001; 0708-0001; 0710-0001; 0711-0001; 0712-0001; 0718-0001; 0722-0001; 0723-0001; 0724-0001; 0725-0001; 0726-0001; 0727-0001; 0730-0001; 0731-0001; 0733-0001; 0734-0001; 0736-0001; 0738-0001; 0739-0001; 0741-0001; 0742-0001; 0743-0001; 0744-0001; 0745-0001; 0746-0001; 0749-0001; 0752-0001; 0754-0001; 0755-0001; 0756-0001; 0757-0001; 0758-0001; 0759-0001; 0760-0001; 0762-0001; 0763-0001; 0767-0001; 0768-0001; 0833-0001; 0834-0001; 0843-0001; 0845-0001; 0896-0001; 0900-0001; 0906-0001; 0911-0001; 0912-0001; 0923-0001; 0931-0001; 0933-0001; 0936-0001; 0940-0001; 0945-0002; 0946-0001; 0947-0001; 0948-0005; 0953-0001; 0960-0001; 0961-0001; 0962-0001; 0962-0003; 0962-0009; 0962-0010; 0963-0001; 0964-0001; 0966-0001; 0968-0001; 0969-0001; 0970-0001; 0971-0001; 0972-0001; 0974-0001; 0976-0001; 0984-0050; 0984-0051; 0988-0001; 1000-0001; 1004-0001; 1008-0002; 1012-0001; 1049-0009; 1048-0011; 1071-0020; 1105-0001; 1107-0001; 1109-0001; 1109-0006; 1112-0007; 1112-0008; 1113-0001; 1114-0001; 1116-0002; 1117-0003; 1120-0001; 1121-0001; 1182-0002; 1183-0001; 1185-0001; 1189-0001; 1191-0001; 1193-0004; 1202-0002; 1205-0001; 1216-0001; 1230-0003; 1231-0001; 1232-0001; 1235-0001; 1238-0001; 1239-0001; 1240-0001; 1242-0001; 1243-0001; 1243-0006; 1244-0001; 1249-0001; 1250-0001; 1251-0004; 1253-0001; 1255-0001; 1257-0001; 1259-0001; 1262-0001; 1263-0001; 1270-0001; 1275-0006; 1278-0002; TRANS-0001-0002; TRANS-0001-0003; TRANS-0004-0002; TRANS-0026-0001; TRANS-0026-0006; TRANS-0027-0001; TRANS-0027-0002; TRANS-0038-0004; TRANS-0049-0001; TRANS-0051-0001; TRANS-0056-0001; TRANS-0070-0001; TRANS-0080-0007; TRANS-0080-0008; TRANS-0083-0001; TRANS-0084-0001

O.7.27 Other Comments

Table O.7-23 Other General Comments

General Comment Summaries and Responses
Comment Summary 1: One commenter notes that the Department of Energy has funded a program called AWAKEN that can provide critical information regarding wake to project developers.
Response: Thank you for your comment.
Submission IDs contributing to comment summary: 1267-0006
Comment Summary 2: One commenter stated that BOEM identifies wind energy area sites without consideration of their adverse environmental impacts in the original lease selection, or that the scope of the review is too limited. The commenter observed that criteria are weighted differently across offshore wind lease areas and recommends that a consistent approach be used across offshore wind lease areas.
Response: Thank you for your comment. BOEM policies related to siting offshore wind lease areas are outside the scope of the Ocean Wind 1 EIS.
Submission IDs contributing to comment summary: 1234-0001
Comment Summary 3: One commenter recommended that BOEM develop measures or metrics to quantify the four-level classification of impacts. The commenter asserts that unquantifiable impact conclusions are not acceptable.

General Comment Summaries and Responses
Response: Refer to EIS Section 3.4, *Definition of Impact Levels*, which provides an explanation of the four-level classification scheme used to characterize potential beneficial and adverse impacts of alternatives. The classification of impacts considers the quantitative and qualitative impact analysis presented in each resource section.
Submission IDs contributing to comment summary: TRANS-0079-0006

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O.8. Form Letters

O.8.1 Form Letter 1

Table O.8-1 Form Letter 1

Form Letter 1
Dear Director Amanda Lefton, Offshore wind has the potential to drive economic recovery and stimulate coastal economies up and down the East Coast. As we begin recovering from the unprecedented social and economic impact of the COVID-19 pandemic, the approval of Ørsted's Ocean Wind 1 offshore project, developed jointly with PSEG, will help create a cleaner, greener, more sustainable New Jersey. I support responsibly sited offshore wind – it will not only help reduce our massive carbon footprint, but it also represents economic opportunity as well as community benefits. The Ocean Wind 1 project is a real opportunity to drive both New Jersey and the nation's clean energy future – and will contribute significantly to the state's renewable energy goals by providing enough energy to power an average of 500,000 homes annually. I am aware that BOEM considered 26 alternatives when preparing the Draft Environmental Impact Statement (DEIS) for the Ocean Wind 1 project and carried forward six alternatives for further review. Within those six alternatives, there is one that BOEM should not consider – No Action. The No Action alternative would result in Ocean Wind 1 not being built, thereby increasing the state's dependency on fossil fuels while decreasing the environmental benefits set forth by the project. Not all offshore wind farms are created equal. The Ocean Wind 1 project is the culmination of exhaustive study and analysis by scientific experts and relevant federal and state agencies, as well as extensive public consultation and collaboration with local communities. The majority of the impacts of Ocean Wind 1, as highlighted in the DEIS, are determined to have negligible, minor adverse or beneficial impacts on several resources, including air quality, birds, bats, coastal habitat/fauna, economics land use/coastal infrastructure, sea turtles and water quality. Ocean Wind 1 will also help New Jersey reduce its reliance on fossil fuels while providing clean and reliable energy and infrastructure enhancements to the Garden State. Responsible offshore wind development projects, like Ocean Wind 1, should be moved forward with the urgency that the climate crisis demands. I understand the environmental concerns that offshore wind, a new and evolving industry presents to everyone concerned with the well-being of our natural resources, both in and out of the ocean. Ongoing engagement, education and outreach combined with plans to avoid and mitigate any disturbances are part of the process and I have full confidence in the plans set forth by Ocean Wind 1 in that regard. Offshore wind is critical to the future of our national security, environment, and economic recovery. As New Jersey's first offshore wind farm, Ocean Wind 1 will play a critical role in helping to further establish a domestic offshore wind industry and realizing the tremendous potential environmental and economic benefits of this rapidly emerging industry, both locally and nationally. We urge BOEM to stick to its published schedule for Ocean Wind 1 and make this project a reality.
Response: Thank you for your comment. BOEM acknowledges your support for the Project.
Submission IDs Associated with Form Letter 1: 1175; 1206; 1206; 1002; 0507; 0899; 1050; 0846; 0993; 0482; 0465; 0160; 0217; 0851; 1057; 0925; 0852; 0559; 0589; 1091; 0166; 1021; 1039; 0811; 0977; 1142; 0780; 1055; 1167; 0567; 0887; 0178; 0919; 0478; 1161; 0502; 0891; 0835; 0231; 0903; 0829; 0525; 0039; 1171; 0804; 0556; 0515; 0046; 0615; 0293; 0169; 1213; 0793; 0897; 0569; 0548; 0280; 0419; 0539; 1134; 0473; 0469; 0333; 0287; 1104; 1145; 1092; 0403; 0409; 0496; 1072; 1062; 0225; 0286; 1165; 0043; 0876; 1215; 0854; 0531; 0148; 1180; 0820; 0856; 0149; 0161; 0800; 0774; 0319; 0574; 0584; 1060; 0235; 1044; 0227; 0902; 0037; 1103; 1223; 0530; 1027; 0204; 0568; 0299; 1140; 0461; 0595; 0262; 1023; 0381; 0842; 0886; 0151; 0203; 0396; 0942; 0249; 0806; 1077; 0239; 0918; 0278; 0881; 0890; 0255; 0551; 0537; 0813; 1132; 0041; 0872; 1025; 0228; 0786; 0956; 1009;

Form Letter 1
0196; 0466; 0499; 0602; 1035; 1143; 0369; 0807; 1047; 0309; 0799; 0179; 0791; 0243; 1201; 0819; 0850; 1036; 0354; 0894; 0216; 0839; 0824; 1225; 0650; 0877; 0343; 0916; 0895; 1014; 0958; 0844; 0245; 0328; 1019; 0346; 0281; 0888; 0771; 0587; 0504; 0898; 0564; 1079; 0823; 1147; 1003; 0193; 0848; 0363; 0994; 0416; 0045; 0397; 0838; 0420; 0401; 0425; 1210; 0323; 0032; 0105; 0357; 0027; 0261; 0904; 1137; 0576; 1172; 1199; 0218; 0616; 0205; 1220; 0359; 0486; 1214; 0832; 0479; 0544; 0410; 0516; 0929; 0215; 0360; 1010; 0312; 1174; 1026; 0841; 1151; 0395; 1081; 0581; 0453; 0769; 0467; 1096; 0892; 0508; 0921; 0030; 0840; 1200; 1033; 0938; 0221; 0275; 0836; 0181; 0818; 1131; 0555; 1122; 0463; 0459; 0258; 0585; 1084; 1089; 1056; 0273; 1016; 1163; 0292; 0109; 0538; 0296; 1017; 0591; 0361; 0266; 0268; 0269; 0790; 1136; 0493; 0557; 1090; 0311; 0322; 0505; 0558; 0519; 1204; 1146; 1141; 0251; 0930; 0614; 0573; 0156; 0382; 0859; 0026; 0384; 0566; 0540; 0795; 0451; 0366; 1170; 0611; 0575; 0171; 0867; 0417; 0265; 0408; 0601; 1224; 0423; 0541; 0165; 0875; 0545; 0185; 0040; 1135; 1095; 0042; 0301; 0772; 0422; 1061; 0186; 1162; 0547; 0825; 0339; 0779; 0477; 1042; 0594; 0162; 1227; 1153; 1058; 1052; 0297; 0909; 1088; 0028; 0414; 0385; 1067; 0523; 0861; 0290; 0815; 0485; 0521; 0847; 0784; 0163; 0802; 0647; 0803; 0684; 0483; 1006; 1155; 0364; 0452; 0199; 1022; 1049; 0472; 0344; 0295; 0579; 0353; 0808; 1097; 0206; 0610; 0189; 0857; 0787; 0308; 0274; 0418; 0492; 1045; 0549; 0905; 1001; 0302; 0686; 0248; 1102; 1126; 0276; 0340; 0883; 0934; 0817; 0170; 1099; 0915; 0455; 0863; 0869; 0464; 0237; 0411; 0190; 0405; 0356; 0370; 0868; 0164; 0831; 0155; 0926; 0159; 1148; 1032; 1160; 0415; 0777; 0957; 0526; 1229; 0412; 1034; 0613; 1093; 0770; 0893; 0600; 0154; 0214; 0996; 0195; 1051; 0983; 1130; 1133; 0685; 0497; 0828; 0378; 0495; 0865; 0233; 0234; 1024; 0873; 0648; 0224; 1070; 1018; 0272; 0855; 0860; 1219; 0805; 0460; 1031; 0184; 0553; 1098; 0603; 1043; 0954; 0498; 1211; 0330; 0345; 0812; 0400; 0797; 1149; 0491; 0144; 1029; 0778; 0879; 0380; 1169; 0932; 0407; 0252; 1128; 0202; 1226; 0801; 0244; 0546; 0599; 0649; 0152; 0285; 0583; 1217; 0238; 0552; 0612; 0036; 1179; 0596; 0796; 0256; 0355; 0580; 0474; 0586; 0352; 1221; 0187; 0271; 0870; 0588; 0318; 0788; 1082; 0789; 0826; 1011; 1198; 0454; 0263; 1074; 0917; 0226; 1159; 1127; 0219; 0358; 0145; 0809; 0943; 0798; 1176; 0889; 0878; 0191; 0342; 0500; 0524; 0031; 0188; 0563; 1054; 0288; 0827; 1144; 0104; 0572; 1129; 0944; 0029; 0371; 0582; 0141; 0781; 0336; 0775; 0362; 0279; 1063; 0197; 0529; 0597; 0200; 1030; 0192; 1152; 0908; 0782; 0822; 0246; 0810; 0874; 0785; 0250; 1078; 0814; 0535; 0470; 0862; 1076; 0560; 0776; 0475; 0277; 0198; 0830; 0604; 0578; 0424; 0456; 0714; 0402; 0421; 1069; 0107; 0959; 0247; 0910; 0220; 0236; 0142; 0821; 0517; 0766; 1075; 0871; 0528; 0386; 1218; 0882; 0853; 0349; 0044; 0260; 1066; 0920; 0561; 1068; 0229; 1065; 0450; 1166; 0232; 1138; 0927; 0816; 0376; 1168; 1038; 0683; 0773; 0413; 1073; 0527; 0506; 0501; 0168; 0324; 1197; 0481; 1208; 0253; 0172; 1101; 0399; 0348; 0329; 0406; 0687; 1007; 0476; 1059; 0457; 0365; 0320; 0334; 0484; 0270; 0536; 1209; 0534; 0368; 0367; 0331; 0173; 0108; 0794; 0347; 0554; 0383; 0880; 0338; 0503; 0167; 0038; 0885; 0570; 0398; 0864; 0379; 0494; 1139; 0522; 1123; 0310; 1041; 0858; 0341; 1164; 0143; 0792; 0377; 0264; 0651; 0267; 1083; 0468; 0332; 1053; 0901; 0106; 0884; 0955; 0230; 0866; 0150; 1028; 0928; 0257; 0291; 0783

O.8.2 Form Letter 2

Table O.8-2 Form Letter 2

Form Letter 2
Offshore wind has the capacity to produce 2 times the amount of electricity the US consumed in 2019, and 90% of 2050 projections if we electrified our buildings, transportation system and industry. It is estimated that the offshore wind industry in the US will create 83,000 jobs and deliver $25 billion in annual economic input by 2030. Climate change is the greatest existing threat to wildlife: 1 million animal and plant species are threatened with extinction due to a rapidly changing environment. Switching from fossil fuels to wind and solar can reduce risks of asthma, heart disease, and other conditions that threaten lives and cause billions of dollars in healthcare costs. Nearly 1 in 4 children in Newark suffer from asthma, a preventable result of burning fossil fuels. Offshore wind will reduce greenhouse gasses and carbon emissions that worsen the impact of climate change. Tropical Storm Ida showed how devastating extreme weather events are for public health in New Jersey, with the number of victims who died during flooding now at 30. Fossil fuel production and combustion creates climate change that can directly affect human health, releasing pollutants that lead to early death, heart attacks, respiratory disorders, stroke, and exacerbation of asthma. Overwhelmingly, to serve our power needs, power plants are located in communities of color – unfair ‘sacrifice zones’ that are the direct result of environmental racism and must be redressed. States like New Jersey and Delaware have some of the worst air quality issues in the country. According to the American Lung Association, both states received poor air quality grades in 2019 and 2020, largely due to the factories, refineries and other industrial facilities in both states which release millions of pounds of chemicals into the air. With offshore wind farms, Delaware, New Jersey, and other Mid-Atlantic states will no longer need to rely on fossil fuels for their power. Instead, they will transition to clean and renewable wind energy, drastically reducing state carbon emissions and cleaning the air in communities most affected by pollution. Offshore wind farms are located far enough from the coastline - at least 9 miles out and usually 15-20 - that, if they are visible at all, the impact to the view will be minimal. The lights they’ll use at night will be visible to airplanes and boats but not to people on shore. The issue isn’t that the turbines might be seen from the shore. The real issue is: Unless New Jersey acts to combat climate change now, flooding from rising sea levels and continually increasing severe weather will end the Shore’s beauty and value as we know it.
Response: Thank you for your comment. BOEM acknowledges your support for the Project.
Submission IDs Associated with Form Letter 2: 0112; 0051; 0051; 0102; 0122; 0094; 0060

O.8.3 Form Letter 3

Table O.8-3 Form Letter 3

Form Letter 3
To the Bureau of Ocean Energy Management, I support responsibly developed offshore wind that all New Jerseyans benefit from, from the cities to the suburbs and everywhere in between. Flooding and extreme weather impact our lives, health, property, and infrastructure. We need to act now to update our infrastructure and transition to renewable energy like offshore wind. We all want a state that's cleaner, healthier, and more fair. Responsibly developed offshore wind means putting communities first by ensuring economic and environmental investments, community benefits and small business opportunities, and respectful coexistence with other ocean users and industries. Our communities should see good family-supporting jobs with project labor agreements, prevailing wage, and union neutrality agreements, and jobs for folks who have historically struggled to find good ones. We need to advocate for a coordinated efficient grid constructed between turbines and the shore with a minimum of cables that is as safe as possible. Local communities where cables come on shore should have a say in that process, as well as direct benefits We know that artificial reef sites work, giving fish a place to live, which in turn can give local fishery industries more fish to catch. The offshore wind sites therefore need to guarantee that recreational and commercial fishermen can still fish near the turbines. Also essential are wildlife protections with commitments to ongoing research and monitoring since we share the ocean not only with other humans, but with the wide variety of animal species who call it home. Most importantly, we need meaningful access to a seat at the table. Offshore wind is our chance to lead on sustainable, non-polluting energy right here in our own state. If done right, we're eager to welcome Ocean 1 to the Jersey Shore. Sincerely, Members of the New Jersey Resource Project
Response: Thank you for your comment. BOEM acknowledges your support for responsibly developed offshore wind. Multiple landfall locations are being considered as part of the Project to minimize disruption to residents and minimize impacts on the onshore environment. EIS Section 3.11, *Demographics, Employment, and Economics*, provides estimates of the anticipated job creation during construction and operation of the Proposed Action and concludes that the Proposed Action would result in beneficial employment and economic impacts related to job creation, expenditures on local businesses, tax revenues, grant funds, and support for additional regional offshore wind development. EIS Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*, discusses potential impacts on commercial fisheries and recreational fishing from the Proposed Action. Included in the analysis for the proposed Project are APMs intended to avoid and minimize impacts on commercial fisheries and for-hire recreational fishing. Appendix H identifies all specific mitigation measures proposed for the Project.
Submission IDs Associated with Form Letter 3: 1258* *Petition submitted by New Jersey Resource Project, 68 signatures including attached unique comments.

O.8.4 Form Letter 4

Table O.8-4 Form Letter 4

Form Letter 4
Program Manager, Office of Renewable Energy, Bureau of Ocean Energy Management 45600 Woodland Road, VAM-OREP Sterling, Virginia 20166 Re: Ocean Wind 1 DEIS ("Ocean Wind 1") We are homeowners who reside at the end of Beach Boulevard in the Bayside Beach section of Lacey Township, New Jersey. Literally, Barnegat Bay is our backyard! We write because the completion of Ocean Wind 1 could provide a valuable opportunity to not only complete our current shoreline restoration project, but to provide enhanced protection from the dire threat facing our shoreline and our community. The shoreline in front of our homes is approximately 3,000 linear feet long. For decades, many families enjoyed idyllic summers in this location, with children who grew up swimming, crabbing, and boating. In recent years, however, the surge in storms and sea level rise has caused significant erosion to this area. Google Earth historical records document well over 100 feet of erosion since 1995! This has brought the bay to our back doors, and if this project is not completed, both our shoreline and our homes will be lost. Our community has been working closely with the Stockton University Coastal Research Center (CRC) and the American Littoral Society (ALS) to implement a nature-based solution to restore our shoreline and mitigate the threats posed to our homes. Dr. Stewart Farrell, Director of the CRC, has outlined the three necessary steps required for successful restoration. First, is attenuating the wave energy hitting the shoreline and reducing the erosion rate using oyster reefs. These reefs act to reduce erosion while also enhancing the water quality and improving the bay floor habitat. This step has been implemented by ALS and the local community. The remaining steps include creating a vegetated berm along the shoreline using natural sediments from Barnegat Bay that have been sifted from this site and repairing the southerly terminal rock jetty to its original footprint. Repairing the rock jetty will keep the sediment in place and prevent it from being pulled by the bay into the local lagoons. To date, this is the largest living shoreline project to be built in New Jersey; however, we need to complete the rock jetty and vegetated berm. We understand that you may have an obligation to conduct mitigation projects to off-set potential damage(s) during your project. We feel that there is a potential for a win-win as you may be required to directional drill in front of the old Finninger's Farm (just south of our FR Beach project) and it could be a perfect fit for a sediment match or beneficial re-use of dredged materials to complete a living shoreline project that the NJ DEP wasn't able to fully fund in 2018. This project is already approved by the NJ DEP and has much of the preliminary engineering studies and permitting in-hand. Project partners have been trying to secure additional funding sources to complete the design and learned of your potential near-by project and the possibility of beneficial sediments. The project would directly impact nearby residents with the protection of their properties as well be beneficial to the ecosystem and an example of people working together for best outcomes. We would welcome a meeting between your representatives and our partners at any time. Thank you for your consideration.
Submission IDs Associated with Form Letter 4: 0737; 1005; 1005; 0997; 0979; 1106; 0982; 1282; 1283; 1276; 0998; 0999; 1261; 0986; 0304; 1094; 0747; 1260; 1279
Related Comments
0721-0001: Forked River Beach received a $1000000 grant and our community is working closely with Stockton University Coastal Research Center (Dr. Stewart Farrell) and the American Littoral Society (Capt. Al Modjeski - project coordinator) on this project. There are three steps for successful restoration and we are in the midst of the first step with the Hesco basket oyster reefs (24 reefs in all) for improved water quality reduced turbidity and sediment replenishment. The next step which is needed quickly is repairing/restoring the southerly terminal rock jetty to its original footprint to keep the

Form Letter 4
sediment in place and prevent it from continually being pulled into the local lagoons. The third step is creating a vegetated berm along the shoreline using the sediments from Barneget Bay and especially encouraging growth of protected eel grass which is critical to the survival of flounder and other marine creatures. During a recent update meeting on the restoration project there was a brief discussion about the windmill project that will utilize the former Oyster Creek Nuclear Power Plant facility. There is anticipated drilling that will take place just south of Forked River Beach at the former Finninger's Farm in order to bring connectivity to the former power plant and this drilling will be disruptive to the environment of our area. We feel there is a great opportunity for our community to work with the Bureau of Ocean Energy Management who may have an obligation to conduct mitigation projects to offset potential damage during the connectivity project. Forked River Beach is in dire need of funds/grants to restore the jetty/groin where the Forked River Beach intersects with the beginning of the lagoon system west of the beach. Dredged materials and rocks from your project could be transferred and used for the jetty eliminating the need for BOEM to find a disposal site. The entire shoreline project has already been approved by the DEP but there wasn't enough grant money available for Steps two and three. Our community would be happy to partner with the Bureau of Ocean Energy Management with this win-win proposal and would welcome an opportunity to meet with your representatives and our many project partners at any time in the near future.
0937-0001: During a recent update meeting on the restoration project there was a brief discussion about the windmill project that will utilize the former Oyster Creek Nuclear Power Plant facility. There is anticipated drilling that will take place just south of Forked River Beach at the former Finninger's Farm in order to bring connectivity to the former power plant and this drilling will be disruptive to the environment of our area. We feel there is a great opportunity for our community to work with the Bureau of Ocean Energy Management who may have an obligation to conduct mitigation projects to offset potential damage during the connectivity project. Forked River Beach is in dire need of funds/grants to restore the jetty/groin where the Forked River Beach intersects with the beginning of the lagoon system west of the beach. Dredged materials and rocks from your project could be transferred and used for the jetty eliminating the need for BOEM to find a disposal site. The entire shoreline project has already been approved by the DEP but there wasn't enough grant money available for Steps two and three. Our community would be happy to partner with the Bureau of Ocean Energy Management with this win-win proposal and would welcome an opportunity to meet with your representatives and our many project partners at any time in the near future.
1037-0001: Currently there is a shoreline restoration project on which we have worked closely with Stockton University Coastal Research Center and the American Littoral Society to implement a nature based solution to restore our shoreline and the threat of Barnegat Bay coming closer to our homes. Oyster reefs are being used to reduce erosion. This is the largest living shoreline project to be built in New Jersey. I am writing because completion of Ocean Wind 1 may provide help in creating a vegetated berm using natural sediments from the Bay and repairing the southerly terminal rock jetty to its original footprint. We do hope that we may be able to work together.
1046-0001: YOU could make a difference to this unique piece of shoreline that once again is likely to be modified by man for the upcoming wind project. If your agency would consider our project to save this natural shoreline as a part of your plan it would certainly give you positive local support and save a very special bit of New Jersey. It has recently come to my attention that some conditions would likely be helpful in making that decision. Firstly at least one condition of inclusion to your project is already completed - the living shoreline project proposal is already approved by the DEP but needs to be funded; and secondly your project may cause changes in Barnegat Bay and surrounding waters that need to be mitigated and one possibility may be to yield much needed local sediments (sand) that could be used to rebuild the beach behind the groin or help build the vegetative berm. Whether for the good of the shoreline or to mitigate a project issue we hope you will assist us to achieve our goals.
0748-0001: We are residents of the Forked River Beach section of Lacey Township. We definitely support finding and utilizing alternative energy sources and we are not part of the NIMBY crowd. We are not scientists nor do we earn our livelihood from the sea. We are simply residents of an area that is directly across the bay from Barnegat Inlet and will therefore be affected by the power transmission line that is headed from the offshore windmills to the Oyster Creek power plant. Our concern is the

Form Letter 4
unintended consequences of that transmission line. Long-time residents of the area contend that unintended consequences of the Oyster Creek Nuclear Power Plant drastically affected the environment of our area. While storms and normal tidal flow over the years have affected shoreline erosion and sediment deposits in the areas' lagoons the power plants need for cooling water drew bay water into Oyster Creek reversing the normal flow and changing the pre-existing currents and exacerbating erosion. We are concerned that the transmission line will have a similar negative impact. We have been involved as volunteers in the Forked River Beach Living Shoreline project which among other things is attempting to reverse the erosion process and improve water quality in the area. One phase of the project requires the installation of a rock jetty at the entrance to the main lagoon which would aid in preventing further erosion and reduce the amount of sediment that enters the lagoons. Unfortunately funding for this portion of the project does not seem to be forthcoming. Installing the jetty would help to mitigate the impact that the transmission line might have in directing more sediment into already shallow lagoons. Therefore we are requesting that this jetty be built before the transmission line is installed.
1279-0001: Re: Ocean Wind 1 DEIS ("Ocean Wind 1") We are homeowners who reside at the end of Beach Boulevard in the Forked River Beach section of Lacey Township New Jersey. Literally Barnegat Bay is our backyard! We write because the completion of Ocean Wind 1 could provide a valuable opportunity to not only complete our current shoreline restoration project but to provide enhanced protection from the dire threat facing our shoreline and our community. The shoreline in front of our homes is approximately 3000 linear feet long. For decades many families enjoyed idyllic summers in this location with children who grew up swimming crabbing and boating. In recent years however the surge in storms and sea level rise has caused significant erosion to this area. Google Earth historical records document well over 100 feet of erosion since 1995! This has brought the bay to our back doors and if this project is not completed both our shoreline and our homes will be lost. Our community has been working closely with the Stockton University Coastal Research Center (CRC) and the American Littoral Society (ALS) to implement a nature-based solution to restore our shoreline and mitigate the threats posed to our homes. Dr. Stewart Farrell Director of the CRC has outlined the three necessary steps required for successful restoration. First is attenuating the wave energy hitting the shoreline and reducing the erosion rate using oyster reefs. These reefs act to reduce erosion while also enhancing the water quality and improving the bay floor habitat. This step has been implemented by ALS and the local community. The remaining steps include creating a vegetated berm along the shoreline using natural sediments from Barnegat Bay that have been sifted from this site and repairing the southerly terminal rock jetty to its original footprint. Repairing the rock jetty will keep the sediment in place and prevent it from being pulled by the bay into the local lagoons. To date this is the largest living shoreline project to be built in New Jersey; however we need to complete the rock jetty and vegetated berm. We understand that you may have an obligation to conduct mitigation projects to off-set potential damage(s) during your project. We feel that there is a potential for a win-win as you may be required to directional drill in front of the old Finninger's Farm Gust south of our FR Beach project) and it could be a perfect fit for a sediment match or beneficial re-use of dredged materials to complete a living shoreline project that the NJ DEP wasn't able to fully fund in 2018.This project is already approved by the NJ DEP and has much of the preliminary engineering studies and permitting in-hand. Project partners have been tiying to secure additional funding sources to complete the design and learned of your potential near-by project and the possibility of beneficial sediments. The project would directly impact nearby residents with the protection of their properties as well be beneficial to the ecosystem and an example of people working together for best outcomes. We would welcome a meeting between your representatives and our partners at anytime. Thank you for your consideration.
1020-0001: In exchange for my support of the Ocean Wind 1 project I would request if this project is approved which will include dredging in the area of Finninger's Farm that the remaining phase of our living shoreline project that includes the re-establishment of a rock groin and completion of a vegetated berm be funded as a mitigation measure. This would not only directly impact something desperately needed for the protection of local resident properties but be of great benefit to the surrounding ecosystem. Our living shoreline project is already approved by the DEP with the first phase the of implementation of oyster reefs already completed. Help is needed to for the remaining phase. Re-use

Form Letter 4
of dredged material and funds to complete the rock groin would complete our project. Thank you for the opportunity to bring this situation to your attention.
Response: BOEM acknowledges these comments and requests for beneficial reuse of dredged material. Ocean Wind has coordinated with NJDEP regarding the disposal of dredged material and has determined that dredged material would be transferred to an upland disposal facility and disposed of in accordance with USEPA Guidelines, USACE Guidelines, New Jersey Administrative Code 7:7 Appendix G for the Management and Regulation of Dredging Activities and Dredged Material in New Jersey’s Tidal Waters, and applicable State Surface Water Quality Standards at New Jersey Administrative Code 7:9B and permit conditions. Ocean Wind currently has an agreement with an upland disposal facility (Clean Earth) and is continuing to evaluate the use of permitted and available confined disposal locations and upload facilities.

O.9. List of Commenters by Commenter Type and Submission Number

Table O.9-1 Federal Agencies

Letter Number	Commenter	Agency
0609	N/A	USEPA
0922	N/A	USFWS
1177	N/A	USFWS
1265	N/A	USFWS
1273	Koeppel, Christopher	ACHP
1287	Pentony, Michael	NOAA National Marine Fisheries Services - Greater Atlantic Region

N/A = not applicable

Table O.9-2 State Government

Letter Number	Commenter	Government Organization
1178	N/A	New Jersey Economic Development Authority
1203	N/A	NJDEP
1207	N/A	NYSDOS
TRANS-0087	Rothmel, Randi	New Jersey Environmental Commissions

N/A = not applicable

Table O.9-3 Local Government

Letter Number	Commenter	Government Organization
0948	N/A	Borough of Seaside Park, New Jersey
1187	N/A	City of Ocean City, a municipal corporation of the State of New Jersey
1277	Shabazz, Kaleem	City of Atlantic City
1281	Peterson Jr., John	Borough of Seaside Park
TRANS-0010	Hayes, Kim	Upper Township Committee
TRANS-0025	Aroke, Christian	Point Pleasant Beach
TRANS-0073	Paul, Emily	Cape May County Chamber of Commerce
TRANS-0103	Peterson, John A.	Mayor of Borough of Seaside Park

N/A = not applicable

Table O.9-4 Elected Officials

Letter Number	Commenter	Organization
0006	Smith, Senator Bob	United States Senate
1156	Coughlin, Craig	New Jersey General Assembly
1266	Norcross, Donald	United States Congress
TRANS-0089	Guardian, Don	New Jersey Second Legislative District

Table O.9-5 Businesses and Organizations

Letter Number	Commenter	Organization
0009	N/A	Clean Ocean Action
0010	N/A	New Jersey Audubon
0011	N/A	Caesar Rodney Institute
0013	N/A	Save Long Beach Island, Inc
0014	N/A	Maritime Association of the Port of New York/New Jersey
0017	N/A	Atlantic Climate Justice Alliance
0019	N/A	Concerned Citizens for Lacey Coalition
0020	N/A	Concerned Citizens of Lacey Coalition
0034	N/A	Newark Regional Business Partnership
0059	N/A	Atlantic Cape Community College
0086	Isaac, Richard	Sierra Club New Jersey Chapter
0097	N/A	New Jersey State American Federation of Labor & Congress of Industrial Organizations (AFL-CIO)
0119	N/A	Eastern Millwright Regional Council
0125	N/A	Surfrider Foundation
0130	N/A	New Jersey 50 x 30 Team
0134	N/A	Eastern Atlantic States Regional Council of Carpenters
0321	N/A	Long Island Traditions
0487	Fagan, Thomas	Communications Workers of America, Local 1075
0488	Nixon, Robert	Recreational Fishing Alliance
0764	N/A	Maritime Exchange for the Delaware River and Bay
0939	Remaud, Greg	New Yor/New Jersey Baykeeper
0941	N/A	Barnegat Bay Partnership
0950	N/A	Ocean Heights Presbyterian Church
0951	N/A	Nouveau Consulting
0967	N/A	American Saltwater Guides Association
0991	N/A	Stockton University
1012	N/A	Save Long Beach Island, Inc.
1064	N/A	Cape May County
1085	N/A	Mid-Atlantic Renewable Energy Coalition (MAREC) Action
1086	N/A	Warwick Group Consultants
1087	N/A	Association of New Jersey Environmental Commissions (ANJEC)
1110	N/A	Fisherman’s Headquarters, Inc.
1118	N/A	The American Waterways Operators
1150	N/A	Marine Trades Association of New Jersey

Letter Number	Commenter	Organization
1154	N/A	New Jersey League of Conservation Voters
1184	Middaugh, Peggy	Unitarian Universalist Faith Action of New Jersey Environmental Justice Task Force
1186	N/A	ConservAmerica
1188	N/A	MAFMC and NEFMC
1190	N/A	Ocean Wind LLC
1192	N/A	Save Barnegat Bay
1194	N/A	New Jersey Offshore Wind Coalition
1195	N/A	New Jersey Work Environment Council
1202	N/A	Cape May County, New Jersey
1212	N/A	Vacation Rentals Jersey Shore, LLC
1222	N/A	Surfside Foods, LLC
1230	N/A	Offshore Power LLC
1231	N/A	LBI Taxpayers Association
1233	N/A	The Nature Conservancy
1234	N/A	Garden State Seafood Association
1241	N/A	RODA
1243	N/A	LaMonica Fine Foods
1247	N/A	Business Network for Offshore Wind
1248	N/A	National Wildlife Federation, Natural Resources Defense Council, National Audubon Society, et al.
1252	N/A	Atlantic Shores Offshore Wind, LLC
1254	N/A	Clean Energy and Sustainability Analytics Center, Montclair State University
1258	N/A	New Jersey Resource Project (FL3)
1259	N/A	Clean Ocean Action
1268	N/A	Wetlands Institute
1272	Wallace, David H.	Wallace & Associates
1278	N/A	New Jersey Council of Divers and Clubs
1280	McCall, Beverly	Chair of Pro-New Jersey Grantor Trust
TRANS-0001	Zipf, Cindy	Clean Ocean Action
TRANS-0002	Martin, Kari	Clean Ocean Action
TRANS-0003	Klein, Zachary	Clean Ocean Action
TRANS-0004	Muthakaranan, Swarna	Clean Ocean Action
TRANS-0006	Walling, Jacqueline	Environmental Committee of Women’s Club
TRANS-0007	Vargas, Sunny	New Jersey League of Conservation Votes
TRANS-0008	Tompkins, Drew	New Jersey Work Environmental Council
TRANS-0009	Toth Sullivan, Jackie	Stockton University
TRANS-0012	Chebra, Hillary	Chamber of Commerce Southern New Jersey

Letter Number	Commenter	Organization
TRANS-0014	Healy, William	New Jersey Alliance for Action
TRANS-0015	Olsen, Olaf	Eastern Atlantic State Regional Council of Carpenters
TRANS-0017	Robbin, Inga	Climate Action
TRANS-0018	Figuerdo, Miguel	Mill Right Regional Council
TRANS-0019	Ace, Chris	Eastern Mill Right Regional Council
TRANS-0020	DeAugustine, Donald	Mill Right Local 715
TRANS-0021	Connor, Michael	Eastern Atlantic States Regional Council of Carpenters
TRANS-0022	Myteris, Megan	New Jersey Resource Project
TRANS-0023	Capaccio, Anthony	Laborers International Union of North America
TRANS-0028	Scalera, Ciro	New Jersey Laborers Employers Education and Cooperation Trust
TRANS-0029	Ford, Eric	New Jersey Energy Coalition
TRANS-0031	Stokes, Steve	Eastern Atlantic States Regional Council of Carpenters
TRANS-0037	Hill, Ed	International Brotherhood of Electrical Workers
TRANS-0040	Davis, Rachel Dawn	Water Spirit
TRANS-0041	Martin, Kari	Clean Ocean Action
TRANS-0045	Santiago, Maria	Atlantic Climate Justice Alliance
TRANS-0046	Thompson, James	New Jersey League of Conservation Voters
TRANS-0047	O’Malley, Doug	Environmental New Jersey
TRANS-0048	Burcat, Bruce	Mid Atlantic Renewable Energy Coalition
TRANS-0051	Hornick, Suzanne	Protect our Coast New Jersey
TRANS-0053	O’Hearn, William	External Affairs for Offshore Power
TRANS-0054	Molina, Isabel	New Jersey League of Conservation Voters
TRANS-0055	Hillbert, Rebecca	New Jersey League of Conservation Voters
TRANS-0061	Peal, Michelle	New Jersey League of Conservation Voters
TRANS-0063	Chait, Michael	Greater Atlantic Center Chamber of Commerce
TRANS-0064	Steingard, Shayna	National Wildlife Federation
TRANS-0068	Klein, Zachary	Clean Ocean Action
TRANS-0069	Martin, Kari	Clean Ocean Action
TRANS-0070	Walling, Jacqueline	Environmental Committee of the Women’s Club of Brielle
TRANS-0071	Coyle, Debra	New Jersey Work Environmental Council
TRANS-0072	Foster, Cameron	New Jersey Resource Project
TRANS-0074	Stewart, Jody	New Jersey Resource Project

Letter Number	Commenter	Organization
TRANS-0075	Hornick, Susan	Protect Our Coast New Jersey
TRANS-0076	Poole, Ann	New Jersey Environmental Lobby
TRANS-0081	Mackey, Scott	Garden State Seafood Association
TRANS-0082	Remaud, Greg	New York New Jersey Bait Keeper
TRANS-0084	Pringle, David	Clean Water Action
TRANS-0085	McCausland, Jack	Pinelands Preservation Alliance
TRANS-0091	Kreibich, Arti	Democracy Organizing for New Jersey Working Families
TRANS-0092	Cantor, Raymond	Government Affairs for the New Jersey Business and Industry Association
TRANS-0093	Laughlin, Mike	Atlantic and Cape May County Building Trades Council
TRANS-0094	Giovanniello, Jen	New Jersey League of Conservation Voters
TRANS-0096	Williams, Indigo	New Jersey League of Conservation Voters
TRANS-0100	Capaccio, Anthony	Labors Local 173
TRANS-0101	Ramos, Anjuli	Sierra Club
TRANS-0102	Nichols, Ray	Universalist Faith Action of New Jersey
TRANS-0104	Bergman, Anti	Business Network for Offshore Wind

N/A = not applicable

Table O.9-6 Individuals

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0005	Yerman, John	N/A
0006	Opella, J	N/A
0007	Binder, James	N/A
0008	Calter, Mimi	N/A
0012	Lewis, Robert	N/A
0016	R, Alyssa	N/A
0018	Erdmann, John	N/A
0021	Ransome, Donna	N/A
0022	DeVore, Heather	N/A
0023	Cerceo, Elizabeth	N/A
0024	Eidman, Paul	N/A
0025	Kallio, Karen	FL1 Master
0026	Noreuil, Joshua	FL1
0027	Cohl, Gina	FL1
0028	Johanson, Erica	FL1
0029	Aragon-Bruzzichesi, Aurora	FL1
0030	Long, Andrea	FL1
0031	Hall, William	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0032	Mae, April	FL1
0033	McFarland, Karen	N/A
0035	Bergman, David	N/A
0036	Maher, Kathleen	FL1
0037	Glassman, Matthew	FL1
0038	Wohler, James	FL1
0039	Curtis, Marie	FL1
0040	Hemm, James	FL1
0041	Guarino, Ann	FL1
0042	Bivona, Denise	FL1
0043	Ruhl, John	FL1
0044	Cousins-Coleman, Betsy	FL1
0045	Troyanovich, Steve	FL1
0046	Paley, Leon	FL1
0047	Fife, Michael	N/A
0048	Waldor, Philip	N/A
0050	Briody, Patrick	N/A
0051	Yavorsky, Donna	FL2
0053	Tucker, Gabriel	N/A
0055	Peters, Joan	N/A
0056	Stires, Anne	N/A
0057	Kunze, Dave	N/A
0058	Hagen, Anthony	N/A
0060	Williamson, Patricia	FL2
0061	Coen, Jon	N/A
0062	Wheeler, John	FL2 Master
0063	Katz, Corey	N/A
0064	Data-Samtak, Susan	N/A
0065	Knowlton, Stephen	N/A
0066	Kahofer, Stephen	N/A
0067	Barson, Sharyn	N/A
0068	Reichman, Edward	N/A
0069	Reina Rosenbaum, Rose	N/A
0070	Szuter, Robert	N/A
0071	Rantzer, Eve	N/A
0073	Gordin, Morris	N/A
0074	Caminiti, Francesco Marco	N/A
0075	Dunn, Gary	N/A
0076	Gangasarran, Asha	N/A
0077	Candea, Nancy	N/A

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0078	Shambaugh, Gerald	N/A
0079	de Voogd, Sebastiaan	N/A
0080	S, John	N/A
0081	Cowan, Dorothy	N/A
0082	Canright, Rebecca	N/A
0083	Maceira, Alex	N/A
0084	Del Sordi, Mariangela	N/A
0085	Davidson, Tom	N/A
0087	Assiff, Mary Ann	N/A
0089	Kahn, David	N/A
0090	Greberis, Stan	N/A
0091	Brooks, L	N/A
0093	Clancy, Kathryn	N/A
0094	Schade, Corey	FL2
0095	Alexander, Gunta	N/A
0096	Ianniello, Phyllis	N/A
0098	Lord, Robert	N/A
0099	Rummler, Matthew	N/A
0100	Rowley, Lincoln	N/A
0101	D, William	N/A
0102	Vitale, Ben	FL2
0104	Richter, Pat	FL1
0105	Trought, Barbara	FL1
0106	Cacciapuoti, Anthony	FL1
0107	Konieczka, marcia	FL1
0108	Neal, E.	FL1
0109	Klenetsky Fay, Jamie	FL1
0110	Dolsky, Ken	N/A
0111	Roland, Edwin	N/A
0112	Waltzer, Mark	FL2
0113	Roy, Jean	N/A
0114	Paterson, Shelley	N/A
0115	Rossin, Linda	N/A
0116	Pakizegi, Behnaz	N/A
0118	Weaver, Jim	N/A
0121	Riss, Kathryn	N/A
0122	Miller, Barbara	FL2
0123	Thoren, susan	N/A
0124	Barker, vilma	N/A
0126	Bulleit, Hallie	N/A
0127	Woolery, Geoff	N/A

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0128	Fluck, Leona and George	N/A
0129	Heaney, Mike	N/A
0131	Johnson, Eric	N/A
0132	Gillen, Joan	N/A
0135	Weinrich, John	N/A
0136	Anderson, Dennis	N/A
0137	Thibault, Natalie	N/A
0138	Brush, Denise	N/A
0139	Ramos, Joann	N/A
0141	Puca Jr., Anthony	FL1
0142	Clancy, Kathryn	FL1
0143	Kurz, Daniel	FL1
0144	Y., H.	FL1
0145	Myers, Kimberely	FL1
0146	Pontecorvo, Maureen	N/A
0147	Isenberg, Tammy	N/A
0148	Peal, Michelle	FL1
0149	Korfmacher, Walter	FL1
0150	Pullen, Seth	FL1
0151	Burval, Peter	FL1
0152	Barrett, Betsy	FL1
0153	Russ, Javk	N/A
0154	Godfrey, Peter	FL1
0155	Lewitz, Charles	FL1
0156	Askins, Richard	FL1
0157	Brown, Nick	N/A
0158	Pearsall, Rand	N/A
0159	Laird, Scott	FL1
0160	Dzubak, Cheri	FL1
0161	W. De Boer, Daryl	FL1
0162	W. De Boer, Daryl	FL1
0163	Goodson, Andrew	FL1
0164	Hartten, Erik	FL1
0165	Dunn, Gary	FL1
0166	Day, Mary	FL1
0167	Schwamb, Tracy	FL1
0168	Picciotto, Elizabeth	FL1
0169	Rua, Maria	FL1
0170	Garcia, Sandra	FL1
0171	Vonderschmidt, Don	FL1
0172	Ponisciak, Joseph	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0173	Sparkman, Kevin	FL1
0174	Frederick, Gary	N/A
0175	Bertsch, Ric	N/A
0176	Kottke, William	N/A
0177	Kimball, Elizabeth	N/A
0178	Weiss, Robert	FL1
0179	Kappler, Kelly	FL1
0180	Kayman, Lindsey	N/A
0181	Brancato, Faith	FL1
0182	Honeycutt, Todd	N/A
0183	H, E	N/A
0184	Redman, Margaret	FL1
0185	Gilson, Ann	FL1
0186	Wheeler, John	FL1
0187	Zuckerman, Michael	FL1
0188	Sandstrom, Mark	FL1
0189	Hand, Helen	FL1
0190	Marshall, Debra	FL1
0191	Measday, Tom	FL1
0192	Goetschius, Lascinda	FL1
0193	Thonet, Kathi	FL1
0194	Tomori, James	N/A
0195	Mahood-Jose, Eileen	FL1
0196	More, Robert	FL1
0197	Johnson, Melissa	FL1
0198	Kilpatrick, Karen	FL1
0199	Van Wie, Torri	FL1
0200	Jacobs, Shannon	FL1
0201	Neblock, Ed	N/A
0202	Maddalena, Barbara	FL1
0203	Kaplan, Carol	FL1
0204	Palenik, John	FL1
0205	Thorsen, Theresa	FL1
0206	Portolano, Frank	FL1
0207	Jacob, Marty	N/A
0208	Das, Sanjay	N/A
0209	Glossbrenner, Kenneth	N/A
0210	Hamilton, Joan	N/A
0211	Victor, Joan	N/A
0212	Furcht, Peter	N/A
0213	Morrow, Robert	N/A

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0214	Ekstrom, Edwina	FL1
0215	Bachmann, Carl	FL1
0216	Coomber, Annette	FL1
0217	Looft, David	FL1
0218	Salim, Abbas	FL1
0219	Colletto, Andrew	FL1
0220	Miller, David	FL1
0221	Carton-Riker, Barbara	FL1
0222	Bernardini, Richard	N/A
0223	Rowe, Kim	N/A
0224	Lombardi, Kathi	FL1
0225	Kahofer, Stephen	FL1
0226	Weinberger, Daniel	FL1
0227	Wilson, Allison	FL1
0228	Pascale, Connie	FL1
0229	Endris, Richard	FL1
0230	Gorrin, Eugene	FL1
0231	DiLeo, Carmine	FL1
0232	Ramirez, Jessica	FL1
0233	Pedersen, Ellen	FL1
0234	Wechselblatt, Marylin	FL1
0235	Everett, Denise	FL1
0236	Hart, Kathy	FL1
0237	Harding, Cheryl	FL1
0238	Bernet, Gregory	FL1
0239	Eklof, Amy	FL1
0240	mccall, beverly	N/A
0242	Jeffrey, Paul	N/A
0243	Abbasparker, Ibn-Umar	FL1
0244	Willard, Patricia	FL1
0245	Anderson, Dennis	FL1
0246	Patoray, Arlene	FL1
0247	Golden, Jeanne	FL1
0248	Golden, Susan	FL1
0249	Rowe, Kim	FL1
0250	Goodell, Edward	FL1
0251	Wilson, Robert	FL1
0252	Hakkinen, Emily	FL1
0253	Kissinger, David	FL1
0254	Sapirman, Nadine	N/A
0255	Goldenberg, Harold	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0256	Hess, Kathy	FL1
0257	Anglin, Eileen	FL1
0258	Varga, Dolores	FL1
0259	McCarthy, Suzanne	N/A
0260	Gilbert, Jake	FL1
0261	Covey, Justin	FL1
0262	Schafer, Helen	FL1
0263	Riggs, Richard	FL1
0264	Simon, Nan	FL1
0265	Giordano, Tony	FL1
0266	Chidambaram, Manjula	FL1
0267	Reimer, Frederick	FL1
0268	Crane, Eric	FL1
0269	Hancock, Caroline	FL1
0270	Charney, Jeff	FL1
0271	Rogerino, Jean	FL1
0272	Silverman, William	FL1
0273	Hartman, Richard	FL1
0274	Beaumont, Leland	FL1
0275	Bengul, Enis	FL1
0276	Van Bel, William	FL1
0277	Zelinski, Dawn	FL1
0278	Cresse, Sharon	FL1
0279	Dowd, William	FL1
0280	Hartwell, Margarent	FL1
0281	Pflugh, Melissa	FL1
0282	Taati, Cathy	N/A
0284	Pannone, Joanne	N/A
0285	Burgess, John	FL1
0286	Pingitore, Dianne	FL1
0287	Montanari, Matthew	FL1
0288	Lieberstein, Gloria	FL1
0289	Bulleit, Hallie	N/A
0290	Estok, Karen	FL1
0291	Tanzi, Nancy	FL1
0292	Kashner, John	FL1
0293	Shaw, Monica	FL1
0294	O’Hara, Eileen	N/A
0295	McCarthy, Pete	FL1
0296	Bourlotos, George	FL1
0297	Kaplan, Mimi	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0295	Royle, Majorie	N/A
0299	Grossi, Joanne	FL1
0300	Young, Phylicia	N/A
0301	O’Neil, Nadezda	FL1
0302	Morris, Bert	FL1
0303	Doyle, Patricia	N/A
0304	Doyle, Patricia	FL4
0305	Bendar, Barry	N/A
0306	Chatten, Kyle	N/A
0307	Karlovich, David	N/A
0308	Lakavitch, Gia	FL1
0309	Abbasparker, Ibn-Umar	FL1
0310	Bushkoff, Paula	FL1
0311	Rosenblatt, Jon	FL1
0312	Dinell, Alexander	FL1
0313	Capaccio, Sandra	N/A
0314	Samuelsen Jr, George	N/A
0315	Caruso, Guy	N/A
0316	Smith, Jonah	N/A
0317	Schenk, Linda	N/A
0318	Nynas, William	FL1
0319	Rossner, A.	FL1
0320	Cooper, Terry	FL1
0322	Wright, Caitlyn	FL1
0323	Bernstein, Joan	FL1
0324	Scholz, Denise	FL1
0325	Van Norman, Bob	N/A
0326	Klein, Lois	N/A
0327	Cox, Susan	N/A
0328	Scanlan, Brian	FL1
0329	Sweeten, Audra	FL1
0330	O’Brien, Jeanne	FL1
0331	Lay, Jyh	FL1
0332	Whitman, Eric	FL1
0333	Atkin, Edward	FL1
0334	Bourlotos, George	FL1
0335	Knopp, Elana	N/A
0336	Solak, Tina	FL1
0337	Ramos, Joann	N/A
0338	Weaver, Jim	FL1
0339	Chernetz, George	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0340	Holder, Lisa	FL1
0341	Stoller, Timothy	FL1
0342	Walden, Don	FL1
0343	Mcleod, Allison	FL1
0344	Rattner, Jeffrey	FL1
0345	Friedberg, Ruth	FL1
0346	Greene, Amy	FL1
0347	Oerke Jr, Carl	FL1
0348	Mazar, Sheila	FL1
0349	Koehler, Christine	FL1
0350	Coughlin, Mary	N/A
0351	Binder, James	N/A
0352	Grova, Christopher	FL1
0353	Sytzko, Victor	FL1
0354	Druckman, Susan	FL1
0355	Caron, Jessica	FL1
0356	Pietrzak, Karl	FL1
0357	Picillo, Nancy	FL1
0358	Fleitman, Bernard	FL1
0359	Mack, Victoria	FL1
0360	Holzman, Neil	FL1
0361	Mantas, Nicholas	FL1
0362	Sherry, Fran	FL1
0363	Nina, Donna	FL1
0364	Francy, Nancy	FL1
0365	C, Julia	FL1
0366	Cimprich, Ronnie	FL1
0367	Foster, Tracy	FL1
0368	Neal, E	FL1
0369	Butterfield, Scott	FL1
0370	Hise, Anne Van	FL1
0371	Halpern, Stephen	FL1
0372	Schwab, Kristin	N/A
0373	Ahern, John	N/A
0374	Sheppard, Rebecca	N/A
0375	Chamas, Lori	N/A
0376	Blinn, James	FL1
0377	Ross, Archie	FL1
0378	Lau, Phyllis	FL1
0379	Fluck, Leona	FL1
0380	Rannells, Jennifer	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0381	Dougan, Sarah	FL1
0382	Liddick, Shawn	FL1
0383	McRobbie, Peter	FL1
0384	Gordon, Sherry	FL1
0385	Withstandley, Leslie	FL1
0386	Iawhashi, Howard	FL1
0388	Prime BSEE, G.	N/A
0389	carfagno, robert	N/A
0390	Zuczek, Robert	N/A
0391	CaricichCaricich, Brigid	N/A
0392	York, Jeanette	N/A
0393	Schulte, Valerie	N/A
0395	Evans, Helaine	FL1
0396	Wright, Caitlyn	FL1
0397	Florance, Brett	FL1
0398	Stockwell, Hunt	FL1
0399	Cohen, Leslie	FL1
0400	Carr, Stewart	FL1
0401	Boice, Ruth	FL1
0402	Clemens, Kathleen	FL1
0403	Ogden, Therese	FL1
0404	Clodfelter, Linda	N/A
0405	Jonach, Elizabeth	FL1
0406	Cohen, Ben	FL1
0407	Cloud, Jarrett	FL1
0408	Leithauser, Marie	FL1
0409	Colletto, Andrew	FL1
0410	Kimmel, Kevin	FL1
0411	Krawczyk, Greg	FL1
0412	Brennan, Ann Marie	FL1
0413	Goetschius, Lascinda	FL1
0414	F, Angie	FL1
0415	Reina, Bettie	FL1
0416	Vachula, William	FL1
0417	Blatnik, Linda	FL1
0418	Farreny, Ashley	FL1
0419	Farreny, Ashley	FL1
0420	Ahmad, Rayat	FL1
0421	Ahmad, Rayat	FL1
0422	Maher, Kathleen	FL1
0423	Krieger, Karen	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0424	Maddalena, Barbara	FL1
0425	Gorrin, Eugene	FL1
0426	Lloyd, Alan	N/A
0427	Cohen, Barbara	N/A
0429	Gray, Ambrose	N/A
0430	Bradley, John	N/A
0431	Harrington, Robert	N/A
0432	Tillman, Barbara	N/A
0434	Stanko, Mitchell	N/A
0435	Conn, Robert	N/A
0436	Barroway, Pamela	N/A
0437	Pannone, Joanne	N/A
0438	Lynch, Laura	N/A
0439	Benner, Elizabeth	N/A
0440	Launi, Barbara	N/A
0443	Hainsworth, Shawn	N/A
0444	Elia, Kenneth	N/A
0445	Hagen, Anthony	N/A
0446	Flanagan, Brian	N/A
0447	Weidner, Denise	N/A
0448	Gallivan, Kira	N/A
0449	R, Bella	N/A
0450	Hodnett, Brendan	FL1
0451	Lukowitz, Wendy	FL1
0452	Wilkes, Harold	FL1
0453	Montgomery, Linda	FL1
0454	Erdreich, Linda	FL1
0455	Tillman, Barbara	FL1
0456	Megnin, Michael	FL1
0457	Russell-Rekika, Angela	FL1
0459	Nierenberg, Susan	FL1
0460	Nelson, Michael	FL1
0461	Burgess, John	FL1
0462	Peacock, Bri	N/A
0463	Melo, Marithza	FL1
0464	Meale, Antoinette	FL1
0465	Mccauley, William	FL1
0466	Linden, Joanne	FL1
0467	Young, Frances	FL1
0468	Gradin, Lynn	FL1
0469	Hart, Kathy	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0470	Berliner, Hayley	FL1
0471	Raleigh, Melissa	N/A
0472	Garcia, Sandra	FL1
0473	Williams, Paul	FL1
0474	Zowader, Ruth	FL1
0475	Baggaley, Margaret	FL1
0476	Vanstrien, Ro	FL1
0477	Powell, Justin	FL1
0478	Ferrance, Marge	FL1
0479	Eckstut, Joanne	FL1
0480	Koetas-Dale, Denise	N/A
0481	Nighbert, David	FL1
0482	Schwartz, Howard	FL1
0483	Ford, Carl	FL1
0484	Schwartz, Brandon	FL1
0485	Chapman, Ed	FL1
0486	Kiely, Melanie	FL1
0489	Dorsogna, Mary	N/A
0490	Hamalian, James	N/A
0491	Schepis, Debbie	FL1
0492	Edmunds, Susan	FL1
0493	Navitski, Margaret	FL1
0494	Dastis, Stacey	FL1
0495	Lanphear, Leslie	FL1
0496	Broekman, Marinus	FL1
0497	Coveney, Margaret	FL1
0498	Raspa, Alejandro	FL1
0499	Malinoski, Erika	FL1
0500	Graham, Joe	FL1
0501	DeMeritt, Barbara	FL1
0502	Tomori, James	FL1
0503	Oconnor, Jayne	FL1
0504	Devlin, Maryellen	FL1
0505	Bishop, Cori	FL1
0506	Kozimbo, John	FL1
0507	Vrancart, Charlotte	FL1
0508	reynolds, rebecca	FL1
0510	Fenton, Ron	N/A
0511	Robinson, Jay	N/A
0512	Peters, Bryan	N/A
0513	Mangin, Jennifer	N/A

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0515	Rule, Thom	FL1
0516	Pack, Judith	FL1
0517	Fehrs, Barbara	FL1
0518	Van Wie, Torri	N/A
0519	Vonderschmidt, Don	FL1
0522	Warner, Sally	FL1
0523	Miller-Cotter, Amanda	FL1
0524	Leftly, Stephen	FL1
0525	Sing, Lorraine	FL1
0526	Sween, Eric	FL1
0527	Ryan, Keith	FL1
0528	Nielsen, Jennfier	FL1
0529	Maguire, Barbara	FL1
0530	Schwartz, Ari	FL1
0531	Cohen, Edward	FL1
0519	Andrews, Alice	FL1
0532	Miller, Steven	N/A
0533	Gablinske, Douglas	N/A
0534	Bertone, Debra	FL1
0535	Ramos, Alex	FL1
0536	Wood, Elsa	FL1
0537	Kole, Robert	FL1
0538	Bruinooge, Scott	FL1
0539	Zsa, Zsa	FL1
0540	Zsa, Zsa	FL1
0541	Adarkar, Bharat	FL1
0546	Gay, Christopher	FL1
0547	Malizia, Richard	FL1
0548	Cunningham, Saran	FL1
0549	Lytle, Denise	FL1
0551	Gallager, John	FL1
0552	Van Sant, Sandra	FL1
0553	Yelenik, Margaret	FL1
0554	Randolph, Karen	FL1
0555	Morrow, Robert	FL1
0556	Merle, Lynn	FL1
0557	Blaser, R.	FL1
0558	Vanstrien, Ro	FL1
0559	DeBeer, Liz	FL1
0560	Santiago, MarÃa	FL1
0561	Rinald, Rebecca	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0534	Schade, Corey	FL1
0535	Ramos, Joann	FL1
0562	Robinson, Carly	N/A
0563	Weinstock, Staurt	FL1
0564	Gillen, Joan	FL1
0565	Usgaonker, Rajdeep	N/A
0566	Greenberg, Brian	FL1
0567	Bernard, Andre	FL1
0568	Finocchiaro, Lolly	FL1
0569	Reichman, Edward	FL1
0570	Magron, Jean-Philippe	FL1
0571	Zatz, David	N/A
0572	Koven, Thomas	FL1
0573	Ortiz, Nancy	FL1
0574	Livingston, Amy	FL1
0575	Schwartz, Brian	FL1
0576	Anouna, Laurence	FL1
0577	I, P	N/A
0578	Jenkins, Jayati	FL1
0579	Halm, Michael	FL1
0580	Mohan, Ajeet	FL1
0581	Broche, Leora	FL1
0582	Lamborn, Jeffrey	FL1
0583	Adams, Brian	FL1
0584	Spector, Helga	FL1
0585	Capizzi, Vincent	FL1
0586	Lee, Jinny	FL1
0587	Plucinski, Michael	FL1
0588	Romanski, W.	FL1
0589	Samuels, Barbara	FL1
0590	Peist, Kathy	N/A
0591	Kosinski, Robert	FL1
0592	Pierce, Charles	N/A
0593	Barbella, Peggy	N/A
0594	Rule, Thom	FL1
0595	Frakenberg, John	FL1
0596	Zaveri, Natasha	FL1
0597	Gaffney, Barbara	FL1
0598	McCabe, Amanda	N/A
0599	Rathvon, Skylar	FL1
0600	Meekel, Jacques	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0601	Findlay, Robert	FL1
0602	Tichenor, Sandra	FL1
0603	Krasovic, Mark	FL1
0604	DeLuca, Glenn	FL1
0606	Mccaig, Robert	N/A
0607	Louro, Hailey	N/A
0608	Belock, Marianne	N/A
0610	Garcia, Robert	FL1
0611	Hager, Jenna	FL1
0612	Farschon, Chris	FL1
0613	Pollitto, Nancy	FL1
0614	Stoll, Noel	FL1
0615	Pollitto, Daurie	FL1
0616	Pollitto, Robert	FL1
0617	Douglas, Patrice	N/A
0618	Entler, Barbara	N/A
0619	Marks, James	N/A
0621	Hempel, Bettina	N/A
0622	Nicolini, Nick	N/A
0623	Leinhauser, Ann	N/A
0624	Annechini, Claire	N/A
0625	Annechini, William	N/A
0626	Roth, Robert	N/A
0627	Marino, Keith	N/A
0628	Evans, Lee	N/A
0629	Andre, Peter	N/A
0630	Andre, Peter	N/A
0631	Colen, Mazie	N/A
0632	Bombolevicz, Patty	N/A
0633	Daidone, Liss	N/A
0634	Boland, Elizabeth	N/A
0635	Hatch, Chris	N/A
0636	Hatch, Lisa	N/A
0637	Griffin, Daniel	N/A
0638	Rocco, Joseph	N/A
0639	Rocco, Joseph	N/A
0640	Mackinney, Susan	N/A
0641	Widmeier, Tom	N/A
0643	McCarthy, Joanne	N/A
0644	Holdwright, Erin	N/A
0645	DeBouter, Danielle	N/A

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0646	Singley, Daniel	N/A
0647	Havner, Brendan	FL1
0648	Steininger, Marion	FL1
0649	Sabato, Jennie	FL1
0650	Zamora, Victor	FL1
0651	DiMona, Robert	FL1
0652	Van Norman, Robert	N/A
0653	Forlenza, Nolan	N/A
0654	Coward, David	N/A
0655	Pekarick, Cynthia	N/A
0656	DeCroix, Keith	N/A
0657	Santora, Darcy	N/A
0658	Smith, M	N/A
0659	Wright, John T	N/A
0660	Hill, Ellen	N/A
0661	Banks, Christine	N/A
0662	Mahoney, James	N/A
0663	Reilly, Ellen	N/A
0664	Banks, Bryan	N/A
0665	Serowatka, Roseanne	N/A
0666	Mignanelli, Kathryn	N/A
0667	Hahl, Don	N/A
0668	Ruszala, Maria	N/A
0669	Colen, Joseph	N/A
0670	Banks, Smith	N/A
0671	DeBevoise, Trisha	N/A
0672	Sergy, Eileen	N/A
0673	Hahl, Judith	N/A
0675	Kennedy, Brian	N/A
0676	Rodriguez, Rich	N/A
0677	Santora, Thomas	N/A
0678	Neill, Colin	N/A
0679	Reiner, Patrick	N/A
0680	Henrich, Renee & Thomas	N/A
0682	B, Erica	N/A
0683	Messina, Robert	FL1
0684	George, Barbara	FL1
0685	Hamblet, Elizabeth	FL1
0686	Esworthy-Menendez, Cindy	FL1
0687	Kuhnert, Martha	FL1
0688	Tomko, Bryan	N/A

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0689	Zomer, Carolyn	N/A
0691	Smithson, Peter	N/A
0692	Pietrzak, Jeffrey	N/A
0693	Johnson, Rusty	N/A
0694	Smartt, Lisa	N/A
0695	Word, R	N/A
0696	Lombardo, Sam	N/A
0697	Erwin, Laura	N/A
0698	Williams, Christopher	N/A
0699	Bond, Patricia	N/A
0701	O’Gwen, Chris	N/A
0703	Wagner, Eric	N/A
0704	Crawford, Katharyn	N/A
0705	Lowry, Eileen	N/A
0706	Gilhooly, Jacqueline	N/A
0707	Ten Hoeve, DJ	N/A
0709	Minerva, Daniel	N/A
0710	Holzman, Dianne	N/A
0711	Hagelin, Christyn	N/A
0712	McLester, Laura	N/A
0714	Vickers, Jenny	FL1
0715	Z, Mike	N/A
0716	Klump, Edward	FL4 Master
0717	Murray, Christine	N/A
0718	Sanford, Geff	N/A
0719	Kovacs, Ernest	N/A
0720	Smith, Cynthia	N/A
0721	Keyes, Darice	N/A
0722	Minerva, Corey	N/A
0724	Murray, Margot	N/A
0725	Murray, Lauren	N/A
0726	Mates, Mindy	N/A
0727	Mills, Jon	N/A
0728	Haas, Michele	N/A
0729	Haas, Casey	N/A
0730	Sawyersawyer, Don	N/A
0731	Kaletkowski, Patricia	N/A
0733	ODonoghue, Marilyn	N/A
0735	Katz, Lee	N/A
0736	Adams, Patrick	N/A
0737	Caputo, Vincent	FL4

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0738	Kegelman, Jane	N/A
0739	Kegelman, Jane	N/A
0740	Borghard, Bill	N/A
0741	Pearson, John	N/A
0742	Long, Leslie	N/A
0743	McKenna, Susan	N/A
0744	Moon, Irene	N/A
0747	Manzione, Frank	FL4
0748	Luczkow, Michael	N/A
0749	Lapihuska, Debra	N/A
0750	Gindin, Meryl	N/A
0751	Metz, Janis	N/A
0752	McCann, James	N/A
0753	Kurek, Kathleen	N/A
0754	Ragone, Jean	N/A
0755	Rotella, Dennis	N/A
0756	Rotella, Dennis	N/A
0758	Labrutto, Linda	N/A
0759	Brancato-Leva, Diane	N/A
0760	B, S	N/A
0761	BeMent, Owen	N/A
0762	Bement, Sherril	N/A
0763	Mueller, Thomas	N/A
0765	LeoneLeone, PE, Frank	N/A
0766	Benson, Eric	FL1
0767	Mal, Linda	N/A
0768	Campbell, Penny	N/A
0769	Malyon, Ann	FL1
0770	Oerke Jr, Carl	FL1
0771	McGuinness, Karen	FL1
0772	Koehler, Christine	FL1
0773	Aguilar, Tom	FL1
0774	Stuebben, Angela	FL1
0775	Sellon, Louise	FL1
0776	Pascale, Connie	FL1
0777	Kornfeld, Laurel	FL1
0778	Smyth, Donna	FL1
0779	DeLuca, Glenn	FL1
0780	Greer, Jamie	FL1
0781	Henson, Linda	FL1
0782	Hanlon, Susan	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0783	Y, G	FL1
0784	Edgar, Michelle	FL1
0785	Smith, Jaszmene	FL1
0786	Perlmutter, Mark	FL1
0787	Cipolla, Patricia	FL1
0788	Charles, Dorian	FL1
0789	Pellegrino, Margo	FL1
0790	Sippie-Gora, Jo	FL1
0791	Schreiber, John	FL1
0792	Shields, Daniel J.	FL1
0793	Russell, Marilyn	FL1
0794	Barth, Stephen	FL1
0795	Joyce, Michael	FL1
0796	Bell, Jerome	FL1
0797	Strykowsky, Kathleen	FL1
0798	Salvatoriello, Larry	FL1
0799	Solomon, Beverly	FL1
0800	Sandritter, Ann	FL1
0801	Maccari, Joan	FL1
0802	Mitchell, Leeanne	FL1
0803	Harkov, Ronald	FL1
0804	Sherry, Fran	FL1
0805	Toomey, Maura	FL1
0806	Lopez, Ariel	FL1
0807	Burval, Peter	FL1
0808	Foxton, Trevanne	FL1
0809	Kecskes, Robert	FL1
0810	Wheeler, John	FL1
0811	Hickey, Sean	FL1
0812	Ramos, Joann	FL1
0813	Bilenchi, Henry	FL1
0814	Hansen, Charles	FL1
0815	Roman, Charlene	FL1
0816	Ruhl, John	FL1
0817	Reicher, Nicole	FL1
0818	Luff, Brad	FL1
0819	Alvare, Michelle	FL1
0820	Thuebel, Joan	FL1
0821	Golden, Jeanne	FL1
0822	Barrett, Kathleen	FL1
0823	Kobbe, Carol	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0824	Rolston, Pat	FL1
0825	Farreny, Ashley	FL1
0826	Cloud, Jarrett	FL1
0827	Pantaleo, Tari	FL1
0828	Byrnes, Louise	FL1
0829	Carnevale, Robert	FL1
0830	Kirsh, Julie	FL1
0831	S., Sylvia	FL1
0832	Schoggen, Stephen	FL1
0833	Elio, Caroline	N/A
0834	Shields, Steve	N/A
0835	Grosso, Kenneth C.	FL1
0836	Berman, Maureen	FL1
0837	McCall, Barbara	N/A
0838	Ryan, William	FL1
0839	Goetschius, Lascinda	FL1
0840	Polo, Eric F	FL1
0841	Polo RN, Eric F	FL1
0842	Toher, Jean	FL1
0843	Dillon, Brenna	N/A
0844	Ramirez, Jessica	FL1
0845	Tafaro, Colleen	N/A
0846	Notaro, Ralph	FL1
0847	McKillip, Linda	FL1
0848	Abbasparker, Ibn-Umar	FL1
0849	Wright, Craig	N/A
0850	Mccullagh, Charlie	FL1
0851	Whitener, Dr. Scott	FL1
0852	Krietzberg, Jo Ann	FL1
0853	Kasbarian, A	FL1
0854	Avallon, Barbara	FL1
0855	Wolf, Anne	FL1
0856	Barrett, Elizabeth	FL1
0857	Palmonari, Renee	FL1
0858	Benz, Wolfgang	FL1
0859	Killian, Caitlin	FL1
0860	Mignola, Lynn	FL1
0861	Manthey, P	FL1
0862	Gorrin, Eugene	FL1
0863	Swift, Robert	FL1
0864	Czekaj, Robert	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0865	Palomo, Andres	FL1
0866	Maher, Kathleen	FL1
0867	Waltzer, Mark	FL1
0868	Jocz, Edmund	FL1
0869	Sullivan, Mary	FL1
0870	Cranmer, Julia	FL1
0871	De Stefano, Ron	FL1
0872	McClure, Louise	FL1
0873	Boice, Ruth	FL1
0874	Hazynski, Chris	FL1
0875	Bushkoff, Paula	FL1
0876	Pollitto, Daurie	FL1
0877	Pollitto, Robert	FL1
0878	Stoll, Noel	FL1
0879	Pollitto, Nancy	FL1
0880	Seymour, Lynn	FL1
0881	Clewell, Gregory.A..	FL1
0882	Murchison, Virginia	FL1
0883	Magie, Bambi	FL1
0884	Williams, Paul	FL1
0885	Sikand, Vikram	FL1
0886	Coomber, Annette	FL1
0887	Young, Marianne	FL1
0888	Dietz, Janet	FL1
0889	Panila, Chris	FL1
0890	Bannon, Kevin	FL1
0891	Welsh, Stacie	FL1
0892	Canright, Mark	FL1
0893	Hansen, Amy	FL1
0894	Canright, Rebecca	FL1
0895	Strauch, Jim	FL1
0896	Maron, Andrew	N/A
0897	Birck, Mathew	FL1
0898	Dresdale, Diane	FL1
0899	Zeitler, Suzanna	FL1
0900	Chirico, David	N/A
0901	Chenelle, Susan	FL1
0902	Langelotti, Alexis	FL1
0903	Kellett, James	FL1
0904	Books, Jennifer	FL1
0905	Santoro, Patricia	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0906	Hannon, Mary	N/A
0907	Reichert, Paul	N/A
0908	Nierstedt, Bill	FL1
0909	Hennessy, Eleanor	FL1
0910	Duggan, Betty Ann	FL1
0911	Voitek, Elaina	N/A
0912	Serowatka, John	N/A
0913	Leone, PE, Frank	N/A
0914	Leone, PE, Frank	N/A
0915	LaVine, Ben	FL1
0916	Gimblette, Claudine	FL1
0917	Hoffman, John	FL1
0918	Restifo, Liza	FL1
0919	Furnari, Russell	FL1
0920	Feldman, Stuart	FL1
0921	Vargas, Anthony	FL1
0924	Neel, Robert	N/A
0925	Barth, Dale	FL1
0926	Lebron, Jody	FL1
0927	Abbasparker, Ibn-Umar	FL1
0928	Johnson, Kenneth W	FL1
0929	Heyer, Diane	FL1
0930	Soteropoulos, Patricia	FL1
0931	Ondik, Liz	N/A
0932	Ndoye, Elizabeth	FL1
0933	Smith, Joseph	N/A
0934	Cohen, Edward	FL1
0935	HarperHarper, Ken	N/A
0937	Stratton, Kim	N/A
0938	Kirby, Nita	FL1
0940	Fiore, Emily	N/A
0942	Warrenburg, Stephen	FL1
0943	Russo, Brian	FL1
0944	Salan, Evan	FL1
0945	Clark, Jeanine	N/A
0946	Lowry, Scott	N/A
0947	North Shirk, Susan	N/A
0949	Peterson, Jr., John	N/A
0952	McCown, Brigham	N/A
0953	Doyle, Trevor	N/A
0954	Schaffer, Ryan	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
0955	Barroway, Pamela	FL1
0956	Henselder-Kimmel, Marie	FL1
0957	Cahill-Makowsky, Ann	FL1
0958	Zion, Menas	FL1
0959	Araujo, Jamie	FL1
0960	Donlevie, Marie	N/A
0961	Davis, Wendy Jo	N/A
0962	Coyne, Frank	N/A
0963	Wieboldt III, Dennis	N/A
0964	Foltz, Jordyn	N/A
0965	Hornick, Mark	N/A
0966	McEneany, Robert	N/A
0968	Peacock, Briana	N/A
0970	Braun, Joseph	N/A
0971	Burmess, Doris	N/A
0973	McMonagle, Bernie	N/A
0974	Feldmus, Mike	N/A
0976	Ross, Bonnie Sue	N/A
0977	knaack, dennis	FL1
0978	K, Katherine	N/A
0979	Sales, Danielle	FL4
0980	Furman, Lawrence	N/A
0981	Karvan, Leslie	N/A
0982	DeMarco, Anthony	FL4
0983	Lytle, Denise	FL1
0984	Wenzel, Brick	N/A
0985	A Melfi, Patti	N/A
0986	Dubel, D.C., James	FL4
0987	Nangle, Mike	N/A
0988	Nangle, Mike	N/A
0989	Mcgee, Joan	N/A
0990	Mcgee, Katie	N/A
0992	Franceschino, John	N/A
0993	Kane, Pamela	FL1
0994	Makofske, David	FL1
0995	Kelly, Brendan	N/A
0996	Diamond, Nichole	FL1
0997	Goodman, Ken	FL4
0998	Barnes, Renee	FL4
0999	Rosenberg, Michael	FL4
1000	Rowohlt, Theresa	N/A

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
1001	Larsen, Ashley	FL1
1002	Larsen, Randi	FL1
1003	Nagiewicz, Joe	FL1
1004	coughlin, m	N/A
1005	Vaccaro, Denise	FL4
1006	Olivo, Jogina	FL1
1007	Smith, Paul	FL1
1008	Scianna, Rosemarie	N/A
1009	Estrella, Leonardo	FL1
1010	Larsen, Greg	FL1
1011	Larsen, Amber	FL1
1013	N/A, N/A	N/A
1014	McConnell, Ellen	FL1
1015	Schade, Corey	N/A
1016	Caporrino, Pietro	FL1
1017	Vargas, Dawn	FL1
1018	Mcguinness, Karen	FL1
1019	Vincent, John	FL1
1020	Norton, Chris	N/A
1021	Ferris, John	FL1
1022	Scarpati, Charles	FL1
1023	Banes, Edward	FL1
1024	Edmonds, Tadri	FL1
1025	Epstein-Teliha, Carla	FL1
1026	Lowery, V	FL1
1027	Lottero, Dennis	FL1
1028	Shambaugh, Gerald	FL1
1029	McSorley, Daniel	FL1
1030	Yacavone, Donald	FL1
1031	Fowler, Ivy	FL1
1032	Lynch, Eileen	FL1
1033	Sherman, Alan	FL1
1034	Yurcich, Regis	FL1
1035	Conklin, Rhonda	FL1
1036	Erba, Annalisa	FL1
1037	DeSantis, Barbara	N/A
1038	Harris, Debra	FL1
1039	Horn, Djar	FL1
1040	Stevens, Craig	N/A
1041	Howard, Ruth	FL1
1042	King, Fawn	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
1043	Pletenik, T	FL1
1044	Oconnell, Morgane	FL1
1045	Lindskoog, Verna	FL1
1046	Greco, Ellie	N/A
1047	Kimmel, Kevin	FL1
1049	Plunkett, Michael	FL1
1050	Atwell, James	FL1
1051	Hazzard, Mark	FL1
1052	Blumenthal, Helen	FL1
1053	Miletta, Jeffrey	FL1
1054	Tozer, Ann	FL1
1055	Gillespy, Nicole	FL1
1056	Wells, Joshua	FL1
1057	Senko, Jen	FL1
1058	Rothrock, Donald	FL1
1059	Galli, Robert	FL1
1060	Fede, Kathleen	FL1
1061	Chasnow, Jo-Anne	FL1
1062	Moody, Richard	FL1
1063	Jacob, Jim	FL1
1065	Szymak, Sue	FL1
1066	Dogas, Robin	FL1
1067	Grant, Richard	FL1
1068	Costas, Susan	FL1
1069	Boyle, Barbara	FL1
1070	W, B	FL1
1071	Coughlin, Tim	N/A
1072	McGrath, Mark	FL1
1073	Coomber, Steve	FL1
1074	Landsman, Eugene	FL1
1075	Goldenbaum, Walter	FL1
1076	Hoffman, Alan	FL1
1077	Infanti, Kristin	FL1
1078	McLean, William	FL1
1079	Martin, Gary	FL1
1080	Lemke, Alison	N/A
1081	Braxton, Cathy	FL1
1082	Lacko, James	FL1
1083	Agugian, Paul	FL1
1084	Schautz, Donna	FL1
1088	Simonelli, John	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
1089	Tustin, Clare	FL1
1090	Coultas, Bruce	FL1
1091	Ariel, Linda	FL1
1092	Egan, Chris	FL1
1093	Hurwich, Sharon	FL1
1094	Doyle, Patricia	FL4
1095	Zeaman, Claire	FL1
1096	Ballard, Reginald	FL1
1097	C, Lin	FL1
1098	Carter-Macchione, Veronica	FL1
1099	Gillespy, Nicole	FL1
1100	Monaco, Dawn	N/A
1101	Morris, Pat	FL1
1102	Bachman, Philip	FL1
1103	Salvatore, Marsha	FL1
1104	Newhouse, Brian	FL1
1105	Kalt, Beth	N/A
1106	King, Katie	FL4
1107	B-----, E----	N/A
1108	Frio, Winnie	N/A
1109	Barbato, Sally	N/A
1111	Petrucci, Derek	N/A
1112	D, Lisa	N/A
1113	Wilbert, Laura	N/A
1114	Valentini, Alison	N/A
1115	Valentini, Alison	N/A
1116	Melone, Thomas	N/A
1117	Kelly, Tom	N/A
1119	Vargas, Sunni	N/A
1120	Freidel, Rav	N/A
1121	Tatem, Ginger	N/A
1122	McConnell, Ellen	FL1
1123	MacFarlane, Robert	FL1
1124	Caputi, Gary	N/A
1125	Barten, Ted	N/A
1126	Calderone, Michael	FL1
1127	Smith, Diane M	FL1
1128	Beeman, Burt	FL1
1129	Mena, Anibal	FL1
1130	Wilt, Jeffrey	FL1
1131	Murray, Thomas	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
1132	Crowley, Therese	FL1
1133	Strykowsky, Kathleen	FL1
1134	Dunn, John	FL1
1135	Deats, Mark	FL1
1136	Matlock, Dan	FL1
1137	Kangas, Rachel	FL1
1138	Young, Elizabeth	FL1
1139	Zelop, Bernadette	FL1
1140	Lazarus, Sara Louise	FL1
1141	Edwards, William	FL1
1142	Stork, Lindy	FL1
1143	Ward-Gallagher, Josie	FL1
1144	Hook, Herman	FL1
1145	Hayes, R	FL1
1146	Schmitt, Peter	FL1
1147	Turi-Smith, Deb	FL1
1148	Binelli, Derek	FL1
1149	Power, Thomas	FL1
1151	Gibbons, Joanne	FL1
1152	Friedman, Gary	FL1
1153	McBride, Owner James	FL1
1155	Djimopoulos, Barbara	FL1
1157	Giovanniello, Jen	N/A
1158	Williams, Indigo	N/A
1159	Borden Jr, Peter	FL1
1160	OConnell, Siobhan	FL1
1161	Lazar, Arlene	FL1
1162	Hyun, Philip J.	FL1
1163	Gindhart, Robin	FL1
1164	Rupino, Darlene	FL1
1165	Campbell, Kelly	FL1
1166	Ford, Marybeth	FL1
1167	Porter, James	FL1
1168	Ewing, Jackie	FL1
1169	Post, Robert	FL1
1170	McNamara, James	FL1
1171	Friedman, Arline	FL1
1172	Sadowski, Eddie	FL1
1173	Fisk, Raymond	N/A
1174	Brown, Lawrence	FL1
1175	Stehlik, Richard	FL1

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
1176	Calderone, Michael	FL1
1179	Aspinall, Ken	FL1
1180	Edler, Allen	FL1
1181	McMonagle, Bernard	N/A
1182	McMonagle, Bernard	N/A
1183	Maysek, Ann	N/A
1185	Foulkrod, LeRoy	N/A
1191	Powell, David	N/A
1197	Allen, Dorothy	FL1
1198	Gilbert, Cassandra	FL1
1199	Palazzo, Rosemary	FL1
1200	Vollherbst, Linda	FL1
1201	Sedlack, Bill	FL1
1204	Kerrigan, John	FL1
1206	McWilliams, Rita	FL1
1208	Benson, Joseph	FL1
1209	Baranowski, Marguerite	FL1
1210	Bailey, Kathleen	FL1
1211	brehm, August	FL1
1213	Westergaard, Reid	FL1
1214	Erwood, Regina	FL1
1215	Hamilton, J	FL1
1216	Bombolevicz, Patty	N/A
1217	Conforti, Anthony	FL1
1218	Dorsey, Morean	FL1
1219	Miller, Suzanne	FL1
1220	Hatoff, Harlee	FL1
1221	Scott, Elisa	FL1
1223	Fisher-Avatar, Linda	FL1
1224	Simon, Robin	FL1
1225	Harwood, Douglas	FL1
1226	Blitz, Roberta	FL1
1227	Saunders, Marilyn	FL1
1228	Guardian, Don	N/A
1229	Godumski, Evelyn	FL1
1232	Blankemeyer, Carl	N/A
1236	Geiger, James	N/A
1237	K, C	N/A
1238	K, C	N/A
1239	Hornick, Suzanne	N/A
1240	Mal, Lin	N/A

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
1242	Parsons, Sue	N/A
1244	Etedali, Anthony	N/A
1245	Himchak, Peter	N/A
1249	Feeney, Timothy	N/A
1250	Sherer, Adam	N/A
1251	Ferrara, Amanda	N/A
1253	MasessaMasessa, Gina	N/A
1255	Bond, Sarah	N/A
1260	DellaPietro, William	FL4
1261	Fernandes, Simon and Stefania	FL4
1262	Todd Jr., Emory	N/A
1263	Public, Jean	N/A
1264	Durr, Senator Edward	N/A
1267	Feairheller, John A	N/A
1270	Amberg, Diane	N/A
1271		N/A
1274	Fiani, Anthony	N/A
1275	Hyde, Beth	N/A
1276	O’Neill, Ren and Danielle	FL4
1279	Patricia Doyle, Kelly Smentkowski-Norton	N/A
1282	Anita Burkat, Kathy Kowalski	FL4
1283	Arce, Tara Louis	FL4
TRANS-0005	Ebert, Joan Marie	N/A
TRANS-0011	Oleath, Chris	N/A
TRANS-0013	Feretti, Gregory	N/A
TRANS-0016	Shades, Miles	N/A
TRANS-0024	Snyder, Bill	N/A
TRANS-0026	Hornick, Suzanne	N/A
TRANS-0027	Schaffer, Robin	N/A
TRANS-0030	Eidman, Paul	N/A
TRANS-0032	Battersby, Jeff	N/A
TRANS-0033	Warring, Tim	N/A
TRANS-0034	Gross, Dave	N/A
TRANS-0035	Finelli, Steve	N/A
TRANS-0036	Diaz, Phil	N/A
TRANS-0038	Finelli, Mary	N/A
TRANS-0039	Cerrito, Mario	N/A
TRANS-0042	Klein, Zachary	N/A
TRANS-0043	Florio, James	N/A

Submission Number	Commenter	Form Letter (FL) or Other Applicable Information
TRANS-0044	Walling, Jacquelin	N/A
TRANS-0049	Pannone, Michael	N/A
TRANS-0050	Quilter, Sharon	N/A
TRANS-0052	Cerceo, Elizabeth	N/A
TRANS-0056	Bertsch, Ric	N/A
TRANS-0057	Gans, Aviva	N/A
TRANS-0058	Bonano, Lisa	N/A
TRANS-0059	Jones, Randy	N/A
TRANS-0060	P, David	N/A
TRANS-0062	Hammond, Ken	N/A
TRANS-0065	Hyde, Beth	N/A
TRANS-0066	Roland, Ed	N/A
TRANS-0067	Ebert, Joan	N/A
TRANS-0077	Bertsch,	N/A
TRANS-0078	Potosnak, Edward	N/A
TRANS-0079	Gfrorer, John	N/A
TRANS-0080	Gonolfi, Dan	N/A
TRANS-0083	Coughlin, Tim	N/A
TRANS-0086	Eidman, Paul	N/A
TRANS-0088	Krane, Jason	N/A
TRANS-0090	Ebert, Joan Marie	N/A
TRANS-0095	Schambach, Lynn	N/A
TRANS-0097	Wenzel, Brick	N/A
TRANS-0098	Guarraggi, Alfonso	N/A
TRANS-0099	Klemmer, Keith	N/A
TRANS-0105	Clarke, Christine	N/A
TRANS-0106	Filosa, Matt	N/A

N/A = not applicable

Table O.9-7 Anonymous

Letter Number	Commenter
0015	Anonymous
0049	Anonymous
0072	Anonymous
0117	Anonymous
0283	Anonymous
0387	Anonymous
0428	Anonymous
0433	Anonymous
0441	Anonymous

Letter Number	Commenter
0442	Anonymous
0458	Anonymous
0509	Anonymous
0514	Anonymous
0550	Anonymous
0605	Anonymous
0620	Anonymous
0642	Anonymous
0654	Anonymous
0674	Anonymous
0681	Anonymous
0690	Anonymous
0700	Anonymous
0702	Anonymous
0708	Anonymous
0713	Anonymous
0723	Anonymous
0732	Anonymous
0734	Anonymous
0745	Anonymous
0746	Anonymous
0757	Anonymous
0923	Anonymous
0936	Anonymous
0969	Anonymous
0972	Anonymous
1048	Anonymous
1112	Anonymous
1189	Anonymous
1193	Anonymous
1205	Anonymous
1235	Anonymous
1246	Anonymous
1256	Anonymous
1257	Anonymous

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O.10. References Cited

O.10.1 Section O.4, Responses to Cooperating Agency Comments on the Draft EIS

Bellman, M. A. 2021. Expert opinion report regarding underwater noise emissions during UXO-clearance activity and possible options for noise mitigation. Report by Institut für Technische und angewandte Physik (ITAP) GmbH, for Ørsted Wind Power A/S. Report number 3960, June 2021.

Bureau of Ocean Energy Management (BOEM). 2022a. *Ocean Wind Offshore Wind Farm Essential Fish Habitat Assessment for National Marine Fisheries Service.* [Month].

Bureau of Ocean Energy Management (BOEM). 2022b. *Ocean Wind Offshore Wind Farm Biological Assessment for National Marine Fisheries Service.* [Month].

Hare, J. A., W. E. Morrison, M. W. Nelson, M. M. Stachura, E. J. Teeters, R. B. Griffis, M. A. Alexander, J. D. Scott, L. Alade, and R. J. Bell. 2016. *A vulnerability assessment of fish and invertebrates to climate change on the Northeast US Continental Shelf*. *PLOS ONE* 11(2):e0146756.

Hoagland, P. T. M. Dalton, D. Jin, and J. B. Dwyer. 2015. An approach for analyzing the spatial welfare and distributional effects of ocean wind power siting: The Rhode Island/Massachusetts area of mutual interest. *Marine Policy* 58:51–59.

Inspire. 2022. *Ocean Wind Offshore Wind Farm Submerged Aquatic Vegetation Monitoring Plan*. Prepared for Ocean Wind, Ørsted US. Submitted by Inspire Environmental. June 15, 2022.

May, R., T. Nygård, U. Falkdalen, J. Åström, Ø. Hamre, B. G. Stokke. 2020. Paint it black: Efficacy of increased wind turbine rotor blade visibility to reduce avian fatalities. *Ecology and Evolution* 10(16):8927–8935.

National Marine Fisheries Service (NMFS). 2018. *2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts*. National Oceanic and Atmospheric Administration Technical Memorandum NMFS-OPR-59. U.S. Department of Commerce, National Oceanographic and Atmospheric Administration.

Ocean Wind LLC (Ocean Wind). 2022a. *Application for Marine Mammal Protection Act (MMPA) Rulemaking and Letter of Authorization*: DRAFT. Prepared by HDR. February.

Ocean Wind LLC (Ocean Wind). 2022b. *Ocean Wind 1 Offshore Wind Farm Updates to the Application for Marine Mammal Protection Act (MMPA) Rulemaking and Letter of Authorization.* Prepared by HDR. August.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

O.10.2 Section O.6, Responses to Other Agency, Stakeholder, and Public Comments on the Draft EIS

O.10.2.1. Section O.6.1, Purpose and Need

State of New Jersey. 2020. *2019 New Jersey Energy Master Plan: Pathway to 2050*. Available: https://nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf. Accessed: January 27, 2022.

O.10.2.2. Section O.6.2, Proposed Action and Alternatives

Eccleston, Charles H. 2011. *Environmental Impact Assessment: A Guide to Best Professional Practices.* CRC Press, Taylor and Francis Group, LLC.

Inspire Environmental (Inspire). 2022. *Ocean Wind Offshore Wind Farm Benthic Monitoring Plan*. February.

Magee, Jerry, and R. Nesbit. 2008. Proximate Causation and the No Action Trajectory in Cumulative Effects Analysis. September. *Environmental Practice* 10:107–115.

Monitoring Analytics. 2021. *2020 State of the Market Report for PJM*. Available: https://www.pjm.com/-/media/committees-groups/committees/mc/2021/20210329-special/20210329-state-of-the-market-report-for-pjm-2020.ashx. Accessed: November 8, 2021.

O.10.2.3. Section O.6.3, Air Quality

Bureau of Ocean Energy Management (BOEM). 2021. *Hydrodynamic Modeling, Particle Tracking and Agent-Based Modeling of Larvae in the U.S. Mid-Atlantic Bight*. Available: https://espis.boem.gov/final%20reports/BOEM_2021-049.pdf.

O.10.2.4. Section O.6.4, Bats

Edgar, Julie. 2016. *Can Bats Really Help Fight Mosquitoes?* WebMD. July 6, 2016. Available: https://www.webmd.com/a-to-z-guides/news/20160706/bats-mosquitoes-zika.

Gonsalves, Leroy, B. Bicknell, B. Law, C. Webb, and V. Monamy. 2013. Mosquito Consumption by Insectivorous Bats: Does Size Matter? October. *PLOS ONE* 8(10).

Hudak, Stephen. 2018. A Batty Idea? Ocean County Commissioner Proposes Using Bats to Control Mosquitoes. August 3. *Orlando Sentinel*.

O.10.2.5. Section O.6.5, Benthic Resources

Bricelj, Monica, J. Kraeuter, and G. Flimlin. 2017. Status and Trends of Hard Clam, *Mercenaria mercenaria*, Populations in a Coastal Lagoon Ecosystem, Barnegat Bay—Little Egg Harbor, New Jersey. Journal of Coastal Research 81 206-253.

Carlsson, M. S., R. N. Glud, and J. K. Petersen. 2010. Degradation of mussel (*Mytilus edulis*) fecal pellets released from hanging long-lines upon sinking and after settling at the sediment. *Can. J. Fisher. Aquat. Sci.* 67:1376–1387.

Christensen, P. B., R. N. Glud, T. Dalsgaard, and P. Gillespie. 2003. Impacts of longline mussel farming on oxygen and nitrogen dynamics and biological communities of coastal sediments. *Aquaculture* 218:567–588.

Costello, C., L. Cao, S. Gelcich, M. A. Cisneros-Mata, C. Free, H. E. Froehlich, C. D. Golden, G. Ishimura, J. Maier, I. Macadam-Somer, T. Mangin, M. C. Melnychuk, M. Miyahara, C. L. de Moor, R. Naylor, L. Nøstbakken, E. Ojea, E. O'Reilly, A. M. Parma, A. J. Plantinga, S. H. Thilsted, and J. Lubchenco. 2020. The future of food from the sea. *Nature* 588 (7836):95–100.

Mirto, S., T. La Rosa, R. Danovaro, and A. Mazzola. 2000. Microbial and meiofaunal response to intensive mussel-farm biodeposition in coastal sediments of the western Mediterranean. *Marine Pollution Bulletin* 40:244–252.

Nicholls-Lee, R., P. R. Thies, J. M. Dulieu-Barton, G. Ólafsson, R. Hughes, A. Hernandez Arroyo, G. Xu, and N. Cartlidge. 2022. Non-destructive examination (NDE) methods for dynamic subsea cables for offshore renewable energy. *Progress in Energy* 4(4):042011. Available: https://iopscience.iop.org/article/10.1088/2516-1083/ac8ccb/pdf.

O.10.2.6. Section O.6.7, Coastal Habitat and Fauna

Carroll, R. P. 2019. Direct and indirect effects of anthropogenic land use on bobcats (*Lynx rufus*) in New England. University of New Hampshire, Durham. Available: https://scholars.unh.edu/cgi/viewcontent.cgi?article=3438&context=dissertation. Accessed: November 24, 2021.

O.10.2.7. Section O.6.8, Commercial Fisheries and For-Hire Recreational Fishing

Bureau of Ocean Energy Management (BOEM). 2021. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: https://www.boem.gov/vineyard-wind. Accessed: August 2021.

Hare, J. A., W. E. Morrison, M. W. Nelson, M. M. Stachura, E. J. Teeters, R. B. Griffis, M. A. Alexander, J. D. Scott, L. Alade, and R. J. Bell. 2016. *A vulnerability assessment of fish and invertebrates to climate change on the Northeast US Continental Shelf*. *PLOS ONE* 11(2):e0146756.

Hiddink, J. G., S. Jennings, M. Sciberrasa, C. L. Szosteka, K. M. Hughes, N. Ellisd, A. D. Rijnsdorpe, R. A. McConnaughey, T. Mazord, R. Hilborng, J. S. Collieh, C. R. Pitcherd, R. O. Amorosoi, A. M. Parmai, P. Suuronenj, and M. J. Kaisera. 2017. Global analysis of depletion and recovery of seabed biota after bottom trawling disturbance. *Proceedings of the National Academy of Sciences* 114:8301–8306. Available: https://doi.org/10.1073/pnas.1618858114.

National Marine Fisheries Service (NMFS). 2021. Socioeconomic Impacts of Atlantic Offshore Wind Development. Available: https://www.fisheries.noaa.gov/resource/data/socioeconomic-impactsatlantic-offshore-wind-development).

National Oceanic and Atmospheric Administration (NOAA) Fisheries. No date. Commercial Fisheries Statistics. Office of Science and Technology. Available: https://www.st.nmfs.noaa.gov/commercial-fisheries/commerciallandings/annual-landings-with-group-subtotals/index.

O.10.2.8. Section O.6.9, Cultural Resources

Bureau of Ocean and Energy Management (BOEM). 2020. *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585*. May 27. Available: https://www.boem.gov/sites/default/files/documents/about-boem/Archaeology%20and%20Historic%20Property%20Guidelines.pdf. Accessed: November 7, 2021.

Bureau of Ocean and Energy Management (BOEM). 2021. *Assessment of Seascape, Landscape, and Visual Impacts of Offshore Wind Energy Developments on the Outer Continental Shelf of the United States*. OCS Study BOEM 2021-032. April 2022. Available: https://www.boem.gov/sites/default/files/documents/environment/environmental-studies/BOEM-2021-032.pdf.

O.10.2.9. Section O.6.10, Demographics, Employment, and Economics

American Wind Energy Association (AWEA). 2020. *U.S. Offshore Wind Power Economic Impact Assessment*. March. Available: https://cleanpower.org/wp-content/uploads/2021/01/AWEA_Offshore-Wind-Economic-ImpactsV3.pdf.

New Jersey Office of the Governor. 2019. New Jersey Board of Public Utilities Awards Historic 1,100 MW Offshore Wind Solicitation to Ørsted's Ocean Wind Project. Available: https://www.nj.gov/governor/news/news/562019/20190621d.shtml. Accessed: November 11, 2021.

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

O.10.2.10. Section O.6.12, Finfish, Invertebrates, and Essential Fish Habitat

Bureau of Ocean Energy Management (BOEM). 2022. *Ocean Wind Offshore Wind Farm Essential Fish Habitat Assessment for National Marine Fisheries Service.* [Month].Inspire Environmental (Inspire). 2022. *Ocean Wind Offshore Wind Farm Submerged Aquatic Vegetation Monitoring Plan*. Prepared for Ocean Wind, Ørsted US. Submitted by Inspire Environmental. June 15, 2022.

Ocean Wind LLC (Ocean Wind). 2022. *Ocean Wind Submerged Aquatic Vegetation Preliminary Mitigation Plan*. December 2022.

O.10.2.11. Section O.6.14, Marine Mammals

Blackwell, S. B., J. W. Lawson, and M. T. Williams. 2004. Tolerance by ringed seals (*Phoca hispida*) to impact pile-driving and construction sounds at an oil production island. *Journal of the Acoustical Society of America* 115(5):2346–2357. Available: https://doi.org/10.1121/1.1701899.

Brandt, M. J., A. Diederichs, and G. Nehls. 2009. *Harbour porpoise responses to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea*. Final Report to DONG Energy.

Brandt, M. J., A. Diederichs, K. Betke, and G. Nehls. 2011. Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea. *Marine Ecology Progress Series* 421(2011):205–216.

Dow Piniak W. E., S. A. Eckert, C. A. Harms, and E. M. Stringer. 2012. Underwater hearing sensitivity of the leatherback sea turtle (*Dermochelys coriacea*): Assessing the potential effect of anthropogenic noise. U.S. Department of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. OCS Study BOEM 2012-01156. 35 pp.

Dunlop, R. A., M. J. Noad, R. D. McCauley, L. Scott-Hayward, E. Kniest, R. Slade, D. Paton, and D. H. Cato. 2017. Determining the behavioural dose-response relationship of marine mammals to air gun noise and source proximity. *Journal of Experimental Biology* 220(16):2878–2886. Available: https://doi.org/10.1242/jeb.160192.

Lindeboom, H. J., H. J. Kouwenhoven, M. J. N. Bergman, S. Bouma, S. Brasseur, R. Daan, R. C. Fijn, D. de Haan, S. Dirksen, et al. 2011. Short-term ecological effects of an offshore wind farm in the Dutch coastal zone; a compilation. *Environmental Research Letters* 6(3):1–13. Available: https://doi.org/10.1088/1748-9326/6/3/035101.

Malme, C. I., B. Würsig, J. E. Bird, and P. Tyack. 1986. *Behavioral responses of gray whales to industrial noise: feeding observations and predictive modeling*. BBN Rep. 6265. OCS Study MMS 88-0048. Outer Contin. Shelf Environ. Assess. Progr., Final Rep. Princ. Invest., NOAA, Anchorage 56(1988):393–600. NTIS PB88-249008.

Russell, D. J. F., G. D. Hastie, D. Thompson, V. M. Janik, P. S. Hammond, L. A. S. Scott-Hayward, J. Matthiopoulos, E. L. Jones, and B. J. McConnell. 2016. Avoidance of wind farms by harbour seals is limited to pile driving activities. *Journal of Applied Ecology* doi:10.1111/1365-2664.12678.

Southall, B. L., D. P. Nowacek, A. E. Bowles, V. Senigaglia, L. Bejder, and P. L. Tyack. 2021. Marine Mammal Noise Exposure Criteria: Assessing the Severity of Marine Mammal Behavioral Responses to Human Noise. *Aquatic Mammals* 47(5):421–464.

Stöber, U. and F. Thomsen. 2021. How could operational underwater sound from future offshore wind turbines impact marine life? *Journal of the Acoustical Society of America* 149(3):1791–1795.

Thompson, P. M., D. Lusseau, T. Barton, D. Simmons, J. Rusin, and H. Bailey. 2010. Assessing the responses of coastal cetaceans to the construction of offshore wind turbines. *Marine Pollution Bulletin* 60(8):1200–1208.

Tougaard, J., L. Hermannsen, and P. T. Madsen. 2020. How loud is the underwater noise from operating offshore wind turbines? *Journal of the Acoustical Society of America* 148(5):2885–2893.

Tougaard, J., O. D. Henriksen, and Lee A. Miller. 2009. Underwater noise from three types of offshore wind turbines: Estimation of impact zones for harbor porpoises and harbor seals. *Journal of the Acoustical Society of America* 125(6):3766–3773. doi:10.1121/1.3117444.

Würsig, B., C. R. Greene Jr., and T. A. Jefferson. 2000. Development of an air bubble curtain to reduce underwater noise of percussive piling. *Marine Environmental Research* 49(1):79–93.

O.10.2.12. Section O.6.15, Navigation and Vessel Traffic

Ocean Wind LLC (Ocean Wind). 2023. *Construction and Operations Plan, Ocean Wind Offshore Wind Farm*. Volumes I–III. May. Available: https://www.boem.gov/ocean-wind-construction-and-operations-plan/.

Sharples, Malcolm. 2011. *Offshore Electrical Cable Burial for Offshore Wind Farms on the OCS*. Prepared for Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) by Risk & Technology Consulting, Inc. November. Available: https://www.bsee.gov/sites/bsee.gov/files/tap-technical-assessment-program/final-report-offshore-electrical-cable-burial-for-wind-farms.pdf.

O.10.2.13. Section O.6.17, Recreation and Tourism

Lutzeyer, S. D. J. Phaneuf, and L. O. Taylor. *The Amenity Costs of Offshore Wind Farms: Evidence from a Choice Experiment.* North Carolina State University, Center for Environmental and Resource Economic Policy. Working Paper Series: No. 17-017. August. Available: https://cenrep.ncsu.edu/cenrep/wp-content/uploads/2016/03/WP-2017-017.pdf.

O.10.2.14. Section O.6.18, Sea Turtles

Bureau of Ocean Energy Management (BOEM). 2022. *Ocean Wind Offshore Wind Farm Biological Assessment for National Marine Fisheries Service.* [Month].

Finneran, J., E. Henderson, D. Houser, K. Jenkins, S. Kotecki, and J. Mulsow. 2017. *Criteria and Thresholds for US Navy Acoustic and Explosive Effects Analysis (Phase III)*. Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 pp.

Normandeau Associates, Inc. (Normandeau), Exponent, Inc., T. Tricas, and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species*. Final Report. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09. Available: https://espis.boem.gov/final%20reports/5115.pdf.

O.10.2.15. Section O.6.19, Scenic and Visual Resources

Bureau of Ocean Energy Management (BOEM). 2021. *Assessment of Seascape, Landscape, and Visual Impacts of Offshore Wind Energy Developments on the Outer Continental Shelf of the United States*. OCS Study BOEM 2021-032. April. Available: https://www.boem.gov/sites/default/files/documents/environment/environmental-studies/BOEM-2021-032.pdf.

O.10.2.16. Section O.6.20, Water Quality

Bejarano, A. C., J. Michel, J. Rowe, Z. Li, D. French McCay, L. McStay, and D. S. Etkin. 2013. *Environmental Risks, Fate and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-213.

Bureau of Ocean Energy Management (BOEM). 2016. *Use of Finite-Volume Modeling and the Northeast Coastal Ocean Forecast System in Offshore Wind Energy Resource Planning*. July. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. BOEM 2016-050. 131 pp. Available: https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/NE-Ocean-Forecast-Model-Final-Report.pdf.

Bureau of Ocean Energy Management (BOEM). 2021. *Hydrodynamic Modeling, Particle Tracking and Agent-Based Modeling of Larvae in the U.S. Mid-Atlantic Bight*. Available: https://espis.boem.gov/final%20reports/BOEM_2021-049.pdf.

O.10.2.17. Section O.6.21, Wetlands

U.S. Army Corps of Engineers (USACE). 2022. Public Notice No. NAP-2017-00315-84. Available: https://www.nap.usace.army.mil/Portals/39/docs/regulatory/publicnotices/Public-Notice-2017-00135-84-Amended.pdf.

O.10.2.18. Section O.6.22, Mitigation and Monitoring

U.S. Army Corps of Engineers (USACE). 2022. Public Notice No. NAP-2017-00315-84. Available: https://www.nap.usace.army.mil/Portals/39/docs/regulatory/publicnotices/Public-Notice-2017-00135-84-Amended.pdf.

O.10.2.19. Section O.6.25, Accidental Releases

Bejarano, A. C., J. Michel, J. Rowe, Z. Li, D. French McCay, L. McStay, and D. S. Etkin. 2013. *Environmental Risks, Fate and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-213.

O.10.3 Section O.7, General Comment Summaries and Responses

New Jersey Office of the Governor. 2019. New Jersey Board of Public Utilities Awards Historic 1,100 MW Offshore Wind Solicitation to Ørsted’s Ocean Wind Project. Available: https://www.nj.gov/governor/news/news/562019/20190621d.shtml. Accessed: November 11, 2021.

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